Sustainability in Design: Now!

Challenges and Opportunities for Design Research, Education and Practice in the XXI Century

Edited by Fabrizio Ceschin, Carlo Vezzoli and Jun Zhang

Proceedings of the LeNS Conference, Bangalore, India

29th September to 1st October 2010

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DESIGN EDUCATION FOR SUSTAINABILITY (DEfS)

DfS education strategies and curricula development

the Learning Network on Sustainability

An analysis of sustainability Issues in Southern African design institutions' programmes

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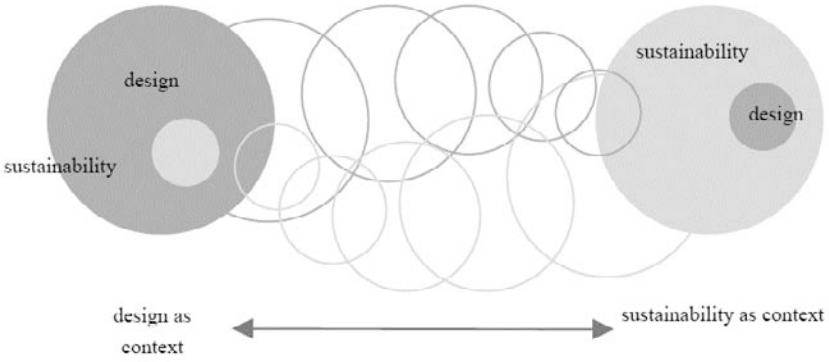
This paper analyses the extent to which Southern African design institutions address issues of sustainability in design and how they are responsive to the current trends of achieving a green future. *Design for Sustainability* (DfS) has evolved over the years in order to raise awareness of the environmental damage people inflict on the environment. Since designers have a large role to play in creating new products, systems and services, it is important to raise awareness and encode the right 'green values' in students as soon as they enrol in design schools. A case study, based on internet search was conducted in eight design institutions in four countries which offer various design courses. The findings show that only two institutions have visible sustainable design courses. The paper concludes by suggesting possible responses related to DfS that can be integrated in various design programmes to effectively address sustainability issues in design.

Introduction

Looking through the eyes of designers in the 21st century, it is inevitable not to see sustainability issues featuring frequently within their vista. If the products they conceive embrace sustainability, then the design approach used would be termed holistic in that it does not only look at the conventional design (technical and aesthetics) issues but rather looks at the design activities and practices that strive at protecting our precious planet through an environmentally, socially, technologically, and economically sensitive approach to designing. This paper examines different curricula in eight design schools in four Southern African countries with regard to their response to sustainability issues in design education. These design schools produce designers in different professional cadres to be absorbed by markets locally, regionally and internationally whose trends are now moving to green production and consumption patterns. The importance of including sustainability issues in design curricula can therefore not be overemphasised.

Designers and design educators should respond to the call for sustainable development in terms of what design can do. This can be achieved by aligning sustainable development principles with *Design for Sustainability* (DfS) strategies. The shift should be more towards looking for design in sustainability as demonstrated by Dewberry and Fletcher (2001).

Figure 1: Range of possible starting points for education in *Design for Sustainability* (after: Dewberry & Fletcher, 2001)



According to the illustration above, in *design as context*, sustainability is tagged to existing design practices where the understanding of sustainability is within limiting parameters of current design activities and priorities. On the other hand, in *sustainability as context* we see the expansion of what design is, covering a broad spectrum of issues outside the conventional design boundaries. This would mean thinking of people and their standard of living, the environment and profits as design inputs rather than as not worthwhile down pipe considerations.

According to William McDonough and Michael Brangart (in Penny Allen, 2001) the design brief for the industrial revolution calls for a system totally destructive to the earth and its inhabitants. Fortunately, contemporary design has the potential to counter this brief if it embraces sustainability.

An overview of design curricula of the eight institutions in Southern Africa has shown that very few of them integrate sustainability issues in their courses or programmes of study. DfS aims to generate as much utility and enjoyment as possible out of the smallest possible quantity of resources over a long period of time. Design graduates need to be cognisant of the impact their design decisions have on the environment, lives of people and economic activities, hence the need to incorporate and appreciate environmental awareness and socially responsible design issues among other pertinent issues through DfS in tertiary design curricula.

DfS and its relevance to design schools

DfS is an approach that aims at developing products, systems and services that address particular human needs through practices that build harmony with nature and its inhabitants by efficient resource usage resulting in a product, system or service that embraces the same. Birkeland (2002) argues that when design embraces sustainability it should fit the following criteria:

(a) *Responsible:* redefines goals around needs, social or eco equity and justice;

(b) *Synergistic:* creates positive synergies; involves different elements to create systems change;

(c) *Contextual:* re-evaluating design conventions and concepts towards social transformation;

(d) *Holistic:* takes a lifecycle view to ensure low impact, low cost multifunctional outcomes;

(e) *Empowering:* fosters human potential, self reliance and ecological understanding in appropriate ways;

(f) *Restorative:* Integrates the social and natural world; recultivates a sense of wonder;

(g) *Eco-efficient:* proactively aims to increase the economy of energy, materials and costs;

(h) *Creative:* represents a new paradigm that transcends traditional boundaries of discipline thinking; to 'leapfrog'; and

(i) *Visionary:* focuses on visions and outcomes and conceives of appropriate methods, tools, processes to deliver them.

These desirable values give DfS the credibility to be recognising the interdependence of humanity, the environment and economic issues. With a significant shift to intensive design research in modern design, product development has become massively reliant on evidence that there is need for the product, system or service. Design is about addressing human needs. Our societies are becoming environmentally aware as there are many environmental awareness campaigns around the globe to sensitise people on issues of environmental sustainability. This capacity building is rapidly influencing their decisions on which goods to buy and which services to subscribe for. With these movements and attitudes the designer to be produced today must be able to respond most importantly to climate change.

Climate change in context

Climate change is the most serious of the manifestations calling for sustainable design. Design has a great opportunity here as most of the environmental impacts in product lifecycles are hugely results of design decisions. Human activities on earth have caused far reaching negative impacts and massively contribute to the green house effect. 40% of the world's population water is supplied from 7 rivers all of which originate on the Tibetan Plateau where ice is melting at a dramatic rate (Nasa, 2009). Climate change has become a crisis. In the Chinese interpretation of 'crisis' it could be said to be presenting 'danger' and 'opportunity'. The earth's priceless resources are getting depleted at an alarming rate. Subsequently, if all of us were to consume in the same way as the developed countries, then we would need three planets to provide the necessary resources for consumption. This situation provides a unique opportunity for more creative interventions to be put in place so as to allow future generations meeting their needs with the same resources. Design has a great opportunity in that the sustainable development principles can be aligned to sustainable design strategies as shown in Table 1 to aid design educators, practicing designers and design students in coming up with environmentally, economically and socially sound design curricula and products (Forum for the Future, 1999).

Table 1: Linking sustainability to design

Source: Forum for the Future, 1999

Sustainable Development Principle	Design for sustainability (DfS) Strategy
Limits to growth	Eco-efficiency; resource productivity; reduce-reuse-recycle; industrial ecology; increased utility; seeking alternatives e.g., renewable resources
Diversity	Local materials; lifecycle stakeholder participation; protecting ecosystems; local culture e.g., vernacular architecture
Joined up systems	Industrial ecology; lifecycle thinking; product-service shift; cradle-to-cradle
Precautions	Eliminating hazardous substances; eliminating inefficiencies; reducing impacts of consumption
Needs and rights	Fostering resilient communities; design ethics; social ecology; increasing quality of life for all

The link between sustainability and design brings into perspective the direction design should take in order to be in the route to sustainable development. This massively supports the view that design stages of product development have a direct influence over about 70% of the final product. This means majority of the product development critical decisions are responsibilities of designers in the product development teams and therefore should be well grounded in issues of sustainable design. The focus is on design as environmental impacts of products are often 'locked in' at the design stage where decisions are made about materials, maintenance, performance, energy source, ergonomics, and functionality among other considerations (Bhamra and Lofthouse, 2007). Careful considerations made at early stages can ensure that positive effects are included in place of negative ones. This eliminates the need to retrofit solutions when their environmental impacts become a serious concern to resources and human life. This is often very costly involving additional equipment and resources.

The Hannover Principles

The established link between sustainability and design sets a clear direction to talking about Hannover principles. These are aimed to serve as a guide to designers to aid their design activities to embrace sustainability issues. These principles are among the important reflectors of DfS and bring to perspective the fact that humanity and the environment co-exist. This is essential in that design can then stand to the challenge of addressing human needs relevant to the changes present and forecasted in the environment. The principles are listed as follows, adapted from William McDonough and partners (1992):

1. Insist on rights of humanity and nature to co-exist;
2. Recognize interdependence;
3. Respect relationships between spirit and matter;
4. Accept responsibility for the consequences of design;
5. Create safe objects of long-term value;
6. Eliminate the concept of waste;
7. Rely on natural energy flows;
8. Understand the limitations of design; and
9. Seek constant improvement by the sharing of knowledge.

There is no doubt whatsoever that the principles challenge design to respond to the above problem of climate change alluded to. Combining these principles with DfS strategies provide a sound recipe for design for sustainability. If climate change is really an issue, then designers should design for 'need' and not for 'greed' (Moalosi *et al*., 2008).

What are the benefits?

The benefits of DfS are demonstrated in all the three broad domains of sustainable development; environmental, social and economic and can be summarised as follows:

a. Environmental benefits

i. Less resource and energy intensity in products;
ii. Fewer material products as design shifts to services instead of products;
iii. Less waste as end of life strategies become applicable to most products;
iv. Slow harnessing of resources through creation of safe objects with no 'built-in-obsolescence' to be used over a long period of time; and
v. Less waste in the environment as people become attached to these products.

b. Social benefits

i. Improved quality of life with an environmentally conscious society;
ii. More resilient communities being established through intensified shared usability of products and services; and
iii. There is improved perception about sustainable development in that people see it in their daily living interaction with green products.

c. Economic benefits

i. Enhanced performance and productivity

ii. There is less strain on existing resources and infrastructure

iii. Reduced product life cycle costs

In view of the proposed framework, Southern African design education system can produce designers whose work would enjoy the above benefits should there be greater visibility of DfS-related issues addressed in their curricula.

Design institutions curricula analysis

A case study in four countries from the Southern African region were sampled which have design programmes. These countries include: Botswana, Namibia, South Africa and Zimbabwe. In these countries eight design institute curricula were analysed with regard to their response to sustainability issues. This analysis was based exclusively on the internet search and on available course descriptions. It should be noted that though South Africa has a number of tertiary-level design institutions, only four were randomly sampled for this study. The following Tables 2-5 shows the level of design institutes' response to sustainability issues.

Table 2: Botswana design institutions

Institute A programmes	**Inclusion of sustainability issues in the curriculum**	
	Yes	**No**
Industrial Design	√	
Design and Technology	√	
Institute B programmes		
Industrial Design		√
Graphic Design		√
Furniture Design		√
Fashion and Apparel Design		√
Textile Design		√
Accessories Design		√
Packaging Design & Technology		√

Table 3: South Africa design institutions

Institute C programmes	**Inclusion of sustainability issues in the curriculum**	
	Yes	**No**
Industrial Design		√
Graphic Design		√
Fashion Design	√	
Interior Design		√
Jewellery Design		√
Institute D programmes		
Graphic Design		√
Interior Design		√

Institute E programmes	
Industrial Design	√
Graphic Design	√
Fashion Design	√
Interior Design	√
Jewellery Design	√
Institute F	
Graphic Design	√
Clothing and Interior	√
Fashion	√
Jewellery Design	√
Extended Programme: Art and Design	√

Table 4: Namibia design institutions

Institute G programmes	**Inclusion of sustainability issues in the curriculum**	
	Yes	**No**
Ceramic Studies		√
Fashion Studies		√
Textile Studies		√
Interior Design		√
Jewellery Design		√

Table 5: Zimbabwe design institute

Institute H programmes	**Inclusion of sustainability issues in the curriculum**	
	Yes	**No**
Graphic Design		√

Findings

Sustainability issues are not pronounced in the design programmes except for two institutions in Botswana and South Africa. The sustainability courses covered by these two institutions include: *Design for Sustainable Development; Eco-Product Design; Contemporary Issues in Industrial Design; Design, Technology and Society; Environmental Factors in Design;* and *Production Environment Studies*.

It is suspected that sustainability issues might be infused in some courses such as Critical Studies and Professional Design Practice. If this is the case, then sustainability issues are still treated as peripheral issues in design in the Southern African region. This does not adequately equip students with the necessary skills to face the challenges of the green economy. There is a great need to push the sustainability agenda to the forefront and design institutes must integrate sustainable design in all their programmes because the emerging sustainable or green economy is based on energy efficiency, renewable energy, industrial processes that reduce carbon emissions and recyclable materials. All these issues have been summarised well by William McDonough (2002) as reviewed earlier in this paper.

There is more to sustainability than the 'reduce, reuse and recycle' maxim. All these are retroffing measures and cannot create a sustainable future. It is greatly appreciable however, that they have been a

good starting point. What usually happens in most design schools elsewhere is to push *recycling* of materials to be the major component of sustainable design. Recycling should be done when the previous two phases are unattainable. During the recent years in most developing countries, recycling has been promoted to the number one slot. This has made the other two (reduce and reuse) seldom discussed or let alone implemented. Government's legislations often drive recycling initiatives through the waste management departments rather than reuse or reduction strategies because recycling is more compatible with economic growth in its current form. Recycling is not 'a one-stop solution' to sustainable production and consumption and it is essential the consumers are not misled into believing that it is the solution to problems they are facing (Moalosi *et al.*, 2008). Covering recycling of materials is an end-of-pipe approach whereby the emphasis is on waste disposal. Chapman (2005) argues that the current methods do not actually attend to the root cause of the problems we face, instead focusing almost primarily on solutions that attend to the effects or symptoms of our wasteful and grossly inefficient existence. The end result is that customers continue wastefully forth, only now they do so with recycled materials of virgin ones. Therefore, the first priority should be to reduce consumption that is making less, buying less, using less, and wasting less. Southern African design institutions are advised not to fall into this end-of-pipe approach when incorporating sustainability issues in their design programmes. A holistic approach to sustainability must be adapted – one that ultimately encompasses the entire community (Manzini, 2007).

However, the problem with 'less everything' is a possible misconception of the whole idea of sustainable consumption with a simple 'tomorrow I will be less wasteful than I was yesterday'. Creating sustainability is where efforts must be intensified in design curricula across Southern Africa. Designing services is a complex form of design innovation but a very concrete design intervention to creating sustainability. In this scenario, we enjoy fewer material products, more intense use of those that are available through schemes like rentals and loans. In this more sustainable lifestyle orientation, the focus is on the transportation services offered by the vehicle, and not merely limited to the product in itself.

Recommendations

The authors propose that sustainability issues must be introduced in the first year of the students study programmes. This will equip students with the necessary knowledge and tools to integrate environmental issues in their design projects as they progress through their study period. It is against this premise that sustainable design seeks to create products/systems and services that are eco-friendly at every stage of their life cycle, from production to disposal.

Design institutes could consider the following areas for integration in their programmes in order to prepare students for the green economy:

Countering unsustainable practices

- Traditional and modern sustainable technologies;
- Pollution management especially disposable products and packaging;
- Conservation of resources;
- Waste management (reduce, reuse and recycle);
- Renewable materials and energy;
- Eco-design tools;
- Life cycle design approach; and
- Joined up systems concept of cradle to cradle instead of cradle to grave.

Promoting sustainable systems

- Designing services instead of material products; and
- Designing for needs instead of wants.

Non-governmental organisations such as the Network of African Designers (NAD) should lead the way on guiding design schools in incorporating sustainability issues in their curricula. A discussion paper on this initiative can presented at the annual meeting of NAD. Further, by aligning such strategies with those of the Learning Network on Sustainability (LeNS) – Africa, useful open-source and copy-left didactic tools are made available for member institutions with the NAD platform (Vezzoli *et al.*, 2009).

Conclusions

Chapman (2005) argues that we need to design products that consumers will actually want to keep, maintain and use for longer periods of time, sustaining their value to keep users caught in the hook of consuming them. Such objects should be designed for empathy and created in an artful way, engendering powerful emotional attachments, evolving narratives, intense user experience and a sustained element of uncertainty and fiction. This calls for design students, designers and design educators to embrace sustainable design to achieve not only a greener future but also resilient.

Sustainability issues in design programmes must be made visible instead of being merely incorporated into other courses. This will give them the prominence they deserve in shaping the green economy. Perhaps, the design schools have been slow to respond to the demands placed by the damage inflicted on the environmental be human beings. There is an opportunity for Southern African countries to learn from their fellow members within NAD who have embraced this concept. Design schools are advised to act now before it is too late.

The authors do acknowledge that curriculum revision can be daunting task to undertake. As a imminent measure, design schools are encouraged to build in and integrate sustainability issues in their current programmes. This will help students to immediately recognise the relevance of such issues in their everyday life.

The concept of sustainability is pertinent to the survival of all species, including human beings on the planet. Including sustainability issues in the curricula should be seen as an urgent imperative to ensure that the future generations' ability is not compromised so that human beings and nature co-exist in a healthy manner. The study has revealed that issues of sustainability especially in the Southern African region are still treated as peripheral in design education. Even though they could be embedded in other courses, they lack visibility since sustainability has become a powerful transitional vector of the age. The challenge for design educators is to review their curricula and encode sustainability issues as a matter of urgency and this will be a positive contribution to the green agenda.

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the Learning Network on Sustainability

Sustainable design education

Why? Whom? Who? How?

Manisha Singh,
NIFT, Delhi

Sustainable design is more often than not is confused with “Green” or “eco” design. There is a distinction between the two. The “Green/eco” design is the practice of reducing or eliminating environmental impacts of design, whereas sustainable design is concerned with the environment, but also with social and economic issues. Therefore, sustainable design encompasses whatever concept Green/eco design has and goes beyond encompassing ecology, economy and cultural contexts.

It is extremely important to identify and address the needs of groups for effective sustainable design education for sustainable development. What really is required is to expose the students to basic concepts as above and a possible framework for thinking about what makes a given example sustainable or not, on ecological, economic or cultural grounds as whole. This needs inputs from three diverse fields and requires collaborative approach in teaching.

Sustainable design is and will always be ever evolving and dynamic area of research and learning and teaching process will lead to rising of specialties within the sustainable design education particularly at post-graduate level programs. Moreover, one cannot possibly “buy in” as sustainable design specialist unless one is exposed and understands the issues from basics. Therefore, the challenge as much lies in introducing issues relevant to sustainable design aptitude/attitude at even elementary and middle level school levels as much at under-graduate and graduate level for different levels and as also training of teachers.

Sustainable design

Definition

“Sustainable design is more often than not is confused with “Green” or “eco” design. There is a distinction between the two. The “Green/eco” design is the practice of reducing or eliminating environmental impacts of design, whereas sustainable design is concerned with the environment, and also with social and economic issues. Therefore, sustainable design encompasses whatever concept Green/eco design has and goes beyond encompassing ecology, economy and cultural contexts.”

“The intention of sustainable design is to “eliminate negative environmental impact completely through skilful, sensitive design”. Manifestations of sustainable design require no non-renewable resources, impact the environment minimally, and relate people with the natural environment.”

Philosophy

Sustainable design is also called environmental design, environmentally sustainable design, environmentally conscious design, etc. and is the philosophy of designing physical objects, the built environment, and services to comply with the principles of economic, social, and ecological sustainability.

Motivation

The motivation for sustainable design was nicely articulated in E. F. Schumacher‘s 1973 book Small Is Beautiful.

In architecture, sustainable design is not the attachment or supplement of architectural design, but an integrated design process. This requires close cooperation of the design team, the architects, the engineers, and the client at all project stages, from site selection, scheme formation, material selection and procurement, to project implementation.

Components of Sustainable Design

Key components for sustainable design are ecology, economy and social/culture.

- **Ecology:** Introduce/take back to basics on the ecosphere. The question is not simply how to recycle materials, but how to see them in the first place--where they come from and where they go to.
- **Economy:** it is economic literacy that is the cornerstone of sustainable design. What do we want to sustain, if not mindless economic growth? What ways can we move in the right direction as economic actors?
- **Social/culture:** the fact that design generally pushes consumerism, and yet, for all its negative impacts, consumerism helps people create meaning. Part of culturally sustainable design is to help find alternatives to consumerism that help people generate meaning.

Principles of Sustainability

Hannover Principles/Bill of Rights for the Planet

This is one of most comprehensive and elaborate document for principles of sustainability covering a larger canvas as compared to only “sustainable design” as has been understood conventionally. This is detailed as below;

A model of the new design principles necessary for sustainability is exemplified by the “Hannover Principles” or “Bill of Rights for the Planet,” developed by William McDonough Architects for EXPO 2000 that was held in Hannover, Germany.

- Insist on the right of humanity and nature to co-exist in a healthy, supportive, diverse, and sustainable condition.
- Recognize Interdependence. The elements of human design interact with and depend on the natural world, with broad and diverse implications at every scale. Expand design considerations to recognizing even distant effects.
- Respect relationships between spirit and matter. Consider all aspects of human settlement including community, dwelling, industry, and trade in terms of existing and evolving connections between spiritual and material consciousness.
- Accept responsibility for the consequences of design decisions upon human well-being, the viability of natural systems, and their right to co-exist.
- Create safe objects of long-term value. Do not burden future generations with requirements for maintenance or vigilant administration of potential danger due to the careless creations of products, processes, or standards.
- Eliminate the concept of waste. Evaluate and optimize the full life-cycle of products and processes, to approach the state of natural systems in which there is no waste.
- Rely on natural energy flows. Human designs should, like the living world, derive their creative forces from perpetual solar income. Incorporate this energy efficiently and safely for responsible use.

- Understand the limitations of design. No human creation lasts forever and design does not solve all problems. Those who create and plan should practice humility in the face of nature. Treat nature as a model and mentor, not an inconvenience to be evaded or controlled.
- Seek constant improvement by the sharing of knowledge. Encourage direct and open communication between colleagues, patrons, manufacturers and users to link long term sustainable considerations with ethical responsibility, and re-establish the integral relationship between natural processes and human activity.

These principles were adopted by the World Congress of the International Union of Architects (UIA) in June 1993 at the American Institute of Architect's (AIA) Expo 93 in Chicago. Further, the AIA and UIA signed a "Declaration of Interdependence for a Sustainable Future." In summary, the declaration states that today's society is degrading its environment and that the AIA, UIA, and their members are committed to:

- Placing environmental and social sustainability at the core of practices and professional responsibilities
- Developing and continually improving practices, procedures, products, services, and standards for sustainable design
- Educating the building industry, clients, and the general public about the importance of sustainable design
- Working to change policies, regulations, and standards in government and business so that sustainable design will become the fully supported standard practice
- Bringing the existing built environment up to sustainable design standards

In addition, the Interprofessional Council on Environmental Design (ICED), a coalition of architectural, landscape architectural, and engineering organizations, developed a vision statement in an attempt to foster a team approach to sustainable design. ICED states: The ethics, education and practices of our professions will be directed to shape a sustainable future. . . . To achieve this vision we will join . . . as a multidisciplinary partnership."

These activities are an indication that the concept of sustainable design is being supported on a global and interprofessional scale and that the ultimate goal is to become more environmentally responsive. The world needs facilities that are more energy efficient and that promote conservation and recycling of natural and economic resources.

Education in Sustainability

Educating for a more sustainable future in its broadest sense includes improving quality basic education, reorienting education to address sustainability, improving public awareness, and providing training to many sectors of society.

Keeping Education in Sustainable design is akin to limiting in its intent, scope and understanding at a macro level. A more appropriate word/term would be "Sustainable development". Sustainable design will be come within the umbrella of sustainable development, and will help in taking a comprehensive and holistic view on what we design.

Sustainable Development will mean "seeking to meet the needs of the present without compromising those of future generations". We have to learn our way out of current social and environmental problems and learn to live sustainably.

Sustainable development is a vision of development that encompasses populations, animal and plant species, ecosystems, natural resources and that integrates concerns such as the fight against poverty, gender equality, human rights, education for all, health, human security, intercultural dialogue, etc.

Therefore the term "Education for sustainable development" will be apt in describing what is needed to understand and learn.

Education for sustainable development aims to help people to develop the attitudes, skills and knowledge to make informed decisions for the benefit of themselves and others, now and in the future, and to act upon these decisions.

The United Nations Decade of Education for Sustainable Development (2005-2014), for which UNESCO is the lead agency, seeks to integrate the principles, values, and practices of sustainable devel-

opment into all aspects of education and learning, in order to address the social, economic, cultural and environmental problems we face in the 21st century.

There are five queries as below, which if addressed will take care of “Education in Sustainability”;

- Why to educate/teach
- Whom to educate/teach
- Who will educate/teach
- What to educate/teach
- How to educate/teach

Why there is a need to educate about “sustainable development” needs to be articulated possibly for each country/region/society/world as a whole. However, it getting understood by professionals, policy makers and society at large as can be understood by various initiatives being taken world-over.

Broadly speaking it can be said that “All human-folks need to be educated / taught /sensitized about sustainable development”. This will mean too broad-based and seem a distant situation. However, to produce effective change agents in society, the focus can be on the followings, which can get structured to be dealt;

- School going children
- Design professionals
- Professionals in other disciplines
- Teachers
- Policy makers, leaders, and citizen groups

Children

They come at the bottom of the pyramid of society and are the biggest interest group. The most significant aspect in this is that children learn about the basics of responsible citizens, which is very significant factor, which contribute in sustainability in own way by living appropriately.

There are initiatives world over for school going children some are;

- The Elementary School for Sustainable Design (blog: http://es4sd.blogspot.com/)
- “At the Elementary School for Sustainable Design, our goal is to enable all students to be lifelong learners, exemplary, responsible citizens, caretakers of the environment, and leaders in the global community. When students understand that what takes place in their school is important, when they are expected to do well both academically and as citizens, when they are engaged in challenging and meaningful work, and when they are supported by a unified community of teachers, parents, and other concerned and involved adults, these expectations will be realized. That shared communication extends to parents with whom the Elementary School for Sustainable Design actively engages in the work of improving student performance.”
- “Environmental awareness”: This and related subject/topics has been introduced in many curriculums in schools in India. However, this is limited in effectiveness so far. There is a need to broad-basing this aspect, which will make children think and make judgments about sustainable options, habits which are positive for sustainability from ecology, economy and culturally.
- The best hope for learning to live sustainably lies in schooling that is “smart by nature.” It includes experiencing the natural world; learning how nature sustains life; nurturing healthy communities; recognizing the implications of the ways we feed and provision ourselves; and knowing well the places where we live, work, and learn.

Designer

There are a number of specific design disciplines such as architecture, interiors design, product design, communication design, and fashion design and so on. They are a growing community trained to practice sustainable design as their professional pursuit. They are a small group overall in design field, but with this profession gradually becoming in demand will become bigger. So far these professionals have in-

creased in numbers is by their own interests and inclinations and professional opportunities. Professional programs for becoming sustainable designer are limited. This possibly can become a specialization at post-graduate level for designers with undergraduate professional qualifications.

Important question here is can an individual brought up living and thinking and imbibing a culture which reflects non-sustainable living be taught to do sustainable design. My view is an individual can be taught and can learn "sustainable design procedures", but will be unable to design for sustainability, unless convinced of sustainable living and that most likely can about from growing years, most importantly through schooling.

The entries to special professional programs for sustainable design should be after a screening for aptitude and attitude of individual towards sustainable development and living, in addition to professional competence. Is creating a breed of professionals of sustainable design enough?

Professionals in related disciplines

Only creating professionals in sustainable design will be not effective, if the professional of interdisciplinary areas for ecology, economy and cultural context do not evolve to deal with concepts of sustainability. Therefore, interdisciplinary studies with professional from design as well as economics, social sciences will be an essential for evolution of sustainable design education. More effort is needed to put in here. However, educating children at schooling level will help in creating an environment, understanding in them to opt for sustainability aspects in their higher studies and thus a larger group (as compared to present situation) of professionals in different disciplines with understanding on sustainability aspects will emerge. This group will be extremely essential for a holistic approach to evolve covering entire range of disciplines significantly linked to sustainable development.

Teachers (for school-going children)

"Institutions of teacher education, in particular, fulfil vital roles in the global education community; they have the potential to bring changes within educational systems that will shape the knowledge and skills of future generations.

Often, education is described as the great hope for creating a more sustainable future; teacher education institutions serve as key change agents in transforming education and society, so such a future is possible. Not only do teacher education institutions educate new teachers, they update the knowledge and skills of in-service teachers, contribute to textbooks, consult with local schools, and often provide expert opinion to regional and national ministries of education. Institutions of teacher education also perform similar services for school principals who have significant impact on what occurs in schools. Because of this broad influence in curriculum design and implementation, as well as policy setting within educational institutions, faculty members of teacher education institutions are perfectly poised to promote education for sustainable development (ESD).

In 1998, the United Nations Commission on Sustainable Development work programme on ESD called for UNESCO to develop guidelines for reorienting teacher training to address sustainability. UNESCO created a the UNITWIN/UNESCO Chair at York University (Toronto, Canada),which led to the creation of a document entitled Guidelines and Recommendations for Reorienting Teacher Education to Address Sustainability.

This includes guidance & recommendations for teacher education programs to fit the environmental, social and economic conditions and goals of their communities, regions, and countries. The recommendations involved curricula, pedagogy, policy, practice, programs, rewards, research, information and computer technology, partnerships, networking, communications, etc. "

Whether they start with an environmental issue or with fundamental ecological principles, teachers can nurture the knowledge, skills, and values essential to sustainable living. The countries should include teacher education institutions in their national sustainability plans.

Teachers/educators (under-graduate, graduate level, and higher learning)

Teaching in sustainable development/sustainable development at this level requires more focus, and methods and evolved concepts. The teaching community in sustainable development/ design for professional disciplines at under-graduate/ graduate/higher learning levels is extremely critical, to steer the evolution of sustainable design education and practice in right direction. This being an evolving and dynamic field, where-as we understand more the application of sustainability principle will also keep on evolving. Therefore, design educators/teachers at this level need to be updated and inked into the latest of sustainability. This is where formal and informal forums on exchange of ideas and creation of online repositories of such issues and development will be an extremely useful tool.

Case studies, methods, examples (failed as well as successful) etc at a common place/ links on website will be an asset for continued learning for the professionals/educators/teachers alike. Some useful websites are:

- http://www.teachsustainability.com.au/
- http://www.partnerships.stockholm.se/index.html
- http://ecoliteracy.org/events/sustainability-education-connecting-art-science-and-design
- http://www.wbdg.org/design/sustainable.php

Policy maker, leaders, citizen group

These are individuals who are either in decision/policy making positions or are those groups affecting the policy/decision making process. There inclination and understanding of sustainability is critical for any policy/decisions to be taken and implemented in right earnest. Therefore, starting early by exposing children in schools to the concepts of sustainability will be an advantage as their understanding of the issues will be that much more. A wrong/much delayed decision in their hands can damage the aspects of sustainability adversely on a wider canvas; similarly a right decision at their hand can also positively impact the sustainable design on an wide canvas.

Evolving management programs at higher levels of learning will be an extremely useful. These can be designed for working professionals in these areas. These can also be designed and integrated during graduate/under-graduate programs in management studies and possibly other related disciplines.

Viability of sustainable Design Education

Ultimately, every profession thrives or dies based on its practitioners' demand. Unless that is there neither the programs will succeed nor the profession will survive, whatever doomsday is predicted.

Here the role of institutional support, philanthropic assistance, and supportive policies will be extremely critical for this to evolve and possibly flourish.

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Diversification in design education

The driving force for sustainable development

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Modern design education began in Germany a century ago, and then “Bauhaus model” and “Ulm model” based on large-scale industrial production model as the background rapidly spread to many countries through the expansive radiation of U.S. economy and culture. Most countries it as a classic model and template so as to introduce it to modern design education. doctrines of Simple style, Functionism become the signs of modern design and synonyms. Take China as an example, more than ten years ago, architecture and interior design style still followed European-style classical architecture. While now, just no more than 20 years, the design teaching in schools and ordinary customers both take the Simple style as their first choice. Simple style became a fashionable slogan. On the one hand, as far as the general process and the special stage of China’s social and economic development concerned, adoption of the Bauhaus and Ulm teaching models is the inevitable choice to guide the general design in history. On the other hand, we have to face new problems, that is, global, highly efficient and modular design education which are creating a common and similar physical environment. When the conflicts of western strong culture, mature design philosophy and educational model and the oriental traditional culture and aesthetics arise, the tradional design philosophy and aesthetics are merged. This obviously results in the departure from the basic goals of social sustainable development under the multicultural background. Conflicts have become increasingly prominent. Especially today in design education system, there are many problems in China.

Prominent Issues

1. design subjects in Design Education are simple and absolute.

Resdearch subjects are rather simple and absolute. The scope of the professional study are liable to be divided into many many detailed branches in domestic design. These divisions may make several barriers in design field. For example, the subjects of industrial design are only identified as the products of mass production with the machanical processing technology. However, Non-production products, non-mechanical processing products regarded as the handicraft products were ignored. The teaching framework is still confined to the Bauhaus and Ulm modle.

2. The simple style as one basic feature of design aesthetics became the basic framework and standards of aesthetic value judgements.

Design aesthetic standards are every simple. Less is more, which is the core of the Bauhaus design aesthetic thought. Today it has become a mainstream in the design world. Due to the Introduction and imitation of Bauhaus education mode people will automatically and subconsciously accept this aesthetic con-

cept and simply copy it as a template. New design= morden design = simple style, this formula becomes an unquestionable logical relations, which neglects the discussions and experiments on design linguistic diversity.

3. No attention is paid to people cultural elements, regional materials and the research and exploration of process.

The study on realization of design means is limited and single. The study on materials and manufacturing methods of products has ignored the importance on the study of the specific process for special materials in specific region because means of achieving research have been limited in the narrow range so that it also has overlooked feasibility study except mechanical process research.

4. Students have poor overall quality and rather low employment adaptability.

The cultivation of students design skills are single. Their professional knowledge and skills have been much more meticulously divided in professional training programs. The cultivating goals and process of industrial design, interior design, graphic design and other design put too much emphasis on their differences which confine the cultivation of students'overall quality and skills training. More Often in employment, adaptability is not strong so that it causes the waste of educational cost with a little production.

Causes for the problems

Nowadays, China is undergoing social and economic transformation at the crossroads after the rapid growth of three decades. Compared with 1978. the annual growth of GDP is nearly 10%, in some areas even more than 20%, which takes more than 6% share of the world and break 30 trillion yuan in all. All these impressive data will always give people full of confidence. But an increasingly urgent problem is placed before us, that is, whether high-energy, and high-cost development model is sustainable or not. If not, how to adjust and solve.

Everyone has reached a consensus on this issue that education is the basis of the status in sustainable development. One basic principle has been mentioned in "China in the 21st Century Action for Sustainable Development", technology and education are the principle of continuous innovation, making education as the primary productive forces. But the attitude is more than action, when it comes to how to implement specific education in order to ensure a good basis for the sustainable development. Most of people will instinctively return to their familiar, comfortable patterns

Modern design inevitably are branded "standardization," "regularization" because in the process of consolidation of industrialization from nearly two centuries of Western industrial civilization beginning. In the Western society Various criticisms of modern design drawbacks are long exist, different people have different opinions. Design Education adopted a very liberal state. Design presents formed a very diverse cultural structure. In 60's of last century originated in the United States, many advocates of green movement today has been accepted by most people. It became A healthy social development of the scale and goal of sustainable development into the basic demands of social development. From Bauhaus was established in 1929 to the present human society through the industrial age into the information age. Widespread use of the computer is called human society revolution, affect all aspects of human. Consistency with the design of their education will have a variety of reasonable models may be more open ground.

Reflections of Differentiation in design education

1. The scope and limitationsof traditional research in design have been changed and diversified

There is a clear boundary between he handicraft and bulk product during the large industrial age. But now the boundary is blurred with the advance in processing conditions and means and the diverse market de-

mand in many cases. We shoule address these changes, study these changes and broaden the study scope of traditional Bauhaus.

Today, the former many confines come to disappear or have disappeared when we utilize today's processing conditions to measure our design scope. Ans many commodities as a single-product have owned characteristics of both artworks and products. "Avatar" movie proved to us the possibility of coexistence of virtual and physical products. The previous concept of design was covered by the concept of products' services, etc.. These changes apparently provide and create greater space and more possibilities for design study and creation.

2. The diversity of the design aesthetic standards

The machining technology under the industrial production is the main reason for minimalism. It was the historical choice. It has become the mainstream aesthetic criterion in design community. But when one design aesthetic criteria converts into a routine and doctrine, it will bring more negative effects. Many pseudo-minimalist works appeared and some false design works for simple style were shown everywhere. As a result of it, the precise characteristics of regional culture and performance of original creative force were totally ignored.

Now at the information age, digital technology has brought revolution of design method and processing means. The computer has become an indispensable tool in the design process. It is not only a reflective means of designer thoughts as well as entirely new space for design. In the design process and design realizing process, a lot of previously unbelievable difficulties can be overcome. So new language emerges, such as complex – nonlinear logical relations, the Guggenheim exhibition in Spain, "Bird's Nest" in Beijing and other buildings.

3. Attention to the research on Regional culture and materials

Respect the specific regional culture, research and use local ecological resources and explore traditional processing techniques and technologies, which are consistent with goals of sustainable development. But in China, many of teachers and students focus on the automobiles, appliances, mobile phones and other products. They prefer metal, plastic and other "modern materials". However, they showed a blind eye to specific area of materials and processing technology. Take tourism products as an example, according to the survey of the Asian travel market economy institutions (ABTM), , China's annual growth rate of the tourism market will reach 10% in the next 10 years and by 2020 China will have been expected to attract over 130 million overseas visitors and become the first global tourist destination begond the United States. While compared to other parts in the tourism industry chain the overall level of souvenir product development is greatly delayed. Homogenization is a big problem to the souvenir industry. We often find a lot of souvenirs which should have specific features sell everywhere in the country such as Sanxingdui imitation bronze, imitation Qin Terracotta Warriors and Horses throughout the tourism market. Though the tourism market is every huge, few products are acclaimed, especially the products combining specific materials and crafts techniques. Throughout China, these schools that open tourism product design specialty are seldom, even if several schools set up their curriculum, the teaching programs are similar or even a complete copy of the general industrial design courses. A few people are specialized in professional design facing the huge market demand.

4. Overall-quality education as the basis for design education to diversify employment skills and scope for design students

Most people draw a conclusion that designers can influence people's lifestyles. The goal of design education is to produce good designers. The key element of cultivating qualified designers is the achievement of sustainable development goals in the whole society. As the qualified designers， they must have a good professional quality, including the ethical judgments. Designer's primary task is not only to show good appearance of the products, but also to make much more profits. They should use sustainable development objectives to check their design. At the same time， the great design teaching philosopy is used to guide the design teaching. At the basic design teaching stage students' general design knowledge should be emphasized, not the professional skills. In the higher stage the professional practice and skills should be emphasized to ensure that students have a good adaptability to the future job and meet the needs of enterprises and reduce rejection rate and repair rate of design education products.

Diversification in design education – the driving force for sustainable development

Sustainable development is a basic requirement for social healthy development. And the designers serve social development by designing lifestyle so the design education undertakes the task to cultivate design talent with overall qualities and skills. On this condition, diversification in design educatiojn is the driving force for social sustainable development. Compared with Jobs` s design concept that makes Apple glamorous and personality of Harley which makes its shares more than 150 times in the past 16 years, we will find that the homogenized design education is the crux leading to lack creativities. Homogeneous model results in lower creativity and similar skills and rather low employment rate. This phenomenon results from much more complicated reasons.

"Time to market" stifles innovation and also encourages imitation. But the worst thing is the fetishism to the Bauhaus and other modern Western design education system, which leads to the main traditional design culture lost its due place for a long time. And the pattern, "Unity" design education appears in China. When holding the though "Foreign things serve China", we should remember t Mr. Lu Xun` s Ism (Everything we should filter and select comes from others to help and serve oursleves). So we need to have our own features and also embrace others' by combining the regional unique history, cultural background, resources and environment with the foreign civilization as the essences of fundamental design education. China's sustainable development requires good design education and adopt good points from others. So we should follow multi-line rule, which is the "the only way" for continual development of design education in China. After a period of time a number of puzzling phenomena arise in the field of design education in China. We really should quietly think the future and the direction of design education, highlight special characteristic, stress differences and express equal and sincere communication. Maybe it is the internal driving force of sustainable development.

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the Learning Network on Sustainability

Sustainable settlements design

Innovation in curriculum

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This paper seeks to establish the need for innovative pedagogic and curriculum approaches within the domain of settlement design and also provides an initial exploratory framework for an innovative and relevant curriculum.

India is poised to undergo an urban transition and must chart an urban development trajectory that will help achieve the aims of equity, inclusion and environmental sustainability. Some of the most significant challenges in this relate to the design and planning of settlements.

Given this background and the need, the paper attempts a re-imagination of the design professional. It then presents pedagogic approaches and curricular elements for educating such professionals. The paper concludes with a case study of the Masters in Urban Practice (MUP) curriculum being developed for the Indian Institute for Human Settlements.

Introduction: multiple settlement transitions of the coming century

This paper aims to establish the need for innovation in the field of settlement design education in India in order to educate professionals who can successfully deal with the contemporary and future challenges of Indian villages and cities.

The world is today witness to a transition in the nature of human settlements: since 2008, more than half the world's population has been living in urban areas, and this number is expected to reach 5 billion by 2030 (UNFPA, 2007; Satterthwaite, 2007). The developing economies like India have also now gradually begun the transition to a more urban future. It is projected that by 2050, 54% of the Indian population will be living in cities (UN, 2009). This implies that there is still a unique window of opportunity to enable a transition into a sustainable urban future for India.

There is another emerging transition that is essential to the long term stability of human settlements: sustainability transition. As we are faced with more and more evidence of the deterioration of ecosystems, settlements across the globe are attempting a transition to low-impact and sustainable ways of functioning. The global climate crisis has increased the urgency for cities to reduce the carbon and resource footprints, but the transition to sustainability is fraught with political and economic obstacles, even when the technological solutions may be available.

In the context of India, the transition to an urban future coupled with the goal of sustainability throws up numerous challenges for professionals in the domain of settlement design. There is a need to reduce poverty and inequality, resolve socio-political conflicts, provide housing and basic services and create livelihoods need while simultaneously minimising developmental impact on the environment and ensuring long term sustainability. It may well be that the development pathways and solutions to critical challenges could be substantially different from those historically seen in the case of the developed world. An example is that India currently needs to simultaneously address the green, grey and brown environmental challenges.

This paper contends that these challenges that emerge from the urban and sustainability transitions call for a new kind of settlement design professional[1].

Re-imagining the design professional

This section attempts to define a set of attributes for settlement design professionals if they need to successfully face the challenges outlined above. This is done with the intention of expanding, rather than replacing, the existing notions of a 'good' designer within the domain of sustainable settlements. For this reason, this section does not look at attributes that are widely accepted to be necessary for designers like creative thinking, spatial abilities among others. It takes them as a given, and explores attributes that are not conventionally attributed to designers.

Interdisciplinary thinking

One of the most critical attributes required of sustainable settlement design professionals is knowledge of and an engagement with multiple disciplines and the ability to use the tools, methods and skills of different disciplines to understand a particular issue or concern.

Since cities are complex entities comprising a set of inter-connected and overlapping systems, it is not possible to intervene in any one of them, without being mindful of its effect on others. An urban project will have to, at the very least, take into consideration resource use, finances, waste cycles, micro-climatic effects, and project phasing and management in order to be successfully conceived and implemented.

However, it is not only the 'hard' systems mentioned above that the designers need to understand. The physical fabric of the city is embedded within larger political institutions, governance systems, and series of laws and policy. An understanding of the above is necessary to develop a project that is feasible in these settings, and also make the implementation possible.

However, inter-disciplinarity goes beyond mere knowledge of multiple disciplines. This requires using the tools, methods and skills of different disciplines to understand a particular issue or concern. In context of design in urban settlements, it implies the ability to approach a problem from multiple perspectives, and hence be able to explore solutions in multiple domains. An interdisciplinary approach to project will go beyond merely getting different professions and disciplines to fix a series of problems sequentially or in parallel, to developing the project in an integrated manner. At the same time it must be mentioned here that the design professionals already possess a high degree of collaborative capacity. This needs to be expanded so that they are able to work with people from varied disciplinary backgrounds.

This is useful for appropriate problem identification in urban systems. A project in an urban area might simultaneously require design solutions, policy changes, and also community participation. For example, the creation of a public park would require an understanding of the specific bye laws that exist, knowledge of the multiplicity of agencies involved, and an understanding of the 'political economy' of these institutions to be able to negotiate these multiple actors. While it is not necessary for designers to fulfil all the roles, true synergies can occur if the members of a team are inter-disciplinary.

Critical thinking

Critical thinking is the quality that enables one to understand, perceive and analyse a reading, project, plans or even professional practice, and be able to develop a independent stand on it. For the contemporary designer, given the widely different nature of cities, the designers work must be grounded in the specific context of the project.

The discussion on critical regionalism (Frampton, 1985) is particularly relevant today in the context of sustainable settlements, as the widely publicised and discussed ideas relating to settlement sustainability often emerge from the realities of cities in the Global North, and may not necessarily be relevant to the Indian context. For instance it could be argued that critical and contextual thinking prompted authorities

[1] While expecting education to respond to needs of profession, the authors would like to clarify that profession in this regard is not limited to demands of the job market, but includes the changing role of the profession in society, for which there may or may not be market demand

in Curitiba to implement a Bus Rapid Transit system instead of opting for the more expensive metro system, which was the widely accepted way forward for a city to deal with mass transportation issues.

Reflection and reflexivity

It is not sufficient for the designers to be critical in general. They need to be critical about their work, and reflect on it. There is often little reflection on the project, and even less on the design process. While the attribute of reflective thinking can be said to be relevant to any profession, it is particularly relevant to design professionals as the context for practice is fast changing, and the design process is becoming increasingly complex, involving multiple sub teams, with feedback loops between them.

There is also a need for designers to go beyond reflection on the process, and become reflexive practitioners, who constantly discern, evaluate and modify their professional roles in the particular context of a problem, and in the wider context of sustainable settlements. Reflexivity ensures that being relevant to the profession is not restricted to being 'up to date' about the latest technologies, and movements in the profession, but constantly re-evaluating and refining their own process of engagement with settlements as designers.

Reflexivity, and criticality, should result in ethical, responsible and empowered practitioners. It is not to say that contemporary designers are not any of the above, but these notions need to be articulated and expanded upon within the current contexts: being ethical also means being aware of the consequences of one's work in the wider society, and to take responsibility for it.

If one agrees on the above re-imagination of the design professional, the question that follows is how one nurtures them. While the change will be mediated through multiple fronts, rethinking the education of the designers, however we believe, will play a key role, in creating new kind of design profession. The next section, then, examines design education.

Pedagogical approaches and curricular elements

This section examines two pedagogical approaches: constructivist approach, and critical pedagogy, that have the potential to contribute to the education of design professionals, and then examines some of the curriculum elements that these approaches lend themselves to[2].

However, before dwelling on the specifics, we wish to underline the fact that it is our belief that the foremost intention of education is to empower the students, and enable their agency, and this can be done by viewing the student as a whole person, and not just engaging with her intellect (Rogers, 1969). In order to do this, an institution needs to address the overall experience over and above the class room experiences. Students' growth and development is affected not only by the curriculum, and the academic spaces, but also through student-student and student-teacher relations, campus design and the overall institutional culture that all of this together fosters. While we believe this to be critical, it is not central to this paper as it is not specific to design education.

Approaches

We now examine the major approaches that we feel can contribute to design education.

Constructivist approach

To enable critical and independent thinking and thus empower the students, it is essential to take a constructivist approach to knowledge. This meta-theory does not consider knowledge as a static given that can be transferred from one person to another but something that one constructs on the basis of previous experiences and ideas. Within a constructivist framework, learning implies creating meaning of a situation. The shift in emphasis is then from 'teaching' to 'learning'. With its focus on creation of individual meanings, constructivist approach urges the student to be independent in their thinking, and approach

[2] While laying out the principles, there are some comparisons to existing education in India. The three main design (related to settlements) programmes on offer in the country are: Architecture, Landscape Architecture, Urban Design. Evaluating each of these programmes is outside the scope of this paper, and the comparisons have been made for illustrative purposes only.

knowledge critically. The focus is also not just on deconstructing the existing knowledge, but also on building new knowledge and means.

In the specific instance of settlement design education, constructivist approach is essential for enabling interdisciplinary thinking. Some of the key disciplines that designers need to engage with are Law, Governance and Policy, Social Sciences and Economics, Finance and Management. In these cases disciplinary concepts can be deconstructed, and then reconstructed around the frame of settlements.

Critical pedagogy

Another approach, that could provide useful inputs into design education, is offered by critical pedagogy. Generally believed to start from Paulo Friere's work, critical pedagogy seeks to understand how inequalities and power affect education, and seeks to rectify it. While critical pedagogy is a loose term, and is often used to describe the entire variety of educational experiences (Apple and Au, 2009), its chief aim to examine knowledge from normative views and histories, and hence give 'voice' to a variety of peoples in the curriculum. Moreover, it encourages students to locate themselves with respect to knowledge being constructed; in doing so it places difference at the centre of the curriculum (Crysler, 1995).

It seeks to empower the students, by challenging the classroom dynamics of 'teacher' as expert, and instead seeks to establish an experience where the teacher, along with students, is embarked upon a learning experience. In the context of sustainable settlements and design, it is important to upset the hegemonic discourses on 'good design', and 'developed city' that may have arisen from a certain specific historic juncture, and may be irrelevant to other cultural contexts.

Curricular elements

The following section lays out some possible curricular elements that can be derived from these approaches, and examines their relevance to education of the design professions. These elements are not exhaustive, but are indicative of the ones we believe to be most relevant to design education.

Experiential education

For the learning to be effective, it must be experiential, and the role of education can be seen to arrange for a series of experiences that leads to growth of the student (Dewey, 1938). In fact, one of the strongest points of the architectural, urban design and landscape architecture pedagogy in India, and indeed globally, is the strong emphasis on its learning by doing methodology. Studios, which are wholly experiential learning spaces, form the central part of their education, and are unmatched in their intensity, other than probably by the medical internship (Crysler, 1995). In addition, the teaching of many of the other classes also involves case study preparation, presentations, seminars and field trips. In these respects, design education can be said to experiential. However, it can further strengthened on the basis of the pedagogic principles above.

Experiential education is a key element in a constructivist approach because it demands that one constructs meaning from one's experience. There is rich opportunity for the design students to interrogate theory from their work and experiences in the studio, and other practical assignments. For example, students might be working on an urban design project, and realise that certain ideas based on static density and use may not be applicable at all because Indian cities change functions from hour to hour. However, currently it is a lost opportunity since studios are conducted in isolation from theory classes.

Moreover, constructivist approach requires constant reflection on one's previous knowledge and experiences to be able to grow, and enhance one's understanding. This opportunity is also lost as the focus of most design studio courses is on the product while the process of design itself is considered secondary. However, through tools such as reflective journals, a student can look back upon her work, and re-examine some of the assumptions, concepts and ideas she may have begun with.

Critical pedagogy calls upon students to examine both their work and experience, and theory from the situatedness of their particular identity. In the context of designers, it helps the students not to see themselves as 'experts' with the responsibility of providing 'technical' solutions, but as practitioners located within a specific socio-political climate.

Cases

Constructivist philosophy lends itself to another pedagogical tool, for helping deconstruct and reconstruct knowledge: the case method. The case method is used in a limited way in design education where either cases are prepared by students, or sometimes cases are brought in by faculty members to explain certain issues. But a learning opportunity is lost as a case is rarely examined from various viewpoints, and is often used to substantiate theory, rather than to question it.

However, the case method is particularly relevant given that that most of the literature around sustainable cities is derived from cities in the North, and little theorising has happened from cities of the South. Cases then develop to question theory by examining it against live examples. It also helps construct interdisciplinary understanding of issues by examining the same case from different perspectives. For example, a student would be challenged to develop an independent understanding of a 'sustainable settlement' if she asked to examine a comparative case study on Dongtan, Auroville, and Lavasa.

Critical pedagogy would further enhance learning by giving space to multiple voices in narration of a case. A case study about urban development around Yamuna: from the Akshardham Temple to the Pushta Evictions, told from the perspective of the bureaucracy and the settlement dwellers would tell different stories, and the students have a chance to understand the multiple discourses in urban development and gauge their relevance for sustainability.

Peer to peer learning

Both the constructivist approach, and the critical pedagogy school question the dominance and superiority of the teacher in a classroom. Since one person cannot 'transmit' knowledge to another, but only help another construct meanings, the classroom becomes a dynamic space where everybody is helping one another on their learning journey. Moreover, critical pedagogy discounts the teacher as an expert, and hence experiences and voices of other students become important.

Peer to peer learning is critical for interdisciplinary learning. As the teacher is not the only source of knowledge, it becomes legitimate for the students to learn about disciplines other than their own from peers, instead of depending on the teacher to 'teach' the canon. It must be mentioned here that the peer to peer learning already exists in design education, with its focus on team work, but can be enhanced further if the student body is more diverse. Most design schools in the country are also located as independent institutions, and hence lose out on the largest ecosystem of the university.

Multiple voices and agents in curriculum

Other than valuing the voice of all students, it is also important to give space to 'voices' other than the traditional experts. In the context of sustainable settlements, it could include a whole range of artists and craftsmen in the built environment, local entrepreneurs, grassroots activists and so on. By allowing these multiple voices, it also challenges the learners to make sense of these diverse voices, often in contradiction with each other, and develop an independent stand on issues. Also, if agents other than faculty team members, like those mentioned above, are involving in tutoring students, then the students would gain knowledge in multiple ways.

A case study: masters in urban practice

The following section gives an overview of an innovative programme (Masters in Urban Practice) that has been developed for the Indian Institute for Human Settlements. Both the authors have been part of the interdisciplinary team that has instrumental in conceptualising, developing, refining and reviewing the curriculum over the past 18 months.

The Master's of Urban Practice, spanning a period of 2 years, will comprise 6 terms of 11-12 week duration, 2 week-long field trips, 2 institutional placements of 2 weeks each, and a 6-week summer internship. In order to ensure a diverse student body, applicants from architecture, planning, select social sciences (sociology, economics, geography, political science), select branches of engineering (civil, structural), law, management and environmental sciences will be selected. There will be a short month long 'zero' term to communicate the basics of other disciplines to the learners. Just as there is a diversity in the intake, the intention and hope of the programme is that graduates will be employed in a range of academic and professional institutions: Indian and global, in fields ranging from public policy, urban man-

agement, planning, design, disaster reduction, climate change and development, and across the continuum of public and private sectors.

The MUP curriculum has three components: Commons, Concentration and Core. Commons comprises mandatory academic courses that a learner has to take in the first year, and represents the interdisciplinary centre of the curriculum. After undergoing the same set of courses in the first year, the students branch out in the second year to select a particular 'Concentration'. While Concentrations will also maintain a degree of inter-disciplinarity, these comprise a set of courses that students will take in a focus area of their own choice. Core, running over two years, and parallel to the Commons and the Concentration, represents the 'non-academic' space of the curriculum, and comprises a range of courses, workshops, field work that learners have to participate in.

Commons

Commons encompasses key disciplines and professional areas that urban practitioners are likely to encounter in their academic and professional work. Instead of constructing a series of modules, that examines each of the disciplines separately, the attempt is largely to convey disciplinary concepts and vocabulary through teaching of issues and concerns relevant to settlements. The intention was also to able to cluster together disciplines, and transact fewer synthetic courses, that will allow both students and faculty to revisit important concepts and issues over the period of a year. With the above rationale, Commons is currently articulated as a series of four discrete, but overlapping and intertwined layers:

Contemporary India

The primary aim of this layer is to get students to critically engage with the broader social, political, environmental contexts within which settlements are located. To do so, it seeks to equip students with concepts, language and skills of a host of disciplines including political science, sociology, and geography. In its current form, the layer covers the broad topics of Political Institutions and Governance, Political Economy of Growth and Development, and Political and Social Cultures of India.

Settlements and environment

The content of the course broadly includes infrastructure and built environment, ecological factors and analysis, settlement patterns and dynamics, stakeholders, institutions, and driving forces in the Indian urban context. However, the focus of the course is not to comprehensively cover all the issues in urban systems in detail; instead it is to provide an overview of the field, and through choice of seminars, activities, and essays, allow learners to engage with issues of their liking in greater depth.

Place based practica

The year-long Commons Practica is set in a single site where learners are based for the whole year. The site is imagined to the scale of a large neighbourhood, a small town or a city ward. This is divided roughly into two hours of lecture and six hours of studio/activity/site-based time per week. The major components of the practica are:

1. Qualitative Methods
2. Primary and Secondary Data Collection
3. Mapping based on different types of primary and secondary data
4. Systems Identification, Analysis and Mapping
5. Policy Evaluation, Critique and Analysis

In the first term, the learners are expected to study and analyse the site in detail both through secondary and primary research. It is the term where learners from different backgrounds will pick up various skills in mapping and analysis. While conducting this interdisciplinary research, they are also taught qualitative methods. The second term focuses on systems. The learners are introduced to systems theory, as well as expected to identify, trace and map systems in the site. At the end of the second term, they are supposed to present a preliminary proposal for the site. The first part of the third term focuses on policy, and learners examine the impacts policy on the site. They also learn to monitor and evaluate policies. In the last half, the learners are expected to develop a comprehensive solution for the site. Depending on

their previous background, and their inclination, this solution could be in the form of a design or planning proposal, policy recommendation, or a project feasibility study.

Quantitative methods, economics and management

This course strives to teach the concepts and principles of economics, finance and management, and also be able to critique the approaches. It also seeks to provide them an overview of the political economy of the India, and management of its cities.

While it expected that each of the layers will ensure a number of pedagogical outcomes, the focus of the layers differs by design. For example, Contemporary India is largely a perspective building course, that will enable learners to critically approach issues, and articulate a reasoned stand on it. In contrast, the focus of the Settlements and Environment layer is enable learners to build an interface between theory and practice, and also to ensure reflexivity in their practice.

Concentrations

An indicative sample of concentrations that will be on offer are Economic Development, Policy and Governance, Design, Planning, Infrastructure and Climate Change. While the exact structures of the concentration differ, all share some common features: a set of 8 courses with a mix of required and electives spread over two terms, and a dissertation in the third term. Among the required courses that the students take, one method course in the first term equips them with skills specific to their area of practice and in the second term they take up an integrated practica, where they apply skills learnt previously as a member of an interdisciplinary team. In addition, the students will be required to take two lighter courses: one on research design, in which the final output is their dissertation proposal, and also an Urban Dialogues course where the students interact with professionals in their own field.

Core

In addition to academic spaces outlined above, Core provides an additional space in the curriculum, that is integral to the overall educational experience. This primary intention of the ‘Core’ is to develop a series of ‘sensibilities’: empathy, courage, commitment etc, in students, largely through experiential learning. This has been conceived with the belief that education involves personal development of the student, and also that there is value in learning other than through means conventionally recognised as ‘academic’.

There are four main intertwined themes in the Core: Health and Wellness, Inclusion and Community, Creative Engagement, and Environment, and over the course of two years, the student has to participate and engage in all of these. The programme proposes to keep the nature of participation flexible to customise it to individual interests and needs. Participation therefore, could take various forms, of differing intensity: workshops, field trips, courses, or volunteering. In order to facilitate this process, it is proposed that, like the teaching faculty, the programme should develop a group of resource persons who will be on campus as invited fellows. This could include people from the realm of performing and fine arts, traditional artisans and craftsmen, philosophers, social activists, farmers, and a wide range of interdisciplinary thinkers, inventors and scientists.

Conclusion

This paper has established the need for a new kind of settlement design professional by locating settlement design practice in the urban and sustainability transitions of the 21st century. The paper identifies multidisciplinarity, interdisciplinary thinking, collaborative capacity, critical and contextual thinking and reflexivity as key attributes that would be valuable to design professionals working in the realm of settlement sustainability. The case study presented is an attempt to formulate a new curriculum based on these attributes and follow up research will be required in order to monitor how well it achieves its stated aims over the initial years of its transaction.

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the Learning Network on Sustainability

Where We Are and To Go

Design for Sustainability in higher education of China

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This paper aims to investigate the state-of-art of D4S in Chinese design academy with the perspective of European experiences, and discuss the way to promote related design education and research in Chinese context.

The paper reviewed the related experiences from two typical design schools in the south of China, Hunan University and Jiangnan University. Reports their course system ongoing and some teaching & research works, in particular analyses the roadmaps among last decades. Their experiences from the two universities tell that it's difficult to move the framework of D4S which developed from European context to China directly. Meanwhile explores how to promote D4S in China with experiences from European by giving some examples, such as compare Chinese traditional philosophy thinking of "Harmony".

The paper proposes introduce especially system thinking to reorganise the education system to Chinese D4S education in university. Describe how to implement the innovation through some pilot course & workshop in these two universities.

Today design and everyday life have been fuelled by an ideology that rests on the concept of continuous (economic) growth. It is obvious that the present model of everyday life with western standard that we Chinese are pursuing is omnipresent. In current China, Sustainable development is being approached in a number of ways that depend on the objective and the scale of the activity concerned. The idea of Design for Sustainability started from western society and entered China following design disciplines. However, in last decades, it never has been so important subject in design education and professions as Europe when the country and society focus on economy growth in quantity, although the related works are active and dynamic recent year, Design for Sustainability are still in an early stage in China.

Spreading and Development of Design for Sustainability in High Education in China

Since the beginning of this century, some European researchers (professors) leaded by Prof. Ezio Manzini from Milan Polytechnic University introduced western thinking of Design for Sustainability to some leading design institutions and universities in China(Hunan University, Guangzhou Academy of Fine Art , Tsinghua University and Jiangnan University) to spread concepts and methods based on "Product System Design" , "Service Solution", "design for sustainability in social innovations", held a number of workshops and designing teaching activities.

Lots of collaborative research works with Chinese local design high education school to discover the characteristic road to develop and promote sustainable design, series subsequent researches and education experiments at these Universities. For example, an international Seminar named the "Immaterial and Sustainable Solutions in China" was held at Hunan University in 2002, numbers of workshop surrounded with the topic of "Design for Sustainability in China" between Hunan University, Tsinghua University, Jiangnan University and GAFA collaborative with Milan Polytechnic University, Hong Kang polytechnic

University , University of Ferrara of Italy, etc. have been done during 2003-2007. Seminars, workshops and Conference have to be intended as different steps in the construction of a stabile network of Chinese Design Schools on Design for Sustainability.

Meantime Some Cross-University research unit have been lanched in these years, such as DESIS-China, Greengaged-China, etc.

Figures 1, 2 and 3: Joint Workshop at Hunan University, GAFA, Jiangnan University

Source: GAFA, 2009



Figure 4: Hunan Seminar, "Immaterial and Sustainable Solutions in China"

Source: Hunan University, 2002

Chinese Ancient Philosophy About Sustainable Development

Ancient Chinese thought that the universe was a mixture of black and yellow color before it broken into two, earth and heaven or Tian. Earth is square and heaven is roundness. Tian is not only the abode of God, the angels and the spirits of the righteous after death (The Random House College Dictionary), but also represents the ultimate nature law -- Tao.

Ecology is a branch of biology dealing with the relationship between organisms and their environment. Some scientist may think we will ultimately understand the ecological system. But I think that the nature of ecological system is its unlimited variety and it is beyond human mind. The whole biosphere is itself a Heaven. Ecological sphere is heavenly harmony – Tao

Tao said 'Man follows Earth, Earth follows Heaven, Heaven follows Tao, and Tao follows Nature'. That was the highest philosophy in making or producing in ancient China. Tao also told his students that 'having is for interest, not having is for using' and 'nothing is everything'

Figure 5: “Tao”

Source: Jianghong Zhao, 2001

Something that we know very well about the present is that the world is changing rapidly and profoundly. The only certain thing that we know about the future is that the current change must change direction, it must find the way to sustainability, with the western methodology of “reduction & reuse & recycling”. Before doing this transition, some modification should be done based on the great difference between oriental and western culture. In this process, China has the concrete possibility to surprise us, more than it did in recent times, and to leapfrog. That is, to move directly to the most advanced sustainable systems of consumption and production, avoiding what, proceeding in a linear way, would be the consolidation of the intermediate (and unsustainable) phases of the material-intensive industrial economy. This leapfrog strategy could involve both the technological systems (from the power generation, to food chains, housing and mobility) and the social ones (from welfare services to new patterns in consumptions, behaviours and ways of living).

Experimental Cases of Sustainable Design Education in China

During recent years, some collaborative research and experimental education activities have been carried out after more and more teacher and student went abroad to Italy, Netherlands, England, and so on, strong relationship were built up between these universities.
The most evident signals of this possibility are that the environmental issue is entering design schools and some design practices. This is happening by moving in a line that starts from life-cycle design (often quoted as green design), to moving towards the design of more complex sustainable product-service systems, to arrive at the innovative field of design for social innovation and sustainability. The focus of design teaching is transferred from design for the "objects" in the past to the concern of the whole system.

From Hunan University

Professor Zhao Jianghong of Hunan University who firstly introduced the concepts of design for sustainability from outside world into China. He mainly focused on the development direction of industrial design and related theoretical issues in post-industrialization and Immaterialism, combining with the philosophy of pre-Qin period in China "what has a existence serves for profitable adaptation, and what has not that for usefulness" to explore the linkage between the ancient philosophy and the contemporary concept of the "sustainable design". He also written a book titled “The Second Truth of Design—Thinking on the Contemporary Sustainable Industrial Design” (Hubei Art Press,2003), it was considered the first book about Design for Sustainability in China.”

There are some pilot design course named “System Design” which introduced DFS concept and methodology to students, some design works of students won international Eco-design award.

Figure 6: “The Second Truth of Design”

Source: Hubei Art Press, 2003

Figure 7: Golden Award Design, Tableware for Western Food Made in Bamboo

Source: ST-ETIENNE Eco-Design Award, France, 2003.

From Jiangnan University

Since 2007, new academic experience between China and Italy promotes new sustainable everyday lifestyles and an harmonious idea of society based on communities, and shows the results of a cooperative design research projects from Jiangnan University and Politecnico di Milano.

Some research activities, such as Chita 08 Workshop, “COLLABORATIVE SERVICES AND MOBILE COMMUNICATION-- How can sustainable everyday life be empowered by mobile communication?” aas hold in November 2008, focusing on the collaborative services and mobile communication technologies.

Figure 8: Chita 08 Workshop

Source: Jinangnan University, 2008

Conclusion and Prospect

During the post-industry and information-based period, China is facing opportunities and challenges with a gap between what we are called to do and what we are able to do. Nevertheless, design education is a fundamental step to move ahead. And this paper is to understand where we are and to go in design education of Design for Sustainability in China.

Recent 2 years, the active LeNS (The Learning Network on Sustainability) Asia-Europe cooperation network for sustainable design teaching has more strongly promoted the spreading of concepts and methods of DFS in China. Tsinghua University and Hunan University have joined this sustainable design network. In early future, LeNS China will also set up to promote Design for Sustainability education cross different university in China.

Figure 9: LeNS DFS Network

Source: LeNS Website, 2010

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the Learning Network on Sustainability

Manifesto for sustainable design

A project in practice

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The 'Manifesto for Sustainability' challenges the role of the designer in this socially-negotiated practice and celebrates the "unique skill-set, vital to today's world" (Quraeshi, 2002) that designers possess. The issues around sustainability are *not* widely integrated in the design process as one of its basic principles, an issue challenged in this paper which presents the manifesto as an experimental design project and forum for debate: a new pedagogic model for articulating complex issues in simple terms. The project will introduce how responsible engagement in an uncertain world, where design is used throughout the problem-solving process, can be used to help shape the actions of individuals and groups by establishing a common cultural dialogue. This in turn reveals the tremendous opportunities student designers have in helping change the hearts and minds of people towards a more sustainable world vision and in developing a more organic and positive strategy for design education.

What is a manifesto for sustainability?

A manifesto is a public declaration of principles or intentions, a call-to-arms, a consolidation of opinions, a powerful purveyor of ideology, or a personal rant. Whether delivered in print or accommodated by the theoretically endless digital space of social networks and information exchange, the manifesto has proved surprisingly suitable to design. Like drafting a proposal, conceiving a well-designed product or crafting the pithy copywriting for an advert, "it communicates directly, it is broken into functional parts, and it has elements of poetry and surprise" (Lupton, 2008). As a form of protest, a proclamation of opinion or a re-envisioning of ideas and ideals, the manifesto is a forum for collective debate and expression that can be a valuable pedagogic device in the face of the diverse and contradictory views relating to eco-design, sustainability and green issues. Sustainability and environmental design have for too long been assigned a marginal, specialist position in visual communication: a new strategy for graphic design teaching and learning is proposed, with sustainability as a core principle, embedded in the curriculum rather than on the boundaries of discipline. The 'Manifesto for Sustainability' project provides a creative platform for individual ideas to be articulated about a shared concern in a studio-based environment testing traditional design skills and innovative approaches in a new paradigm of sustainable problem solving. The manifesto project aims to introduce a sustainable attitude to design early in the students' development. The intended outcomes are focussed more on the process of research and investigation, testing and realisation, which initiate an ongoing awareness rather than one absolute artefact.

This paper will demonstrate how the 'manifesto' project offers space for the students to explore a broader more sustainable world-view of design as a socially negotiated practice, challenging the status quo of cultural and commercial production by exploiting the manifesto's inherent dialectic structure. The aims are not to produce one absolute manifesto representing the majority's wishes and ideals but to develop one manifesto for each student: not one voice but many accents articulating a similar theme. The pressure to craft the ultimate solution to the questions of sustainable design is at least deferred. The manifesto as a visual argument is delivered in this context more like a script, open to individual interpretation, encouraging a more experimental play with meaning and a more organic vision of design.

Design has a ubiquitous presence in our lives, it touches us all in some way, all man-made objects have involved a designer at some stage and even our behaviour and language has become moulded by the products and systems of design. Designers must now operate in a multi-layered cultural landscape, a ma-

trix of inter-relationships between media, people and place, within which the designer must always be on alert for unpredictable scenarios, new technologies, economic and political shifts. In order to mindfully engage in this world – both locally and globally - it is necessary for the future designer to understand his/her role in civic as well as commercial terms, to integrate greater critical thinking, social interaction and creative flexibility within the design process. 'Going green' should not be considered a trend, fad or phase if design is to be a part of the solution rather than adding to the problem of 'cultural waste' where disposability as an essential property of many high street products. Sustainability needs to mean more than a fashionable 'low-fi' aesthetic, a bamboo 'must have' product or 'retro' visual style used to salve the guilt of a minority of wealthier end users: a band aid solution to a gaping wound. What must be tackled are the attitudes of students towards the world community they will be designing for, and in partnership with, as professionals, a more 'worthwhile' use of their skills. Ken Garland's First Things First Manifesto asked for a more meaningful consequence of the designer's skills-set and the discipline itself, and still provides an important ideological position for the discipline and practice of graphic design. But a manifesto without action is merely a self-indulgent wish list: the political version of a mixed tape for your girlfriend.

Motivation and background context to the project

Until only a few years ago issues of sustainability were tackled by the graphic design degree students at the university where I teach as a personal interest research project: a fringe interest, marginal, home-made, a bit intense, serious and rather 'knitted'. In 'Consumer Society', originally penned in 1970, Baudrillard pointed to the conspicuous consumption constituted by a profusion of products and desirable gadgets as a "fundamental mutation in the ecology of the human species". Designers are complicit in the mediation of these chimeras of consumption without consequence, "so we live, sheltered by signs, in the denial of the real" (Baudrillard, 1998: 34). The real and urgent need to address issues of sustainability are seemingly at odds with the future-craving, part-time DJ, technology-obsessed, visual communications junkies, at art college and in the design industry itself. Sustainability is often perceived as a serious issue but "boring". Who needs another manifesto to add to the pile of unread scripts for that penny-dropping, life-changing moment that contributes to a world vision more ethically sound than ever before?

This project makes no such grand claims, instead was motivated a few years ago in direct response to a third year student, who asked why it was that environmental and sustainable concerns couldn't be introduced in the first year? Why leave the big issues to the big boys and girls in the final year of 'serious' study, when they could be introduced as a far more fundamental concern and core principle? As a tutor who loves a challenge I responded to this by trying to think of a format or context for discussing the diverse issues of sustainable design that could be accommodated by a consistently large cohort of 90 students. The motivation was also to frame theory in an active role, invigorating rather than stifling the immediacy of creative debate, facilitating creative learning by making and doing, sharing knowledge and ideas in a more peer-led than didactic way. In order to identify truths when so much reporting on the issues of sustainability is clouded in misinformation mediated by media outlets that persist in projecting an ambivalent of not outright antagonistic attitude towards ethical activism.

Aims and objectives of the manifesto

1. To introduce the urgent issues of sustainability, eco-design and environment as a core principle of design education in the studio-based environment.
2. To encourage open debate around the diverse local and global ideas and ideals of eco-design, environmental design, sustainability, and future design.
3. To encourage awareness of the power of design to change hearts and minds through word and image, digital media and performance, putting theory into action.
4. To recognize the influence of traditional graphic tools and visual mechanisms, such as typographic nuance, to communicate and elucidate a complex idea in simple terms.
5. To use the manifesto as a familiar forum for debate with which to articulate personal viewpoints validated and substantiated by thorough research.
6. To recognize the significance of the medium on the message.

7. To formulate a well-written argument tested 'live' in the studio in peer review.
8. To allow innovative and unexpected proposals to be developed in response to a complex and apparently difficult (boring) task.
9. To have fun, be creative and see the potential in sustainable design to be expressive, sexy, funny, functional, topical and desirable.
10. To establish a set of personal values, gather good practice, challenges to the status quo that can be carried through design education to inform ongoing design practice.

Although "graphic design is probably not going to kill you if it falls on your head" (Helfand, 2002: 22) it can still cause a great deal of harm by persuading you to take an ill-advised course of action, to live beyond your means bewitched by the myths of consumer society. A more critical analysis is given equal importance to creative play, something that is facilitated by referring to the political-artists' manifestoes of the past, such as the English Vorticist's 'Blast and Bless' cultural protest. Acknowledging the manifestoes f the past and present reveals a range of 'accents' available to the student unfamiliar with tackling a subject with such creative and intellectual significance. Basic design skills, already introduced in the weeks prior to this project, prepare the group as a whole and as a number of individuals to engage in a more assured personal mode, confidant of their ability to use photography, typography, conceptual, visual and material thinking. The creative methodologies of the design process sit side by side with a more theoretical stance drawn from critical theory and visual culture and this hybridity is what brings the argument to life.

The manifesto as a set of design principles

Dieter Rams, head of design at Braun for over 40 years is considered one of the most influential industrial designers of the late 20th century: his design ethos inspired a generation and has had a lasting influence on today's design landscape. Rams' ten principles for good design promoted the innovative, useful, aesthetic, self-explanatory, honest, understandable, and environmentally-friendly: recently featured as the principle text in the recent 'Sustainable Futures' exhibition at the Design Museum, London. Although it is certainly debatable how ecologically sound the consumer products and office equipment of Braun have been, Ram's aim to design 'less but better' is an ideological start at least. Perhaps the topicality and popularity is due to the pithy language used and the refusal to eschew commercial desirability at price of developing the environmentally friendly product? Or is it because the aims come in bite-sized chunks, less philosophically demanding and extensive than the Hanover Principles, the Designer's Accord or the demand for design to give more "meaning to our present way of life." (Poynor, 2000).

> Manifestoes have been penned for centuries to decry injustice or to defend truth, to denounce authority or to restore faith – even to rethink purpose and reassess value. In practice, the modern manifesto seems mostly to combine idealist wish lists with idiosyncratic value judgments. (Helfand, 2001: 17)

The contemporary green movement has been described as the epicentre of manifesto-writing today but the manifesto is, in the end, only a tool and one that anyone can write, share and more importantly, *use*. In this case it is the learning that is used and valued rather than the manifesto as an absolute doctrine for sustainable design. Its pedagogic value has consistently been revealed over the past few years since it was introduced as a more substantial and mindful forum for contemporary debate in comparison to the reductive social networking sites of 'YouTube', 'Facebook' and 'Twitter'. Manifesto helps the student articulate their own point of view through peer review, shaping and condensing their theories and ideas that can be expressed in accessible and directed forms, enabling the audience to discover their own position. This project acknowledges the typographic legacy of the Italian Futurists' manifesto, written at time of political turbulence and transition when old orders were being challenged and the new machinery of war and travel seemed to usher in a new progressive world order. The challenge for the students is to take the manifesto-style code of practice and to use it to challenge the role of the designer in this socially-negotiated practice but also to celebrate the "unique skill-set, vital to today's world[1]" that designers possess. These skills include finding inspiration and innovative solutions in diverse sources, developing an awareness of the consequences of media on the message and its production, and testing how local accent can contribute to global debate in a new age of collaboration.

[1] Quraeshi, S. "The Architecture of Change" at "Voice: AIGA National Design Conference" 2002

> The variety and complexity of design issues has expanded. The resulting challenge is the need for a more advanced ecological balance between human beings and their socio-cultural and natural environment. (Icograda: 2002)

Outcomes and responses to the project

Over the years the students' solutions have been intelligent and diverse in the opinions expressed, innovative in their realization and engaging in their integrity and conviction. Sometimes the visual argument has failed, when the student has not fully engaged in the broad based demands of the brief and the urgency of the issues involved. Outcomes are always tested 'live' in the studio in smaller groups, where peer review contributes to the message, medium and viewpoint taken: this critical support is vital to the crafting of a well-resolved manifesto. Figure one, below, shows a solution by a student who conceived of and printed a new layout for the traditional foolscap writing pad with much narrower lines encouraging smaller hand writing and, as a consequence, the conservation of paper. "Bored with serious messages of sustainability, I wanted to communicate how a few small changes can help the bigger picture" (Feb. 2009)

Taking the issue out of the context of the design studio, James Titterton, challenged the corporate social responsibility manifesto, which wastes huge amounts of paper and ink and is rarely read or acted upon. Sometimes the manifesto has gone on to influence personal projects later in the year, such as James, who was concerned with the casual waste of A4 office paper. "Recognisable existing packaging for the product is re-invented as a fold-out poster. The content of the poster illustrates how office workers can re-use their daily paper wastage for personal and environmental benefit". Often it is the re-envisioning of an existing product that provides the key for an argument to communicate capturing the zeitgeist and immediacy of the problem.

The method of delivery does not need to be as serious as the content, if the form it takes is appropriate to the end user: one student decided to create a musical piece. "I found the topic of sustainable design rather unappealing and decided to focus on the boring aspect of it. I wrote and recorded a rap with a catchy chorus, therefore making it memorable and the idea of sustainability made more approachable." (James Ward, 2010)

The culture jamming of Adbusters magazine is contrasted with the Modernist "less is more"

mantra, reused to enable a new vision of creative and cultural production, even the material itself becomes a part of the solution: one student created a manifesto cut into ice that gradually melted. Sometimes responsibility to initiate change is put back in the tutor's hands, as in Ben Urbanowicz's project solution where a badge was created for the staff saying "ask me about sustainability".

Summary and evaluation

The inherent interdisciplinary and collaborative nature of the design process "allows us to envision ideas from different perspectives while drawing inspiration from multiple disciplines. Because of it, we see the multi-faceted nature inherent in any problem". (Quraeshi, 2002). In answering what sustainable design is perhaps we can establish some of the territories of concern that directly affect the designer as a cultural producer, facilitator, and entertainer. Material thinking – the relationship between the medium and the message, and the means by which communication is tangible expressed - is incorporated from the initial stages of conceptual development to final presentation in the studio-based environment. These materials have already changed in value: paper, now, is recycled, considered more carefully before being used. Assumptions around the availability and appropriate use of technology are questioned as essential tools for contemporary discourse. Understanding the public or 'end-user' and researching at the primary source of the issues involved, encourages an ongoing knowledge exchange and good practice that resonates throughout the students' learning. Awareness of the intuitions of everyday life - in the hearts and minds of people, at home and at work - allows local accent to inform global debate. This project introduces responsible engagement in an uncertain world, where design is used to inform the problem-solving process, helping shape the actions of individuals and groups by establishing a common cultural dialogue. This in turn reveals the tremendous opportunities student designers have in helping change the behaviours and perceptions of the world as fragmented rather than organic and interrelated.

At London College of Communication's 'New Views 2' international design symposium in 2008 it was declared that *"Design is Dead"*, a provocative statement aimed at challenging design's role in society, its potential and responsibilities in a new age of collaboration. "*What is soon to be outdated is Graphic Design whereby the designer enters at the end of the process and produces a material thing: an*

object. A poster, a website, a logo" (Triggs: 2008). Manifesto for Sustainability introduces design students to a more global understanding of people, places and products aiding a more sustainable vision of the world and a more positive strategy for design.

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the Learning Network on Sustainability

Building sustainability into design education curriculum

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In the 21st Century, sustainability is high on the agenda of public debate, so is in education worldwide. The impact of sustainability has prompted some mind-blowing challenges and immediate responses from design education sector and the design community. This paper explores and addresses the concept and pertinent concerns of sustainability and sustainable design and focuses on how it may affect curriculum designing and pedagogical development in design education, especially at the Hong Kong Design Institute (HKDI) in Hong Kong.

It is argued that sustainability as an introduction to, and preparation for, design studies (generic and specific) at all levels and all disciplines, and it should draw a good attention. Analysed data from interviews, discussion forums and staff consultation meetings together with the empirical study by the author and co-author as leaders heading programme design and curriculum planning for HKDI's programme at tertiary level. As a result, a curriculum framework best suits the education in design sustainability has been devised, namely 3ARE. 3 stands for 3 paradigms and 3 also phonetically sound as 'free' in Cantonese. The 3 significant paradigms are Immersion, Experience and Commitment. The first ARE is Aware, Rethink and Explore; the Second ARE is Apply, Redo and Empower; and the final ARE is Aspiration, Responsibility and Evolution. The 3ARE curriculum framework proposes learning through building blocks and is freely engaged in planned diverse learning activities. For instance: collaborative projects with the community; discussions and debates; train-the-trainers and competitions in sustainability context. The experience herein reported are the process and progress of redesigning curriculum, the challenges and the barriers. The study reckons that the continue rise in essence of sustainability associated to green life, green business, green economy and green community does not exist in isolations that collects efforts from various sectors are deemed necessary if a sustainable future is our ultimate destination. Yet, education for sustainability in design is imperative for understanding the vital need to care for the business world with deep concern of the natural world.

Introduction

The United Nations Conference on Environment & Development (UNCED) 'Agenda 21' (United Nations Sustainable Development, 1992) is a theoretical and practical tool for addressing the problem of sustainable development; it has made a concrete proposal in the context of the Rio Declaration and is served as a blueprint for each government to draft its own 'Agenda 21'.

In response to 'Agenda 21' - an action plan to suggest ways of preparing the world for future challenges in accordance with sustainable development by the Hong Kong Government is established. The Chief Executive of Hong Kong Special Administrative Region (HKSAR), in his 1999 Policy Address, has em-

phasised the importance of the community, the business sector and the government working in partnership to embrace the principles of sustainable development. To facilitate this goal, the Council for Sustainable Development has been established to encourage and inform the wider community to develop an understanding of the concept and importance of sustainability for economic development and awareness of broader social concerns and respect for the natural environment. A strong message was delivered to members of the community that they should all pay a part in making Hong Kong a sustainable city through noticeable practices in all sectors. (The Council for Sustainable Development, Paper01/03 & Paper02/03, 2003).

In the 21st Century, the world, not lease Hong Kong, the importance and impact on sustainability have been explicitly prompted some pressures and immediate responses in the design community including creative industry, education institutions, employers and design practitioners. In connection to sustainable development and sustainability issues that professionals in a wide variety of roles have to deal with complex social, environmental and economic issues. Substantively, employers are seeking new kinds of competency of their employees (graduates from higher education), for example in ethics, human ecology, conflict resolution and environmental (sustainability) management (The Higher Education Academy, 2006). Yet, how to nurture designers with sustainability capacity and what are the challenges of designers in the 21st Century and future - these are questions required immediate responses from design education disciplines. There is also an urgent need for people with an interdisciplinary, multidisciplinary and problem-solving capability because learning for sustainability involves how to make decisions that consider the long-term future of the economy, ecology and equity of all communities (Glasser, 2004). All of these issues have a major bearing on curricula and the processes of learning in tertiary and higher education. Learning for this purpose is rather than a traditional, and often over-specialised, scientific or technical competence (UNESCO, 2002). To achieve these goals, concerted efforts are required; it is not limited to students but also for all teachers, administrators, and educational planners, as well as non-formal educators in all sectors (UNSD, Agenda 21, 1992; Jay, 2004).

Definition of terms

Sustainability

Sustainability is to be considerate as work processes of the system within which people work, not solely focused on the product but having a critical concern of material selection, production method, transportation, packaging, design cycle, product's life and ways of consumption. It is a driver of business values to boost economy and is both a necessity and an opportunity for the creative industry. To work sustainability is a new way of working which maximising positive impact and minimising negative impact thus allow individuals, communities and economic systems to flourish (Centre for Sustainable Fashion, 2009; RE-centre, 2010). However, referring to Huckle (1996) that sustainability has no single and agreed meaning just like liberty, justice and democracy. Its meanings are contested and a key function of education for sustainability is to help people reflect and act on these meanings and so realize alternative futures in more informed and democratic ways.

Sustainable development

In 1987 the United Nations provided the definition of sustainable development that is used most often: 'meeting the needs of the present without compromising the ability of future generations to meet their needs' (UN World Commission on Environment and Development 1987, 54). Significantly, sustainable development does not solely on environmental issues, but broadly captures the different dimensions of development and it is a lifelong process (Fox, 1992; GHK, 2008). Building capacity for sustainable development will contribute to the creation of a workforce and civil society better qualified to meet the huge challenges that the world is presently facing (UNESCO, 2002; Securing the Future, HM Government, 2005).

Sustainable design

Jones explains (2008) that sustainable design suggests a macro perspective on environmental responsibility for protection of the health and welfare of global ecosystems for current and future generations. He further extends that sustainable design provides ongoing benefits without degrading the environment. In correlated with McDonough's Cradle-to-cradle approach that is to apply design intelligence and ecological intelligence to the design process. It indicates, sustainable designs should be generated and created with a close relationship of economy, ecology, technology, equity, social values and human activities (McDonough et al. 2002).

Necessity to build sustainability in design curriculum

Educating for a sustainable future is a formidable challenge and design education for sustainability is going to be another new discipline heightened by design educators, designers and business sectors (Steffen, 2006; Tokei University Prospectus 2007/08). This concept is strengthened by 'Agenda 21' and Koichiro Matsuura, the Director-General, UNESCO.

> Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues…it is also critical for achieving environmental and ethical awareness, values, and attitudes, skills and behaviour consistent with sustainable development. (UNCED, Agenda 21, Regency Press, London, 1992, Chapter 36)

> The new vision of education for a sustainable future places education at the heart of the quest to solve the problems threatening our future. Education – in all its forms and at all levels – is seen not only as an end in itself but also as one of the most powerful instruments for bringing about the changes required to achieve sustainable development. (Koichiro Matsuura, Teaching and learning for a sustainable future, UNESCO, 2002, foreword)

What will be the new role of design education and what are the challenges? Heskett (2002) describes design as 'Design is to design a design to produce a design'. By this definition, it implies that designing is through various stages of processes and is fun. How to ascertain these processes and the solutions are the best consideration in terms of sustainability? This question not only leads designers being conscious in their design processes but also design educators and curriculum designers being conscious in their development of curriculum and pedagogy approach on how to develop and create a sustainable economy and education for sustainability. United Nations Conference on Environment & Development (UNCED, 1992, Chapter 36) states that "Education is critical for promoting sustainable development" and Shabecoff's (2000) indicates that "shaping of minds begins first with immediate family, but most profoundly with education, with the school." These quotes are again to indicate that education plays an important part to build a sustainable future. Significantly, it involves learning how to make decisions that consider the long-term future of the economy, ecology and equity of all communities (Glasser, 2004). Referring to Roling (2004) and Goldblatt (1996) the main driving force behind the challenges of education of sustainability is human activity. Therefore, a strong message should be informed to every person that every individual should acts as a learning leader at some level and capacity to manage changes (Meadows et al, 1992). Indeed, the cultural impact is also regarded as one of the important elements of this change. Cultural impact is to produce new aesthetic, cultural and intellectual forms and practices, which are labeled postmodernism that help reflect and shape an economy in a new form (Smart, 1993). It is noticeable that building the capacity for such futures-oriented thing is key task of education and must be based on changing human activities (Kosko, 1994; World Resources Institute, 2000). Significantly, a visionary education system with sustainability at its heart, producing designers who can use their creativity as a tool for communication together with a holistic interdisciplinary approach is vital to achieve all these tasks (UNESCO, 2002; Centre for Sustainable Fashion, 2009). It is totally agreed with Sterling (Sterling,1996:18) that "if it (education) is to fulfil its potential as an agent of change towards a more sustainable society, sufficient attention must be given to education as the subject of change itself'' and O'Sullivan (2004) extends that this is the challenge for all areas of education (Corcoran et al. 2004; Jay, 2004). Eventually, curricula design for this purpose should enable teachers to plan learning experiences that empower their students to develop and evaluate alternative visions of a sustainable future and to

work creatively with other disciplines to help bring their visions into effect (UNESCO, 2002). As teaching of sustainability is comparatively new in Hong Kong, innovative teacher education will be an important part of educating for a sustainable future.

Research methodology

Ample data was collected by using discussion forums, focus groups and consultation meetings from a constituency of stakeholders including (internal) course development team, teaching staff and students; (external) design practitioners and employers and with extent from "Agenda 21" and a lesser extent from curriculum survey, web sites, conference, and presentations. Subsequently, data analysis was grounded in theory with reference to current literature on sustainability, sustainable development and government policy. The methodology here employed interviews, discussion groups and consultation meetings because the common nature of these methods can elicit rich, detailed material and firsthand information (Stewart et al. 1990; Lofland, 1995; Frechtling et al. 1997). And these methods are also the centralisation of human interaction for knowledge production (Kvale, 1996). The grounded theory introduced by the sociologist Barney Glaser and Anselm Strauss (Glaser et al, 1967) is chosen for this research, the reason is that it permits researchers to follow emerging leads and clearly focus on the collected data , without sacrificing detail (Charmaz, 2006) so as numerous possibilities are woven in different ways thus illustrate various issues interact. It is also noted that case study may also suit this research because it help develop strategy for answering questions about how or why. And refer to Merriam (1998) that case study can accommodate a variety of research topics. In considering the impetus of this research – a starting point to integrating learning into design curriculum, that case study may be appropriate for the next stage for evaluation and enhancement study. The paper contributes a curriculum framework with emphasis on agile curriculum design processes and implementation would be necessary as a starting point to undertake sustainability issues into design education at all levels of design disciplines. Yet, a course/programme was not recommended to launch due to the immaturity of teaching environment and employment opportunity in the present stage in both the Institute and creative industry in Hong Kong.

Curriculum framework: Objectives and content

The research identified four broad levels of objectives for devising a curriculum framework for sustainability education to ensure content and learning outcomes of the module curriculum are educationally sound, up-to-date, relevant, and culturally appropriate for use within Hong Kong design education settings.

1. **Study and understanding the importance of sustainable development**
   Design for sustainability is the international trend which concerning the global climate seriously. It is also genuinely to take up the social and cultural responsibility with a wider perspective starting from the society to the community.

2. **Learn and create in a new way**
   Design educators and designers should use their abilities to the utmost for creating design to help realize and promote sustainable culture and societies. In respect to design, designers create designs with the lowest possible environmental impacts by minimizing resource and energy consumption throughout the life cycle of products, structures, services and systems. Equally important is with due respect for cultural diversity which are rooted in their history, customs and traditions.

3. **Educate with new approaches**
   A designer, by its job nature is exciting, powerful and joyful. A visionary education approach for sustainability education should producing designers who can manager changes towards sustainability in

new places, people and collaboration. Teaching approaches of sustainability should engage with emerging technologies, so as to bring efficiencies, novel material and new opportunities.

4. Build excellent partnership with other sectors

Celebrate partnership including business, government, community, green organisation and industry to forge new ground with sustainability at the very core of its values. Both teachers and students should actively participating international conferences and workshops to learn and benchmark good practices within academic institutes and business sectors, subsequently transformed into local issues as appropriate.

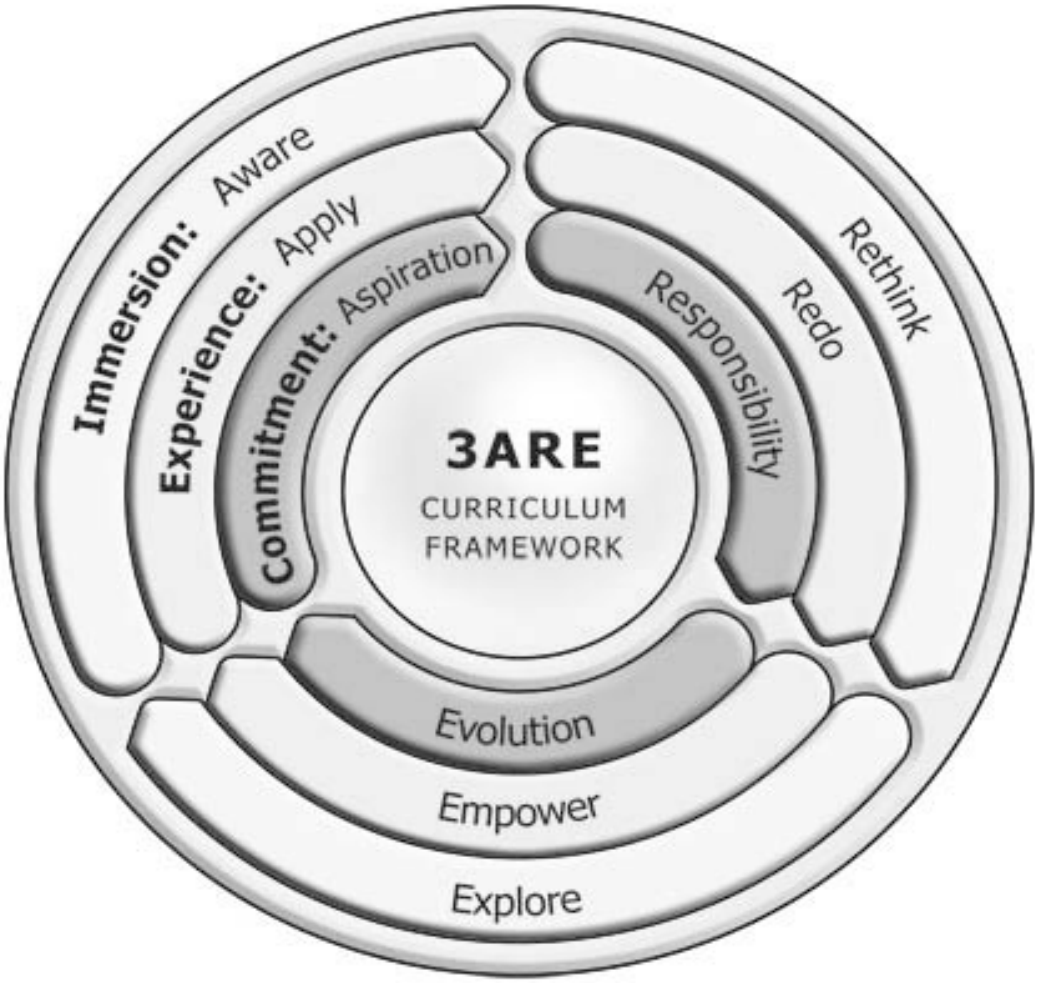
Strategic planning and implementation

The **3ARE** curriculum framework is devised based on the defined four objectives evolved by this research. 3 for 3 significant paradigms and 3 also phonetically sound as ‘free’ in Cantonese. The duel meanings of ‘ARE’-, it is the compositions of the 3 paradigms and is also an indication that to promote sustainability that a rich pool of individuals has to work together. The 3 major paradigms are Immersion, Experience and Commitment. Each paradigm contains ‘ARE’ approaches. The first ARE is Aware, Rethink and Explore; the Second ARE is Apply, Redo and Empower, and the final ARE is Aspiration, Responsibility and Evolution (Table 1). The 3ARE Curriculum Framework proposes learning through building blocks in a logistic sequence is shown in Diagram 1. Learning is engaged in a diversity of activities, for instance: collaborative projects with the community; discussions and debates; train-the-trainers and competitions in sustainability context. 3ARE is a flexible curriculum which provides new ways of planning for projects, lessons, modules and course curricula. It can be freely integrated and arranged to the module hours with close consideration to the objectives, intended learning outcomes and level of study of a programme (Diagram 2 and Diagram 3). We are doing this through collaboration with a wide range of stakeholders including students, teaching teams, design practitioners, employers and green organisations. The 3ARE in an attempt to nurture and develop graduates who are ready to take in consideration the social, ecological and cultural diversity, as design practitioners, consumers and citizens in Hong Kong.

Table 1: 3ARE: Approaches and Content of the 3 paradigms commonly applied to all levels of studies of design disciplines.

Paradigm	Immersion	Experience	Commitment
A	**Aware**	**Apply**	**Aspiration**
	Respect resources, local communities and livelihood. Increase the understanding between reuse and recycle.	Select right choice not great choice. Cycle resources in a closed loop system to reduce material use. Get involved both directly and indirectly in the business and community	Promote good habits associated with sustainability issues. Trigger and encourage changes in design thinking and way of consumption.
R	**Rethink**	**Redo**	**Responsibility**
	Improve knowledge and skills by reflection of design experience. Establish new design thinking, new business models and dematerialisation of value.	Encourage the lost of repair and cherish design items through care.	Design and make more durable pieces. Challenge convention and business models and give shape to a new more sustainable module. Offer both vision and object that can help in creating a sustainable city in Hong Kong.
E	**Explore**	**Empower**	**Evolution**
	Discover the current design practices and return to the craftsmanship of emotionally durable products	Develop a deeper Understanding of the Motivations of the groups of customers. Work deliberately with a wide range of professionals. Benchmark with other institutions for improvement actions	Investigate successful design stories and evolving new way in the design process associated to the sustainable aspects. Expand the study scope not limited to design disciplines but business social, technology and ecology.

Diagram 1: 3ARE CURRICULUM FRAMEWORK

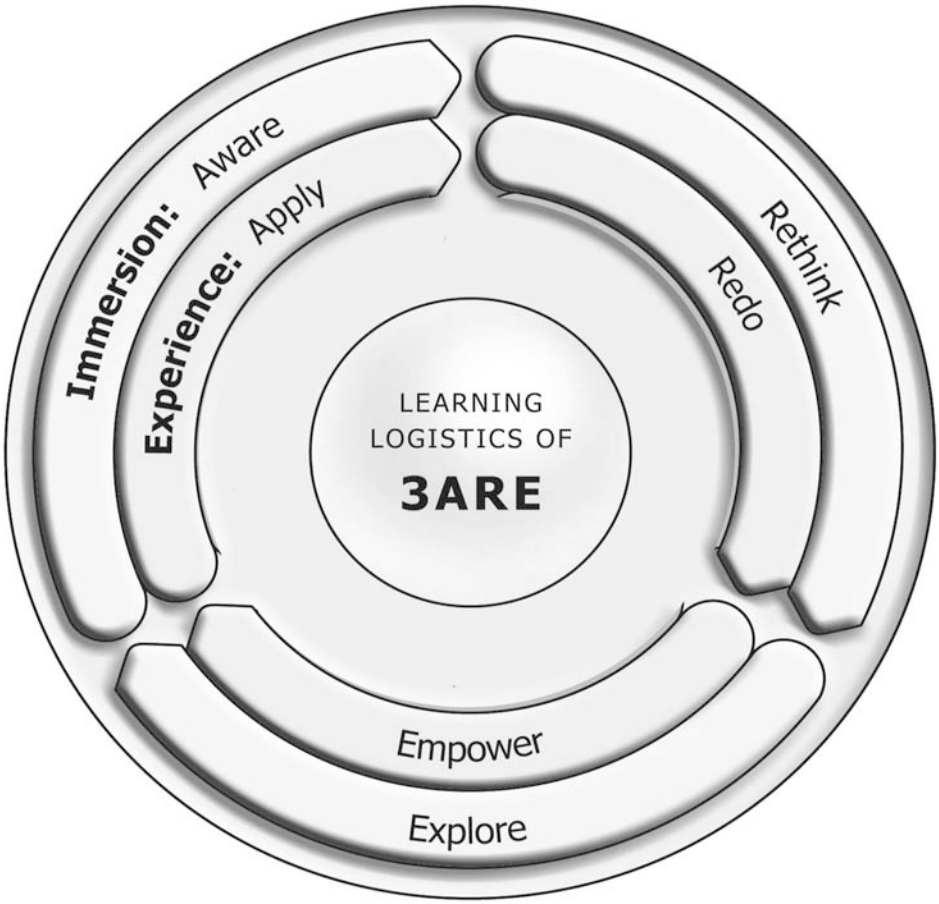


Learning experiences

This study reflects that many of these knowledge, skills and attributes are not easy to teach in a traditional sense (The Higher Education Academy, 2006); therefore, to achieve this goal, new way of devising a curriculum and pedagogy should be established. In response to this aspect, 3ARE is designed as an activist to promote sustainable development in education with a staunch support from teaching teams, and a collective effort from the creative industries and design associations to develop practical skills for integrating sustainable themes into the curriculum. Equally important, is to include sustainability aspect in employability to best suit to the knowledge, values and citizenships of educating for a sustainable future.

The experiences herein reported are some good examples of how the subject disciplines adopted 3ARE creatively to facilitate learning and activities of educating sustainability.

Diagram 2: 3ARE LOGISTICS OF LEARNING (Immersion and Experience)



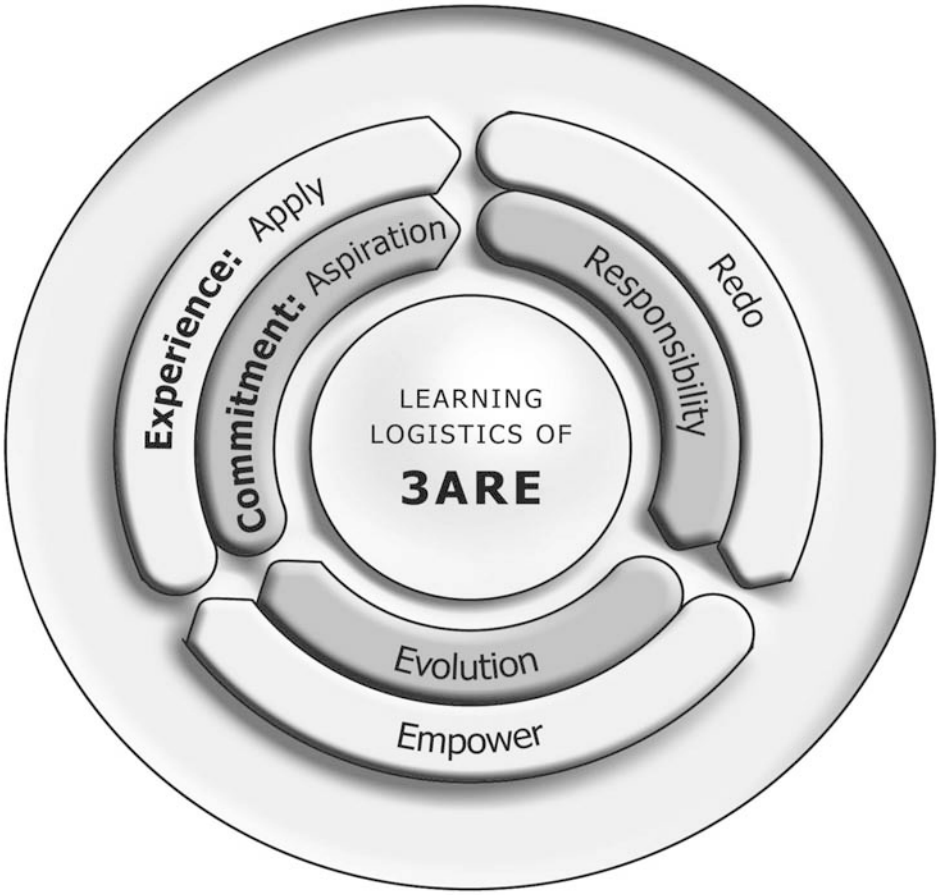
Immersion and Experience (case 1)

Discipline of Design Foundation Studies has already drawn on awareness, concept and application of sustainability into its curriculum includes cultural studies, workshop studies, and design projects. Students are encouraged to actively engage themselves in competitions on sustainability such as re-used, re-designed products from useless things.

Immersion and Experience (case 2)

Visual Communication design is the most active teams amongst teaching teams to engage students in this field. A significant number of collaborative projects had been done with media, advertising and design companies. Students also proactively participate competitions associated with sustainability and with remarkable results.

Diagram 3: 3ARE LOGISTICS OF LEARNING (Experience and Commitment)



Experience and Commitment (case 1)

The Product discipline worked collaboratively with the Friends of the Earth, a green association, to study the problem caused by the disposal of electrical and electric equipment and then created art pieces by composed all these disposal electrical wastes to convince the media and public of the urgency of electronic waste problem. Students' perception and understanding of design processes and sustainable way of consumption have been increased through this project.

Experience and Commitment (case 2)

The Interior discipline, students have been actively engaged in eco-material workshops with renowned design practitioners and academics to learn the sustainable development in material through discussion and group projects. Significantly, students are inspired by the flexibility of employing bamboo as a key material for architecture, interior as well as daily utensils design. A sustainable material lab is going to be established to fulfil their interest, curiosity and knowledge-exchange of this field.

Immersion and Experience and Commitment

Part of our activities is linked with research. The Fashion discipline started a research project on jewellery design made by a minority group in China's Mainland. Students were impressed and inspired the craftsmanship and learn how to appreciate the cultural diversity as one of the major parts in designing fashion, accessory and jewellery. Teaching team in Design Foundation Studies conducted a research with focus on

cultural diversity that inspiring young design students to expand their design concept with alternative design ideas.

Implementation process: Barriers and solutions

The experiences herein reported were the challenges and barriers of the 3ARE implementation into many of the modules of design disciplines at the Hong Kong Design Institute (HKDI) since 2009. Solutions were sought from a constituency of stakeholders, with remarkable contribution from the Task Force of Sustainable Design (TFSD) of HKDI which has been established in January 2009.

Table 2: Implementation process: Challenges, Barriers and Solution

Challenge and barrier	solution
Staff buy-in this concept	A Task Force has been established with staff members from subject disciplines. To promote a strong message that design education are required to make a transition towards sustainability. Seminars and workshops are continuously conducted to deepen and widen staff's awareness, understanding and appreciation of sustainability.
Relevance and responsiveness to the respective creative industries	Renowned experts in various design disciplines with a research focused on sustainability issues were invited as advisers to share their good practices in conducting programmes/courses of sustainability. Defined workshops would be conducted to both teachers and students.
Pedagogical approach	Highly interactive activities to enhance the teacher's understanding of sustainable development and related themes would be developed. Off-campus learning experience was encouraged.
Accountability	Academic standards were drawn on international experience in formulating measures regarded to quality and accountability. Subsequently, developing assessment guideline to best suit to the local setting.
Limited staff awareness an expertise and no time to develop this knowledge	Encourage staff to actively attended conferences and workshops. In practice, funding implication and time constraint would be the setback to fulfil this task.
Distribution of resource to support new initiatives	It is always the most critical issues to be solved in education settings. Apply funding from government will be one way to solve this problem but it is an arduous journey in terms of efforts and time demanding.
7. Syllabi writing and preparation of learning and teaching package	Encouraging staff to gain experience in syllabi writing and work as a team for knowledge-exchange. Workshops were provided by Teaching and Learning Centre.
Development of Innovative projects	Persuading staff to join design associations with focus on collaborative project of sustainability. Celebrating the new technologies, establish dialogues through web.

The challenges, barriers and solutions outlined in the studies are to share the rutted process of implementation of 3ARE. Major barriers were defined; however, there were many small issues happened at every stages of the development of sustainability into the curriculum of design disciplines.

Conclusion

The 3ARE curriculum framework was born out of a rich pool of stakeholders through interviews, collective discussions and references from documentations and aims to thrive and navigate the paramount of sustainability issues and commits to put forwards education of sustainability into curriculum of design education in Hong Kong. In this research, it is noticeable that the process of change will inevitably involve learning through doing; creating shared visions and cycles of agreement regarding sustainability practices. To achieve this goal, firstly, this curriculum framework will be used as a barometer to gauge our work and will extend as a basis for our interaction with colleagues, partners, collaborators and other education and creative sector experts. Secondly, colleagues must have a degree of 'ownership' of this curriculum framework before they will be willing to endorse it and participate in its implementation. This research will offer a platform of expertise, renewed insight and innovation that will affect change in the way that we, as designers; educators; administrators, will appreciate the nature, and will work, design.

Ultimately committing all concerned parties in developing a sustainable future through education of sustainability as a whole.

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the Learning Network on Sustainability

Prospects and challenges for a new education for sustainability

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Different civilizations located in different time and spaces have handled the issue of sustainability in their characteristic ways. Some have given greater emphasis to sustainability of self while others to the natural habitat. The purpose of life within these civilizations is accordingly defined. Cultures go to great length to affect balance among Individual, social, business, environmental ambitions. Often welfare of one can conflict with other. To this end, inter-value structure for sustainability is explored. Education for sustainability requires developing the capability to work with the big picture in a bigger time frame. To this end the paper further focuses on understanding the essential foundation for learning in sustainability. Cultivation of faith, feelings, metaphysics of existence, growth of the human mind, Faith, objects vs. values, cross cultural perceptions, evolving our concerns in system thinking, and watching the equilibrium would become the building blocks of the new education system

Culture is at the core of sustainability. It is the culture that seeks to sustain itself and it is the culture that that provides us the cradle to grow and to self actualize. Culture lives of the environment. Each culture has vision, viewpoint and has to evolve an equation with the environment. Religions have formed the basis of culture. It is the religion that has been establishing the relationship between the man and the environment. Religion has provided the meta-physical constructs that has formed the basis of the man-environment relationship.

We will discuss two popular extremes.

There is Jainism with its famous one liner " Ahimsa Parmo Dharma". What I find most fascinating is that it emphasis the action of not killing as the ultimate religion for mankind. This preaching also implies that if you do not kill you will not disturb the movements in nature and all will be well. The nature and environment has a logic that is sustainable and we should look for a path of self development that is based on non-killing and no interference with nature.

For the other extreme I take Christianity, merely because the environmental crisis is most rampant in Christianity dominated countries and they are also most concerned about the crisis. Lynn White (1967), himself a Christian, in his study concluded that many of our environmental problems could be traced to the Christian notion that God gave this earth to humans for their use and specifically directed humans to exercise dominion over the earth and all of its life forms. Christianity conquest of Pagan religions took the "spirits" out of the trees, mountains, and seas. Christianity's ghost-busting theology made it possible for man to exploit nature in a mood of indifference to the feelings of natural objects. It made nature man's monopoly. This materialist paradigm has dominated the modern world for last few centuries. Christian thinkers have over the last three decades formulated a response to White's indictment. They have come up with the Stewardship Model, that concludes that God did indeed give humans dominion, but only on the condition that we act as wise stewards, exercising our dominion with prudence and care.

Das (2005) has shown that the uniqueness in Indian culture, is in its capability to create an environment that recognizes the insecurity and instability in man. It strives to create a culture that provides the child social stability and then uses the culture to prod the child to reflect, as it grows older, on the illusory nature of the physical and mental reality. Thereby the focus is shifted to the unchanging, all encompassing, all knowing nature of the consciousness, which is also ascribed the basis of all that is in the universe. It role model is a sadhu, sanyasi,and rishi. A sadhu or a sannyasi is held in great veneration. So

much so that when a society ill treats a sadhu then even Lord Vishnu has to reincarnate on earth to restore order. A sadhu is a social rebel in the sense that he has rejected the society. He strives to free himself from social conditioning, lives on bhiksha (alms) provided by families, and on natural resources, and spends most of his time in meditation / understanding the true nature of self and then serve the society by facilitating a value based rather then a product based lifestyle. Sadhus come in innumerable forms, but always worthy of veneration. In the phraseology of Arnold Toynbee he is the social rebel who ultimately emerges as a creative leader to rejuvenate society. It is these sadhus who provide an ascetic underlying thread to the design of the Indian man made environment.

The sadhu's belongings are very, very few; in many cases limited only to a begging bowl. They may not wear any clothes. The directions of space are the only clothes (dighamber). Yet they are alert, watchful, content, restrained, and pleasant. They have love, understanding and wisdom. It would be an honour to have them as friend, philosopher and guide. They become interpreter and articulator of the working of the Brahman, Maya, laws of Karma, mythologies, scriptures and the society in general. They understand values and the relationship among values. What is relevant when? They are chief adviser for any king in the most difficult decision making needed in the management of state.

In traditional Indian culture (pre Islamic), it is values which is at the core of culture- environment relationship. It is these values that determine the cycling of material, and what material is used when and where. It is these values that will determine when to use disposables and what material to use for homes palaces and temples.

Inter-Value Structure for Sustainability

Cultures go to great length to affect balance among Individual, social, business, environmental ambitions. Often welfare of one can conflict with other. We can emphasize business welfare in utter disregard to other concerns and what may result is a business where adulteration, poor quality, unfair practice can become the norm. Similarly we may neglect social equity, allow poverty to take root and then poor people will have no option but to live off the environment or resort to theft and robbery. Understanding of inter dependence of values is essential for evolving strategies for sustainable development.

Some of the values of concern are

> Freedom, equality, compassion, justice, equality, collectiveness, tradition, growth, interdependence, holistic, trans-disciplinary, interdependency, interactive, relative, general, perceptive, conceptual, complex, dynamic, openness, feedback, integrative, adaptive, homeostasis, stability, regenerative, harmony, holism, empathetic, experiential, intuitive, evolutionary, wholeness, creative, synergy, organized, openness, hierarchy, descriptive, continuous, Self Organizing, Interconnected, interdependent, mutually self supporting, self cleaning, self organizing, evolutionary, regulating, diversity, clustering, symbiotic, Authentic, beauty, caution, comfort, choice, creativity, delight, imagination, desirableness, elegance, emotion, excellence, freedom, innovation, glamour, perfection, pleasure, passion, power, style

Today we cannot do without the urban landscape. We also cannot ignore our grasslands, forests, rivers, ponds, lakes, mountains, atmosphere and their ability to support us now and well into the future. We also cannot ignore individual and social aspiration. Business has to viable. Interaction of associated values is well represented in the Fig. 1 given by Adams, W.M. (2006).

As our intellectual & innovative capability to simultaneously consider and evaluate social, business, and eco-logical improves, the culture will move towards sustainability. The ideal state arises when all the three value concerns, social, economic and ecological overlap as much as possible. This would maximize sustainability.

To sensitize designers about sustainability concerns, it would be useful to list out the social economic and ecological values that are relevant to a given culture. Prioritize these values. Understand the relationship among them. Then alternative product design concepts should be evaluated for its propensity to support, undermine or being neutral to each of these values. This will enrich a product designers understanding of design in the context of sustainability. It will be useful to take existing product concepts and evaluate them in this framework over their product life cycle. Following product concepts can be taken as a starter.

- Ready made factory stitched garments

- Tailor made stitched garments
- Unstitched garments like dhoti / saris
- Drinking from reusable glass
- Drinking from a disposable glass
- Drinking from a reusable glass without lip contact
- Drinking from a '*kullar*'

Development is a team process. It requires that symbiotic advantage should accrue to the many stake holders. It also requires that the product concept while being sustainable should also be liveable, equitable and viable in sufficient measure for it to be sustainable. We can have a highly liveable house, but it will not measure up to equitable and viable benchmark and as such will not be sustainable and there by not the most desirable solution in the long run.

Some values are best evaluated subjectively, other objectively. Team work and democratic evaluation of the stake holders and feedback of the non state holders is equally important. It would also be useful for the designer if instant feedback could be made available on these measures as the design proceeds.

Essential Foundation for Learning in Sustainability

The present education system in Design & Engineering is based on consumerisms and harnessing physical laws in favour of nation's wealth. In view of the same there is a tendency not to look at problems and solutions in a long term and widespread perspective. Quest for quick gain clouds consideration and valuation of solution in a framework of long term or robust values. The education system has little scope of working on problems of trans-disciplinary or inter-disciplinary nature. The students are groomed for speed work and test taking. In the process the curriculum, the students and creativity is garnered quick results and profit making. The students are not encouraged to be reflective, compassionate and caring. The university system has become collection of silos within silos, from the system to faculty and students.

There are various challenges before us for restructuring the education system for environment care and sustainability. Here I will discuss a few which I consider most important for design education.

Importance of Faith

Any venture into the unknown is an "Act of Faith". This is a virtue that needs to be cultivated. Students, faculty and the education system must have great faith in themselves and in each other for any collaborative work to happen. They have to have faith that the problem is worth pursuing, then only will invest the required time and resources. They have to have faith that a solution to the problem is possible. They have to have faith in themselves to take up the challenge. Works of Charles Darwin, Albert Einstein and similarly development of GNU/Linux, E-Mail, Wikipedia, Facebook are all great acts of faith that have changed the way we live, interact. The problems of environment care and sustainability requires an equally strong act of faith.

Importance of Feelings

The role of feelings is often undermined in critical thinking. Professions that pride themselves on critical thinking, like science, engineering and law often suffer from creative thinking. Poets, musicians, painters on the other hand are more creative. They are also more feeling centred. Feelings as are such important to development of alternative viewpoints. It is also important for the consideration of different viewpoints.
Felling are important for generation of different viewpoints and also for the consideration of different viewpoints. Cultivating feeling is therefore crucial to the development of capabilities needed to address complex issues of sustainability.

Engaging in the metaphysics of existence

There are questions about existence that has no immediate answers. Opposites seem equally plausible. Yet each possibility opens up very different prospects. All great thinkers have to wrest with such problems. Albert Einstein wrestled with the proposition "Does God play dice". He was convinced that it is not so. This enabled him to work in one direction and his contemporary in another direction. Today general theory of relativity is as much accepted as is quantum theory. Similarly questions like " Is there life after death", "Do we live are karmas" are fundamental questions of existence that change the course of the sustainability debate and design strategy.

Growth of human mind

Education system is not built upon an understanding of the human. While we seek to have intelligent students and to an extend also appreciate creativity, inventiveness and innovation, we do not have a clear understanding as to how these can be fostered and nurtured. a teacher must understand them and their progression well enough to employ such methods of teaching-learning which promote their development. Intelligence is the foundation on which others are built. Creativity is a result of mental processing that seeks plurality of relationship or configurations from a set of elements. It results in generation of new ideas, association or configurations. Invention is characterized by doing or making something new and useful. It implies that creativity is an important part and building block for inventiveness. Innovation requires something more. This is the ability to see new social, cultural and ecological relationships. Only then innovation happens.

In table 1 we describe our understanding of cognition, intelligence, creativity, inventiveness and innovation. With this understanding it becomes easier to structure our education system.

Cognition	Ability to perceive	Improved ability to perceive improves intelligence
Intelligence	Ability to see relationships or configurations	Improved ability to see use intelligence from different viewpoints leads to greater creativity
Creativity	Ability to see many different relationships or configurations	Ability to critically evaluate relationships and configurations leads to inventiveness
Inventiveness	Ability to see new, viable and meaningful relationship	Ability to critically imagine and evaluate inventions in a socio-cultural context leads to innovativeness
Innovation	Ability to see new socially and culturally meaningful relationships	Synergy with society & culture leads to OVATION

Table 1: Cascadian connectivity in mental development in design education

Objects vs. Values

Designers design artefacts and when artefacts are valued highly and mass manufactured many fold they become strong carrier of values. With artefacts comes a complete socio-cultural service structure. A value structure inherent in a product gets ingrained in the minds of the people and in the culture itself. Car as a mode of transport creates one value system. Metro as a means of mass transportation creates another value system. A 'sadhu' or 'sanyasi' who has taken a vow to travel bare feet only creates a yet another value system. Education should learn to handle values within its curriculum without weighing down on student or teachers conscience. Alternative design strategies have to be explored in a larger time frame keeping in view the values it would propagate and these values in turn will influence future growth. In Table 1 as we move from intelligence to innovation, we also see a greater concern with values. Understanding values, their interaction and their influence on human growth, environment and physical infrastructure quality will drive the sustainability debate.

Cross Cultural Perceptions

Different solutions exist in different cultures to the same problems. Understanding the cultural logic of a given solution will enable us to understand the value structure of that culture. This appreciation is essential for designing culture specific solutions which are likely to be more sustainable. Cross culture studies is an essential component of education for cultural sustainability and environment care.

Redefining System

Development of system theory was a great step away from the fragmentation of reductionism. It was a movement towards integrative thinking, towards holism, towards biological like design perfection. However it was still concerned only with man made systems and was exploring how they can be made better, more efficient and fail safe. Environment was still at the periphery. Its health was not the focus. Product, system or the task health was the prime focus. If the system approach to sustainability is to succeed then it is essential that we bring environment and the human as also the prime concern of system thinking and analysis.

Watching the equilibrium

The interaction and wellbeing of man, system and environment is important on one hand and interaction of values at the level of society, business and ecology on the other hand. Watching these two equilibriums is essential for creating any sustainable culture. This is a challenge that is worthy enough for the best universities in the world to consider. It requires a new out look where disciplines interplay and communicate with each other and where creativity and care will work together. Such a paradigm will open up new frontiers for human development and environment care. The physical man made systems will be the means and not an end in itself.

Conclusions

Dominant emphasis on objects rather then values is the prime cause of sustainability crisis. This is seen in cross cultural studies and related religious systems. Extend of disparity or the overlap between social, business and ecological values determines the space for sustainability success. The problem can be best addressed by a refocus of concerns in our education system which has to move towards creativity and care and analyzing and evaluating problems in a longer time scale. This requires emphasis on the importance of faith, feelings and meta-physical issues of existence. Study of values and design valuation in term of long term values will become important. System have to be redefined from the current concern with physical element to that where wellbeing of man and environment is equally important. a value centric viewpoint where individual, social, business and ecological value interact. Systems will have to be analyzed not only in the now time frame but also in the then time frame. The power of ecological values and emotional design has to be rediscovered as it will help propel people to higher echelons of needs with lower overhead on the environment.

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Vocational college of design education for sustainable development

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It is aim at cultivates high level vocational and professional designer in college of vocational design education in china. The responsibility of vocational design education is very important because of it is the one of the base of society. But in china, the Damocles`s sword always suspend upon these vocational colleges that are recruit students and rate of employment of students, the both are direct effect all vocational colleges because low level recruit and employment will be fatal factor for them. So how can attract more students and ensure high level rate of employment are headache things to every college. The rapidest method maybe change courses name make these look like more modish or use short order courses replace some base and significance courses. Of course most of us all can foresee these ways are not sustainable especially to vocation of students. How to balance these factors is pressing thing to vocational design education in china, I think we should be practical and realistic come out of from characters of vocational education.

Vocational education, aimed at training high-quality application type of professional. Art & Design vocational education undertake training for the community of high-quality art and design talents of great responsibility. The students with the better vision for the future to vocational education schools, for them, the learning experience here is very important, and will affect their life career development planning.
The “recruitment” and “employment” are two Swords of Damocles hanging over vocational colleges in china, these direct impact on the school’s survival and development. Because of these facts specialties set up often pursue fashionable name and “practical” courses. More severe the current employment situation in china, most of vocational colleges emphasize “professional programs”, such as the various professional courses have enhanced the software application, compression of the basic training, all of these have neglected talents in employment after sustainable development. How to solve the problem aim at improve students sustainable capability, starting from the characteristic of vocational education is the basic line.

The characteristics of vocational education

1. Short-termism

Most of vocational colleges have 2-3years length of schooling compare with university time is limited, Therefore, the training program must be compact and practical.

2. Specialization

The curriculum more professional and more focused for a limited time to achieve their professional qualities.

3. Practicality

Intensive training through on-site so that students with greater ability in practice. Based on these characteristics, the design of specialized vocational colleges should be combined with the characteristics of students in curriculum settings, develop reasonable teaching programs for students lay the foundation for future career development. However, in severe recruitment and employment situation, vocational colleges are struggling to respond to the sustainable development of human resources to become empty and come into the wrong region.

Misunderstanding

1. Neglect of basic training

The students and their parents often position vocational colleges as second place after cannot enrol in university. Most students in vocational colleges have lower capable at study from the Candidates not only the basic of artistic capabilities but also basic knowledge. Their study habits, understanding are yet to be developed. Basic training curriculums are the most since they entered the school needs. Indeed, due to the characteristics of the academic structure we do not have much time, so regardless of basic or applied course curriculum must be compressed. However, the necessary basic training is indispensable. As the graphic design speciality, a certain ability to shape, colour knowledge is the basis for curriculum design, drawings, colour and composition curriculums should be the first academic year of training as basic skills. If basic training is not enough when to design courses even takes more time maybe not necessarily meet teaching requirements. However, as with Chinese characteristics, first-year students should spend much more time at variety of general subjects, so the speciality basic course of lessons have to be compressed. These basic skill trainings can also be added in the second year of undergraduates, but vocational college students do not have the condition because limited length of schooling. Dedicated teachers who will then ask students to practice at their off hours, this would be a solution. The majority of vocational colleges often reduce the basis of courses, some last remnants of course also have to receive “curriculum reform” be imposed “applicationism”, such as pattern design course, some teachers to compressed the core of course content to arrange a lot of time for “application design.” These dones was received greatly admired from school management and even that is a model to meet the vocational education reform ideas. Moreover, some institutions insist remove most of the basic courses , such as drawing, colour training, because such courses be deemed to have no “practical.” These thinkings derail from the original intention of vocational education.

2. Ignore the professionalism

Quality is sustainable development of any professional life, no professional relate to job is painful and immoral and cannot sustainable. Unfortunately, for the sake of speed up “curriculum reform” some vocational colleges look for subdivide of the name of courses, for the lip-born “teaching achievement”. In order to achieve in the short term, some teachers encourage students to imitate. Because to do that you will win recognition from higher level rang officials, the students “support” and parents “praise”, but can not win the sustainable development of professional life even adversely affected community and industry .

3. Neglect interest and passion

“Professional” word here seems a little embarrassed, It represents the “second best” of helplessness, but also seen the hope of employment. In such helpless and hope, seems to determine these students is forced to learn the skills as a means of livelihood. Education officials often encourage students study hard in order to get fat pay. This “reality education” seems to be “practical” but students the only remaining point of art, design beautiful imagination vanished replaced by instant success and the arts, design resistance. Interest is the best teacher, interest and passion is the driving force for sustainable development career , if passion absent, learning of momentum will exhaust career inevitably miserable and divert to be inevitable, then what have few years of vocational education for their lives?

Foundation, literacy, interest, passion, these neglected elements of the above, these seems “impractical” and “useless” concepts stand in the “vocational education” opposites, as if born destined to be ex-

cluded from vocational college. In fact these “nothing” thing, supporting students design career and design professionals, are indispensable driving force for sustainable development.

The propose

1. Strengthen basic training

In the limited time to increase hours is unlikely, but try not to compress the basic courses and “applicationism” in the “Curriculum Reform”. “ Effective use class time to strengthen students modeling ability, appreciation of colour knowledge, Also use the first year of extra-curricular time, ask students to sketch every day practice, accumulate day by day will be very significant.

2. Increase the professionalism of education

Vocational education mainly by professional teachers, in the teaching process, strict requirements, set good examples, so that students are subtle influenced. So it is necessary for teachers to improve their own professionalism. Schools can provide training programs for this. Can also set up a lecture on a regular basis, make the industry insiders own experiences improve their professionalism.

3. Professional knowledge of education

Professional understanding of the purpose of education is to enable students to understand the specialty, and then love it. The sustainable development study momentum should base on interest. Specialties name attract freshman in normal conditions, which is the reason that institutions interested in the name of stunning professional. Freshmen will have a professional description, but the abstract concept is difficult to impress. Followed by one year foundation course, so until the second year, students have access to a “professional courses”, and another year they have to leave school. So most of the students in the school learning process is not clearly, and lack of understanding on the specialty, let alone love. The vocational colleges and enterprises can cooperate to carry out the professional knowledge of education, field trips for students, visit the related industries, while go to the exhibition, listen to lectures is also effective.

4. part of the curriculum and course design software merger

If you want to compress hours, then the most effective approach is reasonable merger. Some instructional objectives can achieve in one course, such as some software programs and design courses that the process of learning design of course have to use software. In fact, some of the software is relatively easy to study without special commencement, such as CorelDraw, Photoshop, AutoCAD, etc., which can be synchronized in the design of the curriculum study. This program will not only dry out of a disinterested sense of software course, but in order to produce their own work is more study hard , then experience the fun of learning and achievement. That is cultivates professional interest and passion also helped. It can also be used to strengthen the conservation part of the class hours used for basic training or vocational training.

5. Combine with theory and practice courses

At present, China’s education system is to separate the theoretical courses and practical courses. In most of situations professional program must contain a certain amount of theoretical and practical courses. We asked the Department of Educational Administration Department to adjust the education plan that will be part of the curriculum direct change into practice course. However, this suggestion not approved by academic department because theory courses not enough that are against the rules. But in actual teaching even in theory courses also should combined with practice. So if these courses can not merge, the second select is theory and practice courses proceed by turns, while starting and ending. Wenzhou Vocational and Technical College is to do so. It` s a shoe design and technical school. Shoe design course is the theory, design methods and explain the shoe plate-making method, while the leather process is the practical lesson, ask students to design their own plate of shoes and make a finished product. This not only combine the two courses, students also feel the fun of learning from get a sense of accomplishment. More importantly, the practice can test the reasonableness of the design and plate making, accuracy, identify problems in time to adjust. Such as former plate shoes if there are deviations from the plate itself is difficult to find, but in the proofing it will stretch appears uneven, distorted and so on. Thus courses can be

designed to detect problems in a timely amended for the next study to lay a solid foundation. In practical work the same way, corporate design departments including proofing department, a shoe model designed to be immediately proofing, correction, then play like, and then modified. All of these repeat several times to ensure the accuracy of shoes sample. In the study of knowledge, skills, students also learn the process of the enterprise's work processes, future employment can adapt better and faster.

6. Increase focus on vocational training courses before graduation

"Employment rate" is a sensitive topic, because the severity of employment situation, whether schools or students all serious about it, the school required each department to report monthly employment rate to estimat the situation. Therefore, students often hurry for jobs in the fifth term. It is contradiction that officials are gratified, but teachers are worry about the students had only two years of professional study, although learning the necessary basic courses and some professional courses, there are a lot of skills not learned, because some of the important specialized courses in the fifth semester. As China's national conditions and factors, this conflict can not be solved yet now. Before graduation students in order to get many professional skills, summer holiday training plan can be taken. In the summer before the fifth semester, focus on vocational training arrangements and cooperation with enterprises or aim at Grading Test to conduct targeted training.

These recommendations are based on the current situations and the characteristics of vocational colleges, may sacrifice part of interest of some stakeholders, However, the long term, sustainable development of human resources not only great significance for the students and school, but also sustainable development of society.

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Approaches, methods and tools to support education on product design

the Learning Network on Sustainability

Pedagogy for sustainble design practices in fashion schools

Teaching experiences cases and examples

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In the global scenario, to achieve a sustainable product, the exclusive use of eco-friendly materials may not be economically feasible in the decades to come. In such a situation, using all the materials, including the 'non- eco-friendly' ones, to address the real problem of environmental crises is quite relevant. This can be achieved to a certain extent by exploiting these materials to its ultimate usage, thereby limiting the production of such materials. This will reduce environmental hazards in a considerbale way. In this regard, a different approach can be adopted in design thinking.

This paper deals with the new pedagogical development in design conceptualizing and teaching in fashion schools. The main objective of the study is to develop teaching methodology for more sensible and responsible designs that can be a better solution for sustainable fashion. The aim of developing this methodology is to design a fashion product with extended usablity and also to satisfy consumer's expectations.This was achieved by planning product's second life in the beginning itself by the designer and not by the end user as the conventional practice goes.

Fashion and the concept of sustainability are seemingly paradoxical. On one hand, fashion design is the applied art dedicated to clothing and lifestyle accessories, created within the cultural and social influences of a specific time. It is considered to have a planned obsolescence usually of one or two seasons. On the other hand, sustainable design refers to the philosophy of designing physical objects, built environment and services, to comply with the principles of economic, social, and ecological sustainability.

Sustainable fashion is designed to be environment friendly. It is a part of the larger trend of "ethical fashion". It is a global movement that involves economic, environmental and social issues. It is not just a trend but is a way of designing styles as per positive future demands.[1] Fashion is a huge industry and influences environmental, ecnomic and social systems in many ways. Incorporation of sustainable aspect at every level is important and it starts with the right understanding of the field. Sustainable fashion is not a trend. It is way of designing the styles as per positive future demands.[2]

As per Fry, design future is concerned with humanity, and more specifically, how a design can contribute to the continuation of humanity. Design is intrinsically linked and intertwined with humankind and the myriad problems facing the current state of the world.[3]

Today, fashion is one of the most dynamic, challenging and fastest growing sectors and therefore, it influences environmental, economic and social system in many ways. The sustainability movement is all pervasive today and touches many elements of consumers' daily lives.

Making fashion sustainable means taking into account more than just style, quality and cost. Therefore, it is important that while teaching design development, one should understand the benefits of sustainable operations starting at concept development level, thereby broadening the design aesthetics and the functionality of a product. The goal of design methods should be to gain key insights or unique essential truths resulting in more holistic solutions. This will help to achieve better experiences for users with products, services, environment and systems they rely upon.

Today, a conscientious consumer covets and consumes products with certain ethics, and therefore, there is a need for complete reconceptualisation of the practice of design. In such a scenario, the pedagogy for fashion requires certain amount of sensibility in terms of sustainability. Sustainable development requires radical changes in the way we design, produce, consume and socially interact. These changes will not only be technical, but also social and ethical. Important contributions to change are directly linked to the role of the design. However, the design community as a whole is not yet the proactive and diffused agent it could potentially be.

Expression is the focal interest in fashion design. Introduction of sustainability aspect, in making and using fashion will broaden the design aesthetics. Although there are many references talking about fashion designing with various perspectives, the literature on teaching methods which involves ethics with aesthetics is not extensive.

This paper deals with the new pedagogical development in design conceptualising and teaching in fashion schools. The main objective of this study is to develop teaching methodology for more sensible and responsible designs that can be a better solution for sustanible fashion. The aim of developing this methodology is to design a fashion product with extended usablity and also to satisfy consumer's expectations.The design development is done in such a manner that a product's second life can be planned in the begning itself by the designer and not by the end user as the conventional practice goes.

Hypothesis

The 'Planned Second Life' philosophy enables designers to create unconventional and innovative designs influencing the design of the first life by the second.

Objectives

Formulating a pedagogy for fashion designing which results in a more functional and culturally rich sustainable design.

- Designing the product for its first life by keeping its second life in consideration.
- Planning the transformation of the product from first life to second life, convinient to the end user.
- To study the influence of the second life in the design of the first life.

Methodology

The experiments were conducted in National Institute of Fashion Technology, Bangalore.
Sample size was 35. Practical class assignments were done by the ongoing 6th semester students of Fashion Design. The assignment brief given to the students was as follows.

1. Design the product for its first life, taking its second life into consideration.
2. Plan the transformation of the product from first life to second life, that is convenient to the end user.

(Note: This assignment was not designed as an empirical experiment to test and evaluate teaching methods and models in a strict sense).

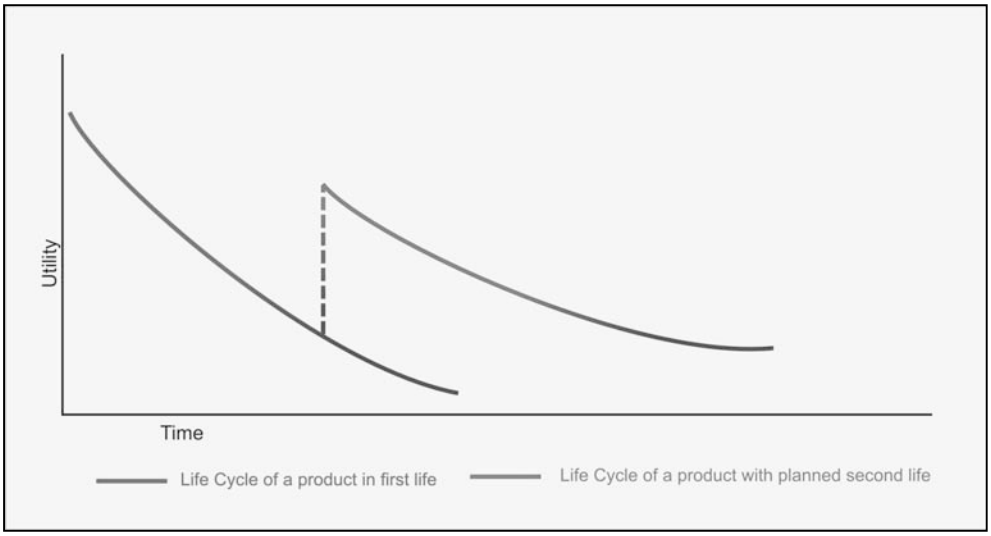
Analysis of the incorporated plan on the complete design process was studied. The influence of the planned second life on the design concepts and process was also carried out. Documentation was done by recording still images of the product at its first and second life stages.

Development of new design process

The objective of this exercise was to develop strategic thinking in designing in order to achieve viable solutions for sustainable fashion designing. Since fashion caters to psychological utility than functional utility, the normal lifecycle of a fashion product lasts for one season. The idea of this exercise was to approach design formulation in such a way that the overall life cycle of the product can be increased, resulting in conservation of material, time and energy involved. At the same time, the product created in extended cycle may also be a designer product, which can gratify consumers' psychology.

For achieving the psychological and functional utility of a fashion product, the design process was modified to design two life cycles for one fashion product. Also, the transformation of one life to the other was planned in the design process itself by the students.

Figure 1: Life cycle of normal fashion product vs. life cycle of product with second life cycle in terms of utility

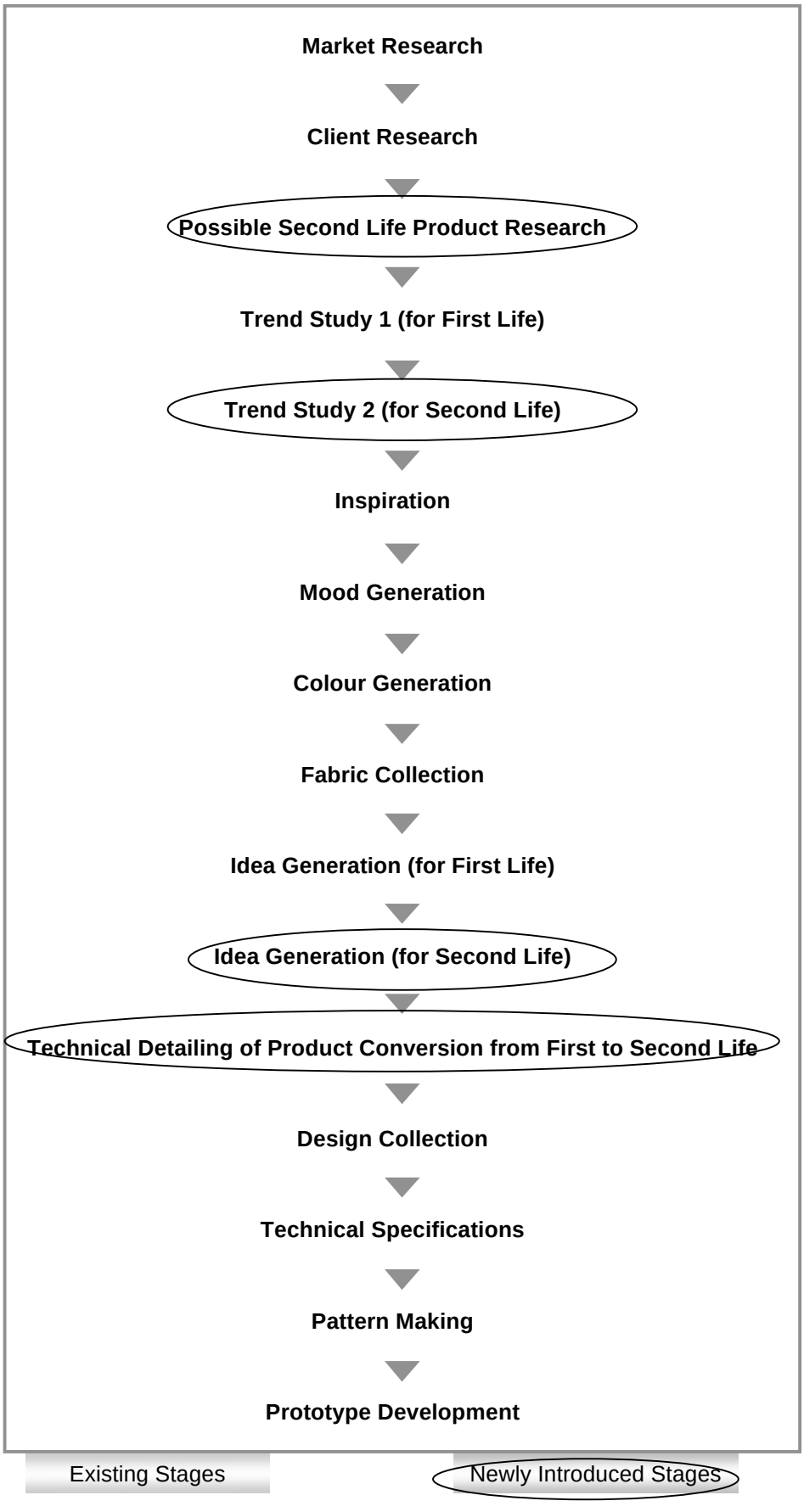


The application of new design process will result in:

- Logical understanding of the design process
- Understanding sustainable design philosophy to comply with the principles of economic, social, and ecological sustainability
- Intuitive approach towards the second life of a product
- Ability to understand and apply long term trends
- Ability to think design with a sense of responsibility
- To be innovative in design detailing
- Extend the endurance of the material used beyond the product's first life

The assignment was planned for 8 weeks. Weekly monitoring and final analysis at the end of the design project was done for each design. The brief was given to students to develop the product with a modified pedagogy as shown in table no 1:

Table 1: Modified Design process



For this study, four examples are being analysed to support the hypothesis formulated.
The observations made are as follows:

Observation: 1

The theme taken for this product was ***Spring Awakening***. Initial concepts were developed which were evaluated and monitored. A tunic dress was approved for the first life and a fashionable sack-bag was planned for the second life.

A stylish tunic was designed with a focal point on the neck. The whole neck line was developed considering the second life, a sack-bag. In the second life, the neck line was transformed to the handle of the sack-bag. The bottom hem was folded and stitched with a draw string inside for easy conversion from the first life to the second life. Shown in figure 2.

Figure 2: *Spring Awakening:* A stylish tunic was transformed to the handle of the sack-bag

Observation: 2

The theme taken for this product was ***Oriental***. Initial concepts were developed which were evaluated and monitored. An empire line dress was approved for the first life and a window curtain with holders was planned for the second life.

A stylish empire line dress was designed with multiple pockets and extra large loops with large decorative buttons. The pockets and loops were added to the garment after considering the second life, i.e., a window curtain with letter/magazine holders. In the second life, the loops would be used to hang the curtain on a rod. The conversion from first life to second life has been made easy by removing the stitches from the empire line of the tunic. Shown in figure 3.

Figure 3: With an *Oriental theme,* an empire line dress would be transformed to a fashionable window curtain

Observation: 3

The theme taken for this product was ***Illusion***. Initial concepts were developed which were evaluated and monitored. A jacket was approved for the first life and a set of table runners, mats and coasters were planned for the second life. A stylish jacket was designed with innovative use of appliqué work. The appliqué work can be dismantled and used in the second life. The bottom area of the jacket would be converted as the table runner and appliqué would be converted as table mats and coasters. Conversion from the first life to the second life can be done by unravelling a few stitch lines. Shown in figure 4.

Figure 4: With an *Illusion theme,* a jacket would be transformed to a set of table runners, mats and coasters

Observation: 4

The theme taken for this product was ***Denim***. Initial concepts were developed which were evaluated and monitored. A tank top was approved for the first life and a fashionable back-pack was planned for the second life.

A stylish tank top was designed with an unusual kangaroo pocket and wide straps, considering the second life, i.e., a back-pack. In the second life, the tank top would transform to a back-pack with a running stitch on the bottom hem to close the opening. The string inside the piping at the upper hem can be pulled to close the back-pack. Shown in figure 5.

Figure 5: With a *Denim theme,* a jacket would be transformed to a back-pack

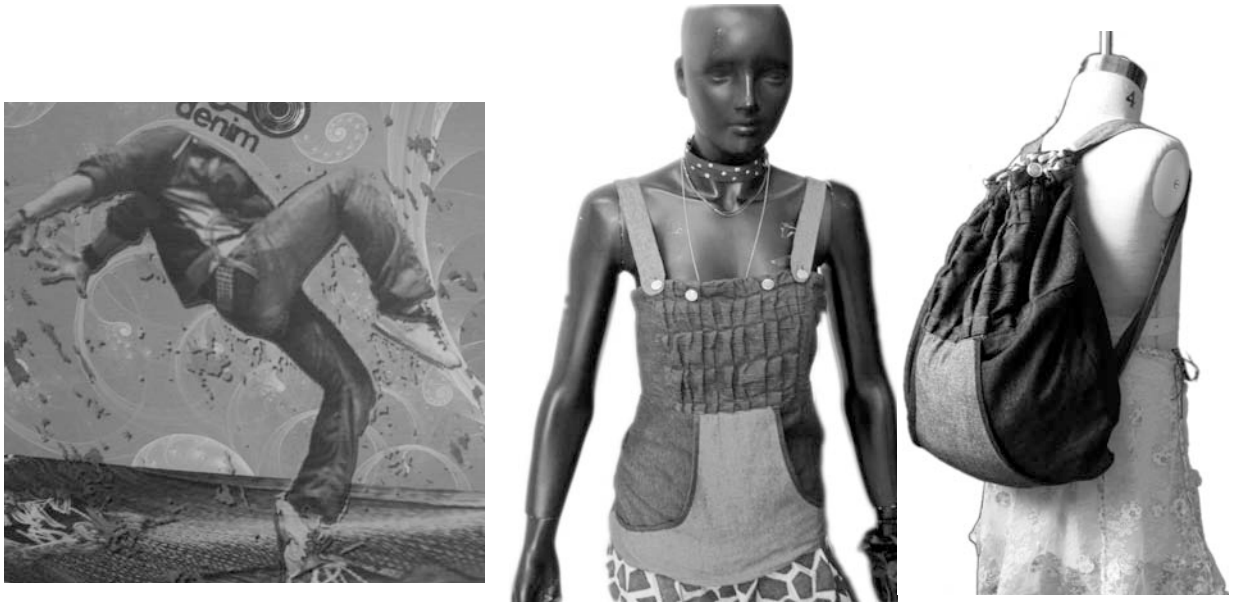


Figure 6: First life – a top and skirt & second life – a cushion cover and a bag

Figure 7: First life – a top with a zip and skirt with waist string & second life – a bag

Plate 8; First life – a top & second life – pillow/cushion covers

Conclusion

The developed pedagogy has multiple advantages over the conventional design pedagogy as it provides logical understanding of the design process for sustainable fashion, intuitive approach towards the second life of a product, to think design with a sense of responsibility, to be innovative in design detailing and to extend the endurance of the material used beyond the product's first life.

After analysing the recorded studies, it can be concluded that the design of a product can be done keeping its second life in consideration. A thorough research about long term fashion trends is important in designing the extended life cycle of the product. A designer can incorporate simple and convenient methods to transform a product from its first life to its second life.

The study has proved beyond doubt that planning of second life of a product will certainly have an impact on the design thinking of its first life.

In today's scenario with global focus on sustainability, extending a fashionable product's life beyond the recognised horizon will certainly have a positive impact. Including the aspect of sustainability in teaching itself will give students a wider perspective to think design in a more holistic manner and to become sensitive and sensible towards environment while designing.

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Communication and sustainable development of traditional culture in new media environment

Take Chinese traditional costume culture for instance

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During the period of accelerated economic development within developing countries, the sustainable development of traditional culture, including costume culture, has faced numerous problems. New media communication tools have provided a new and broad space for the communication and development of costume culture. How to accurately convey the study results of Chinese costume culture to costume majors, the costume world and the general public to promote the sustainable development of costume culture has become a new subject. As teachers of BIFT, we have made significant efforts with exploratory studies on the communication and sustainable development of Chinese costume culture. We hope that these efforts will draw the study results of Chinese costume culture out of studies, mass communication, industrial transformation and contemporary development. It will seek new mode of promotion and sustainable development of Chinese costume culture and explore new ideas for the communication and sustainable development of traditional culture in the new media environment.

The diversity of the environments provided by the earth for human survival diversifies human culture. Since the emergence of humans, people living in different geographical environments have survived and developed in different natural conditions and progressively formed different types of culture of different countries, nations and regions, of course including different costume cultures.

With the progress in science and technology during the past fifty years coupled with the development of global economic trade and information transmission, cultural exchanges between different nations, countries and regions have become increasingly close and frequent. In other words the world has gradually become an integral whole. Thus this great tide of globalization and integration has meant that cultural differences between nations and regions have become smaller and cultural features have become increasingly convergent. As a result originally colourful cultural forms have become increasingly unitary.

The accelerated economic development of developing countries has resulted untraditional culture being neglected and it has sunk into a state of loss. This period of social transformation has almost become the period of cultural discontinuity and as one of the integral parts of Chinese traditional culture, Chinese costume culture is also facing this same problem.

The Limitation of Communication of Chinese Costume Culture has brought some Realistic Problems in the New Media Environment

For a long time, the study results of Chinese costume culture has primarily been communicated by fields such as costume, archeology and history, and the communication of Chinese costume culture has been restricted greatly for the people in other fields. However, there is no “inheritance” or “innovation” with-

out “communication”. The communication of study results of Chinese costume culture is an important element for the inheritance of Chinese traditional costume culture, and contemporary popularization and applications of Chinese costume culture is an integral part of the sustainable development of Chinese culture.

Abroad, costume design masters such as Yves Saint Laurent, Valentino and John Galliano who had used Chinese cultural elements shone on international stages. Japanese costume designers such as Issey Miyake, Kenzo and Yohji Yamamoto also successfully explored the essence of Oriental traditional culture, thus challenging the domination of Western designers and establishing the international status of Japanese costume designers and their brands.

However, in China, the limitation of communication and development of Chinese costume culture has brought about a number of problems which need to be addressed urgently.

The clothing industry lacks cultural support

The lack of “cultural creativity” in China’s clothing industry has long been in an embarrassing situation for OEM, thus becoming a processing plant of costume manufacturing worldwide. Resulting from lack of cultural support, Chinese costume brands are weak, deficient in design and innovation and, short of the intellectual resources needed for sustainable development. A creative design and brand building of Chinese costume has become paramount. Under these circumstances, the clothing world has begun to pay attention to the industrial popularization, applied study and development of Chinese costume culture. The call is on finding the new way out for the development of China’s clothing industry with traditional costume culture as its source.

Mass media relay rumours

With the economic development of China and the rise of China’s international status in recent years, the national enthusiasm and cultural confidence of Chinese people has been strengthened. So-called fevers of “Tang costume” and “Han costume” have emerged, mass media have been haggling over “Han costume”, “National costume” and “Chinese costume”, and a number of non-governmental organizations and websites backing “Han costume” have emerged. This phenomenon indicates that the general public is eager to understand Chinese costume culture and hopes to replicate the temperament and spirit of China. However, because of a lack of expertise, the general public and some non-professional media have an incorrect understanding of Chinese traditional costume culture and communicate them to others through the online networks, leading to a blind fever of Chinese traditional costume culture.

Film & TV media grossly distort the history of costume

In recent years, historical films and TV series have become a highlight of film & TV works. Despite exaggeration, some serious film & TV works have tried to respect the history of costume to enable the audience to explore the appearance of costume during the periods and this has played a subsidiary role in communicating Chinese costume culture. However, many film & TV works have seriously deviated from and distorted the historical appearance of costume and greatly misled the audience which has a negative impact on Chinese costume culture. This is a worrying trend and it should draw more adequate attention.

China’s costume history education needs to be innovated urgently

China’s costume history is an integral part of the education of costume. Due to the limitations of teaching conditions, means and ideas in the past, teaching was prone to theory inoculation, while it was difficult for traditional historical teaching to arouse the interest of students born in the 1980s and 1990s. How to effectively use modern teaching techniques, methods to inspire students’ enthusiasm, initiative and arouse their interest in the history of costume is a difficult challenge. To make them feel the charm and essence of Chinese costume culture, lay a solid theoretical foundation and build good cultural accomplishment is an important issue for costume history education.

Exploratory Studies on Communication and Development of Chinese Costume Culture in the New Media Environment

Apart from classes and textbooks, the young generation acquires over half their knowledge online. New media communication has broken the traditional limitations of space and time to offer more selection space to the target audience and provided a new, possible and broad space for the communication and development of costume culture. In this new media environment, how to suitably and accurately convey the study results of Chinese costume culture to costume majors, the costume world and the general public to promote the sustainable development of costume culture has become a new subject of the academic circles of Chinese costume culture.

The authors have made great efforts and exploratory studies on the communication and sustainable development of Chinese costume culture from the following aspects through teaching and a series of scientific researcher, and would like to share them with you.

Reforming and innovating the teaching of Chinese History of Costume, and advancing the development of education information technology and the network construction of the course

BIFT is the most important Chinese institution of higher learning in costume education. Both the construction of capital costume culture and the cultivation of cultural creativity talents call for the understanding of and passion for national cultural history.

Chinese History of Costume is one of the most important courses of cultural quality education of BIFT. It has been over 20 years since the development of the department and the opening of the course in 1987. Now, the course is a required course for undergraduate majors in the areas of costume art design, costume design and engineering as well as a compulsory subject for the entrance examination of costume postgraduates.

Historical education is an integral part of disciplinary education as well as a relatively difficult course to teach. In 2005, we embarked upon a teaching reform for the *Chinese History of Costume* and used new teaching techniques, methods and means and updated teaching resources to facilitate more effective teaching, which stimulates students' interest in the history of costume and enhance their understanding of traditional costume culture.

- **Using diverse teaching methods:**

  We abandon the stereotype of traditional historical teaching. We use various methods such as class teaching, class discussion, teaching visits, after-class reading and integrate texts with large numbers of fine pictures and video clips for multimedia teaching; we do this using Beijing's rich cultural resources and BIFT's national costume museum for museum teaching and object teaching to enrich the course, improve the class atmosphere and broaden students' vision.

- **Novel and flexible assignment constitution:**

  We design flexible and diverse "major assignments" for the course and require students to cooperate in completing discussion about a subject and the assignments are designed to enhance their understanding of traditional costume culture and enable them to put it into practice. This cultivates their capacity for independent thinking and deepens the concept of teamwork. For example, some groups focus on the study on Chinese ancient underwear, some apply Chinese ancient costume culture to poker design, others make Chinese ancient costume culture into a small game imitating "Super Mario", and others copy ancient Chinese classic costume and wear it for personal demonstration. Students have marveled, "I never thought we could learn the history of costume this way!"

- **Intensifying network teaching platforms:**

  In the current online teaching environment, we have established a website of fine courses for Chinese history of costume (http://eol.bift.edu.cn) and a website including featured resources for Chinese ancient history of costume and modern history of costume (http://rs.bift.edu.cn) to provide online plat-

forms for teachers and students as well as social people to understand Chinese history of costume. In the process we have established Chinese Traditional Costume Culture Net (http://www.ctcc-web.cn), which has become an exploratory room for students concerned about traditional costume culture, on which the column of "Costume Forum" explores the current hot topics of costume culture. This receives strong responses and strengthens interactions between teachers and students.

- **Establishing "Watchman Club":**

Supported by the institute, we have established "Watchman Club" for the publicity, rescue and environmental protection of traditional culture, and often hold seminars, literary and artistic activities on Chinese traditional culture. For example, we've carried out activities such as "Lion Dance" and "puberty rite" of Chinese ancient women, and conducted the planning, screenwriting, directing, acting, shooting and post video production completed by club members, to provoke students' potential and inspire their passion for traditional culture.

- **Integrating teaching aid and poverty relief with national costume culture collection:**

The institute's teachers and students of costume culture and costume design spend time after-class working on aid and poverty relief in minority areas, we also collect and survey national costume culture, to enhance our sense of social responsibility and deep understanding in national costume culture.

Using the new teaching ideas, techniques and methods has made the course *Chinese History of Costume* far more worthwhile. Because of the enhancement of reading, watching, listening, wearing, interacting and participating, this has produced promising effects and won praise from students and the world of costume education. The course was listed among "Beijing's Fine Courses" and awarded the "First Prize for Results of Higher Education of Textile" by the Beijing Municipal Commission of Education (BMCE) and China National Textile and Apparel Council in 2008 and 2009 respectively.

Studying the effective mode of communication of Chinese costume culture in the new media environment and conducting innovative development on the new media communication resources

Given changes to the channels of knowledge and information accessed by the young generation, we are conducting studies on the communication of Chinese costume culture in this new media environment. This involves:

- Study on the actuality of communication of Chinese costume culture in the new media environment
- Study on the effective mode of communication of Chinese costume culture
- Study on the service mode of communication of Chinese costume culture
- International comparison of communication of Chinese costume culture
- The construction of Chinese costume culture websites and innovative study on the new media communication resources

In this study, we will explore the effective forms of technology for updating and the integration of Chinese costume culture resources. We analyze the ever-growing diverse demands by different groups for knowledge, study the most effective modes of communication of Chinese costume culture in the new media environment, and analyze its academic, interactive and commercial natures of communication. On the basis of the study results, we will intensify the digital processing of quality information of Chinese costume culture and the innovative development of new media communication resources attempt to build a diversified, open and shareable platform for the social communication of Chinese costume culture. We will provide different groups with quality costume culture resources in a targeted manner by construct websites for the mass communication of Chinese costume culture, provide various media resources such as text, image, audio, video, animation and interactive games as well as forums on Chinese costume culture, and explore the convenience, interest and interactivity of the communication of Chinese costume culture.

Now, we have completed *the project of featured education resource pool of the scientific and technological innovative platform of BMCE - resource pack of Chinese ancient history of costume and resource*

pack of Chinese modern history of costume. With the construction of the "digital campus" and information resource construction as the core, the project, intended to vigorously promote the applications of information technology in teaching, research and services, is part of the overall layout of the strategy of education information construction of BMCE. Through the project, we have established a website featuring resources for Chinese ancient history of costume and modern history of costume (http://rs.bift.edu.cn), and the two resources packs cover the history of Chinese costume from the primitive society to the modern and contemporary society in the forms of text, image, audio and video, containing about 140,000 words, 20,000 images and 500 audio and video clips, which are open for free and unrestricted download. This service helps to facilitate mass communication and popularization of Chinese costume culture. We selected representative dynasties and costume stories in Chinese history of costume to produce six animations in cooperation with new media teachers and students of the school of art design of the institute. These were created in different forms of representation on the basis of differences between the content of costume and divided into animation with ancient artworks story animation and documentary animation, the attempt increases the interest and convenience of teaching resources of Chinese history of costume, and provoke great interest by students and wins praise from peers.

The study and implementation of the resource pack project opens up new ideas and modes for the social communication and mass popularization of costume culture. It is innovative, and was listed among the outstanding resource packs by BMCE in 2009. Our study on the communication of Chinese costume culture in this new media environment is based on the thinking and practices and applications of the resource pack project.

Intensifying the theoretical study on Chinese traditional costume culture and optimizing and deepening costume culture resources

Also, we attach great importance to intensifying the theoretical study on Chinese costume culture and optimizing costume culture resources. In recent years, we have conducted a number of studies, such as *Rescue Study on Chinese Traditional Textile K'o-ssu Craft* (a national key art project), *Study on Beijing History of Costume Culture* (Beijing's key cultural project during the "Eleventh Five-Year Plan"), *Rescue Study on Cultural Heritage of Folk Costume in Beijing* (a key cultural project of BMCE), *Study on Chinese Traditional Costume Techniques* (a BMCE project), *Study on Chinese Ancient Classic Costume and Clothing Systems* (a project of cultivation and financing of Beijing's outstanding talents), *Study on Costume Culture in Liao, Jin and Yuan Dynasties* (a project of "Young and Middle-aged Talent Cultivation Plan" under the Program for Intensifying and Deepening the Education of Talents of Beijing's Municipal Institutions of Higher Learning), *Craft Preservation - Studies on Traditional Embroidered Dye and History of Woman Costume Development Over the Three Decades (1949-1978) since the Founding of New China* (a key project of BIFT), *Study on Chinese Silk Culture and Symbols and Elements of Silk Costume and Report on Building Hangzhou into a "City of Silk"* (a project entrusted by the Hangzhou Municipal Committee and Government) and *Study on the Costume of Reprehensive Figures in Chinese History of Traditional Chinese Medicine Development* (a project entrusted by a traditional Chinese medicine enterprise). Through these studies, we have increased the quality and level of costume culture resources and published monographs and theses to introduce the results of these academic studies on costume culture to the industry and society. We have published works such as *Chinese K'o-suu-Saint of Textile* (Hu Yue), *Beijing History of Costume* (Yuan Ze, Wang Ziyi), *Centurial Costume* (Yuan Ze, Hu Yue), *Folk Costume* (Yuan Ze, Jiang Yuqiu), *Han Costume* (Jiang Yuqiu, Wang Yixuan), have written many study reports and published dozens of professional academic theses.

These projects have intensified and deepened the study on traditional costume culture, and the publishing of their results has contributed quality resources to the social popularization of Chinese costume culture.

Promoting the applications of Chinese costume culture in contemporary design and promoting the industrial transformation of academic results of Chinese costume culture

Apart from academic studies, we also pay attention to industrial transformation and social popularization of Chinese costume culture from various aspects in the current new media environment. This is done under the current industrial demands by providing the industry with quality costume culture resources in a targeted manner, cementing relations between traditional costume culture and contemporary design and culture industries, providing cultural support and creation sources for China's clothing industry, promoting the design innovation of the industry and increasing the level of cultural creativity for the industry to accomplish "culture design and inheritance" and promote the dual development of culture and the economy. Such as:

- Study on Chinese Silk Culture and Symbols and Elements of Silk Costume and Report on Building Hangzhou into a City of Silk

This is a project entrusted by the Municipal Committee and Government of Hangzhou known as the "City of Silk" of China. Silk represents the summit of national industry and cultural accomplishments in ancient China. It is an important carrier of the material and spiritual civilization of the Chinese nation, embodies rich cultural information and bares deep national spirit. However, in the current economic environment, the silk industry has bade farewell to much prosperity, almost lost the right of pioneering the trend in international and domestic mainstream markets and remained in the situation of a world plant of primary textile products. Chinese silk culture and silk industries are facing challenges from all sides. Exploring the essence and significance of silk culture and assessing China's silk industry from a strategically advantageous position is the foundation and premise for revitalizing Chinese silk culture and silk industry. This topic aims to explore the significance and essence of Chinese silk culture, extract the major symbols and elements of Chinese silk costume, build on the strength of Chinese silk and lay a solid cultural foundation for the contemporary development of China's silk industry. The study report *Deliberation · Silk-Study on Chinese Silk Culture and Symbols and Elements of Silk Costume and Report on Building Hangzhou into a City of Silk* (in three volumes) has been adopted by the Hangzhou Municipal Committee and Government and played a significant role in instructing the municipal government in building the "City of Silk" and boosting the development of the silk industry in Hangzhou.

- Construction of the platform for the creative design and virtual demonstration of Chinese concept garments and costume

The ongoing project is a special topic for the cultural creation industry in Beijing, An industry which pays attention to the joint understanding between and industrial popularization of academic study on Chinese costume culture and applied study on design and development as well as the integration of "costume culture ecology" with "costume industry ecology" to form a solid platform for scientific and technological transformation.

The project will focus on the construction of three sub platforms; the platform for theoretical and applied studies on Chinese traditional and national costume culture, the platform for design creativity and production-education cooperation of Chinese concept garments and costume as well as the platform for the creative design and demonstration of Chinese concept garments and costume. The project involves mainly a study on Chinese traditional and national costume, study and material duplication of Chinese traditional and national costume crafts, the contemporary design of Chinese traditional and national costume crafts, and the applied study on the integration of elements of Chinese traditional and national costume crafts with contemporary fashion. Also, developing fashion products with Chinese concepts and style as well as augmenting products with Chinese concepts, including costume, bags and suitcases, footwear, caps, jewelry, pajamas, home textiles, dolls, handicrafts etc. This is done paying attention to the media communication of design innovation of Chinese concept garments and costume, developing virtual costume design software, establishing an online publishing system and 3D demonstration system for virtual Chinese concept garments and costume, clearly demonstrating the results of design innovation of traditional culture, and extending forward-looking applied topics such as wearable smart costume, virtual fitting systems and intelligent trend analysis systems.

The project places equal emphasis on academic and industrial nature. Its duty is to inherit and carry forward Chinese tradition and national costume culture, we attempt to make full use of our advantages shown in the study with applied design of traditional and national costume culture, study and development of Chinese concept garments and costume, incorporate traditional and national garment and costume culture with contemporary design, fashion and high technology, provide intelligent support and services for the design of Chinese elements and national brand costume in China's garment and costume industry. The implementation of the project will make Chinese garment and costume brands richer in cultural identity and will be of positive significance to the contemporary applications and industrial transformation of Chinese costume culture.

Conclusions

Connecting traditional and contemporary culture, focusing on the development of the culture and the industry, promoting the contemporary communication, applications and sustainable development of traditional costume culture, creating the industrial value of the culture and blending the essence of the culture into contemporary design and life has become an subconscious part of people's life, rather than merely a museum exhibition or a reflection of the past. Only this is the best inheritance and development of traditional costume culture and such inheritance and development is vital and, only in this way will the culture of a country and a nation develop endlessly.

Through these efforts we will promote the results of the study of Chinese costume culture, strengthen mass communication, industrial transformation and contemporary development, explore the new modes of promotion and sustainable development of Chinese costume culture in the new media environment. We will seek new ideas for the communication and sustainable development of traditional culture in the new media environment and the study and its practice and applications will undoubtedly be of social, cultural and economic significance.

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the Learning Network on Sustainability

Educating for sustainability

The secret of learning design

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This paper aims to address the question of how teaching design and environmental sustainability can be innovated through learning design-driven sustainability. A project was conducted for the development of an alternative way of learning characteristics of materials and processes usually applied in product development. The selected characteristics should be relevant for design scholars to know and should have an important contribution for environmental sustainability. The groups of scholars from the first year of an new undergraduate course of Design had to create new games with simple rules, dedicated to students of a lower age. The result were eleven new games, both attractive and with a challenge.

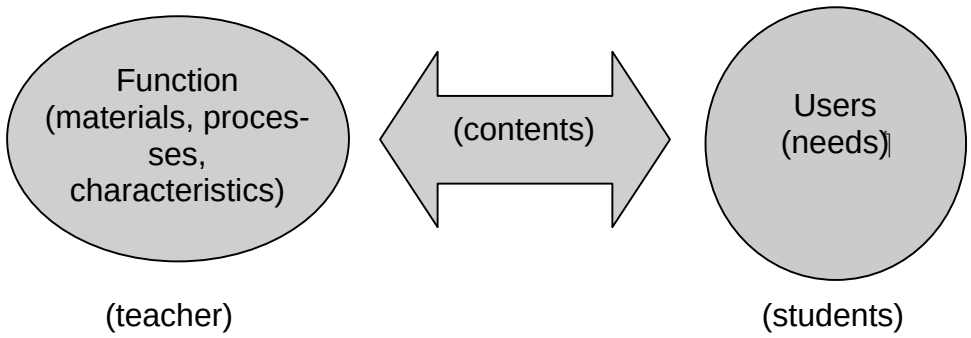
Purpose, basis and the problem

What is the contribution of design to learning characteristics of materials and processes and its contribution to sustainability? The debate on what is design is alive since the birth of design, but it is not our purpose here to enter into this debate, that is authoritatively developed in design schools. In a new undergraduate course of Design, in an emerging country, with teachers from different experiences and ground of education, this could easily be an endless discussion. For the purpose of this paper, it is assumed design as the integrated innovation of function and form, a definition that needs to be further adapted to better highlight the peculiar approach in the field of higher education. Several scholars have recognized and underlined the semantic dimension of design (MARGOLIN; BUCHANEN, 1995). A project was conducted to innovate the usual method of teaching characteristics of materials and processes for scholars of design. As a change on the traditional way, the purpose were to have classes about characteristics of materials and processes and their contribution on environmental sustainability. The theme of sustainability was taken for its huge importance in the last years, as well as to give an tangible objective to the project.

The traditional way of studying these subjects is with the teacher telling the scholars the characteristics of materials and processes, illustrating with examples of products using them, altogether with photos, real products and slides in weekly sessions of classes (see Figure 1).

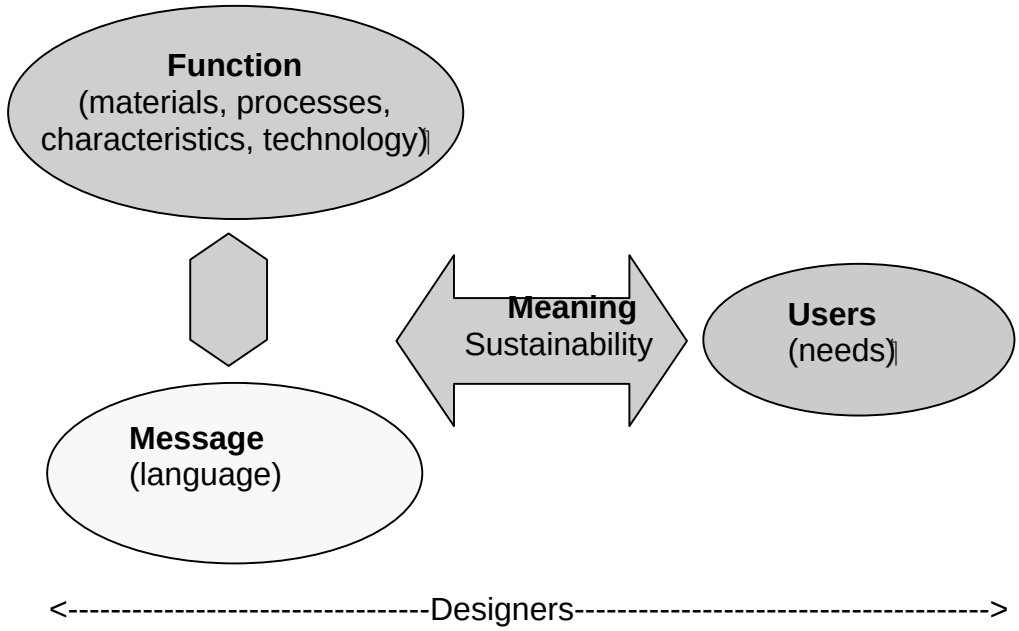
During the sessions, the contents are told the scholars that can ask questions, ask for help and so the main concepts are elaborated. That can be called the traditional form of teaching design.

Figure 1: The traditional way of teaching materials and processes



Maintaining the function of teaching characteristics of materials, processes and technology, a proposed scheme based on the spirit of Design expands and elaborates the concept of form (in classes), to better capture the communicative and semantic dimension of learning classes (language) through practical work in groups. Our adapted framework is illustrated in Figure 2. The classic dialectic of teaching versus learning, sometimes leads to restrain the latter to the aesthetic appearance of powerpoint slides and almost only one-direction talking. Apart from styling, what matters to the student, in addition to the meaning of the concepts given in classes, is its emotional and symbolic value of constructivism in learning.

Figure 2: The dimensions of learning sustainability



If functionality aims at satisfying the operative needs of quantity and wide range of concepts given the student, the meaning lessons tickle his/her needs of learning. Most of all, the restrict range of action of teachers and scholars change to a wide concept of designers working together in teams and taking both views in an unified way.

Objective

A project was conducted for the development of an alternative way of learning characteristics of the main materials and processes usually applied by designers in product development. The selected characteristics should be relevant for design scholars to learn and should have an important contribution for environmental sustainability. The grade was about learning ways of reaching sustainable products studying the materials and processes through the Life Cycle Design (VEZZOLI; MANZINI, 2007). The dynamic consisted in propose to scholars a system of values, a personality and identity, that might easily go beyond information in slides. This paper aims to explore an alternative way of learning concepts of sustainability used in design, in a joyful way, through challenges presented to scholars in a Design undergraduate course.

Methodology

The process followed a structure with work in teams. This approach was applied twice, in two different groups, but always with scholars from the first level year of an new undergraduate course of Design. In

both situations the teacher proposed that they should design a game to help students of lower school level to learn characteristics of materials and processes and their impact to sustainability (as presented by Manzini & Vezzoli (2008).

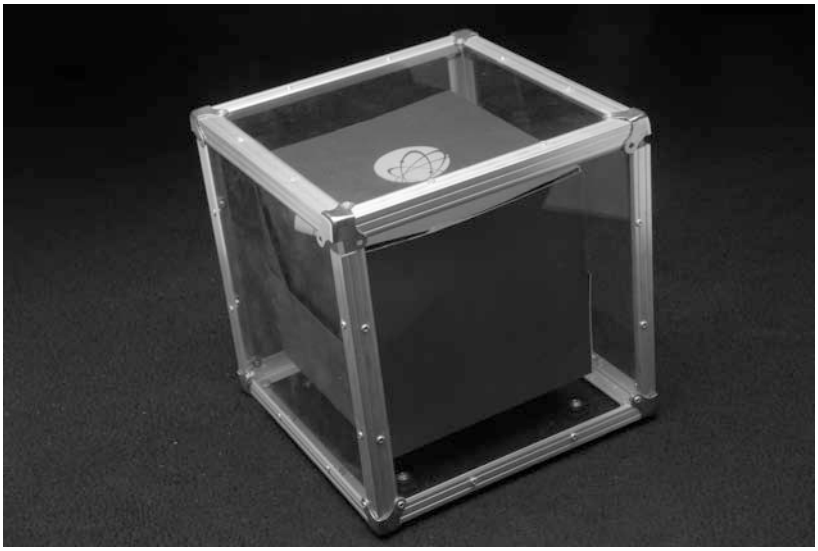
The first experience

In the first experience it was given the class a very known table game as a reference they should follow. It is a quiz with questions and answers. For each material or process there is a card with a statement about characteristics of them. May be an application, a object where it is commonly used, or any other sort of tip. For each one of these cards there is a list of ten tips about the material. As a rule of the game, the participants are told the statements. If the participant think it is enough to give the right answer he will win several points. But if he thinks he needs a tip, he will choose one and in case of a right answer he will win less points than before. The participant can have up to three tips each time. The more tips he needs, the less points he will have. Depending on the number of tips required, a right answer will give a number of steps ahead. It is a funny game where the participants have opportunity to have informations on a several kinds of materials, processes and the impact of each one on the environment.

The first phase of the project consisted in identifying the materials, processes, relevant bibliography on the subject, important authors, books, internet, manuals of suppliers, and other sources of information. Secondly they divided the whole work in subjects in order for each scholar to search. Thirdly each one consulted the sources to identifying relevant characteristics (physical, chemical and characteristics related to sustainability) to know. After that they had identify important characteristics to quiz, as duration, poison, danger to environment, years to be consumed, life-cycle, etc. So they resumed the characteristics in small elements so as to put in the cards in the form of a quiz. Meanwhile some people had to think about the form of the cards and the form of the final product. Later they put all this together and the product was born.

It was a collective work and the final product was one game for the whole class, with an innovative and attractive package (see Figure 3) of a transparent box. As the dark package relies on the base of the transparent box, it seems it is flying. That attracts curiosity on the object. The game actually was a board of paper with plastic pieces (see Figure 4). Any user could hardly see how the content game could be inside the box without touching the base. It was an enthusiastic group of scholars, full of energy, and they all seemed happy with the work. They divided the work in groups and naturally arose coordination needs and a leader. It was a collaborative experience with an easy game.

Figure 3: The flying cube – (collective creation)



This Flying cube can be considered of high degree of innovation, as it has attracted the attention of many people. In an spontaneous sample none of the people exposed to the object have seen it without

asking what was about. One of the rules for a good game is that it attracts the attention of the participants. In this game 126 cards were prepared, each one with ten characteristics. So a total of 1260 different informations could be "studied" by the participants. With this amount of information, the game should be played by participants of an advanced scholar age. Some of the questions, actually could be considered difficult.

Figure 4: Inside the flying cube – (Collective creation)

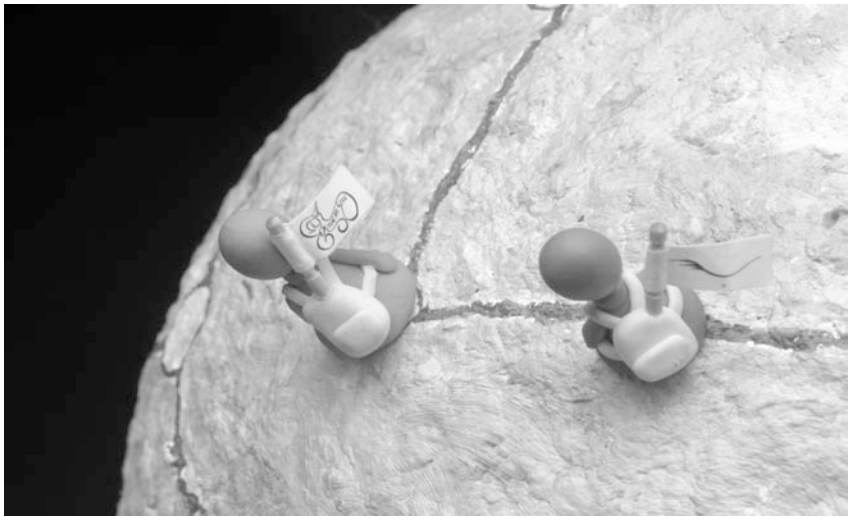
The second experience

In the second experience, the class of forty was divide in groups of four to five scholars and they should also develop a game for other students, but this time there were new constraints. The game should be attractive (MUNARI, 2009), challenging, with simple rules and directed to a certain age of students from the earlier school years. The games could not be electronic and would be tested with students in early schools. So besides the contents, the scholars should address the age of the participants or their scholar age, identify their level of interest, so as to determine the level of difficulty, the language and attractiveness of the final product.

This global planet game was designed for children of five to seven years old (see Figure 5). Its language is childish and only 24 characteristics treated. The challenge for the designers was to find a language appropriated for this kind of client. The spheric board has metal points exactly at the cross of the lines. The participant is expected to cast a dice and count the number of steps. At the bottom of the character there is a magnet to hold it on the surface of the planet board (see Figure 6). For a child it helps to develop patience and ability with hands.

Figure 5 – Global planet game

Figure 6 – Detail of the Global planet game



The second experience produced a total of ten different games, all of them with simple rules, attractive, and complete and innovative in the sense of not existing before in the market (see Table 1)

Table 1 – Innovative games on sustainability

Materials, processes and environmental sustainability characteristics			
Game	**Cards**	**Number of Characteristics**	**Total number of characteristics**
Flying cube	126	10	1260
Global planet		24	24
Ultra trunco	36	4	144
Materials battle	24	6	144
Trinca	36	5	180
Materials action	55	6	330
Materials pizza		80	80
The specialist	24	10	240
Materials party		74	74
The father of materials	45	3	135
Amalgam		36	36

As can be seen, it is a wide variety of innovative games. None of them still exist in the market for buying.

Results

Eleven different games were prepared and presented. The level of complexity ranged from low to high, and the target was for participants from 5 to 16 years old. The number of participants ranged from two to

five people. Most of them were fit to the scholar year of the students, although some of them could be considered much too difficult for the level initially considered. Most of the games had simple rules, usually base on casting dice and stepping forward, but the initial proposal was exactly that. The challenge for the designers was to research characteristics, adapt them to a game, learn the concepts while researching, and propose an interesting solution to turn the game attractive. Some games had sophisticated rules, but only two were based on electronics games. What was most surprisingly was the innovation form of the games proposed. All of them are curious games with attractive appearances. An attractiveness test was undergone and almost all the visitors did not remained indifferent to the games spontaneously demonstrating curiosity by what was that object on the table.

Managerial/organizational implications

Although most of the design theory and sustainability concepts were not known by the scholars, the solutions presented were sophisticated, with an appropriated design language and aligned with modern concepts of values and meanings for the users. At the end we may define learning sustainability and design as an innovation where novelty of how construct learning (design language) is significant and prevalent compared to other ways of design learning.

Next steps

The project stopped at the end of the scholar semester. Although the games can be very well evaluated as they reached the target proposed, it was not until now tested with students. A pilot test with the first game was prepared and was made with two students, one of them eight years old and the other fourteen years old. In their evaluation the games are creative appealing, but the level of difficulty was considered high. It was made a contact with a school with constructivist learning theory approach, for students of the first level (six to fourteen years old students) and they are interested in a wider session of tests.

Conclusions

Studying, teaching and learning Design is still characterized as a challenge in the field of education, and has to be seen under the light of addition of value for scholars. A important concept of design of an innovative integration of function an form has a fundamental role in this process of learning.

That is particularly fruitful in the field of education where the process of learning must be attractive and challenging for scholars. It would be much better to practice this process in a participative way.

The experience of creating games as a way to learn concepts and characteristics of materials and processes and their contribution to sustainability is valid, to both, the scholars researching and students playing the games.

The paper contributes to fill a lack of data on learning design and sustainability in a constructivist learning approach.

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the Learning Network on Sustainability

Creating a shared mental space for sustainability awareness on a university campus

Design student projects in sustainability awareness in the age of iPhones and social media at the University of Texas at Austin

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This paper presents the methodology and results of a semester-long collaboration between a senior class of design students and a university facilities operations unit to consolidate campus-wide sustainability efforts to affect a change of culture within faculty, staff and general student body. The project sought to combine existing educational and outreach efforts and to create new opportunities for sustainability engagement through new iPhone and social media technologies. In order to enhance their own understanding and positioning on sustainability, students were placed in a position to simultaneously research and to communicate about general sustainability issues and specific local practices and the importance of campus sustainability efforts to the university community.

Design education is still largely in the process of being defined and researched in its own right, but there are some identified tendencies that are useful as a starting point. A common educational format in practice-based design classes is learning through projects (Lee, 541), and the dominant design education vehicle for simulating design practice is problem-oriented education (Coyne and Rosenman, 90). While traditional models of design education are "based upon the replication of professional task performance." (Oxman, 105), these simulations and replications generally concentrate on the methods of creative development that are meant to stretch creative theoretical thinking and form-making in the student and necessarily must avoid the realities of design project development. These avoided realities can, however, be reincorporated into the studio classroom at advanced levels, and the studio transformed into a workshop through the designing of an actual project.

Course organization

The title of the course was Design Perspectives conducted in the Fall of 2009, which is a topic-driven course taken in the final year of the degree that allows students and instructors to explore current themes and issues in design and society. The topic of the class was Sustainability, and an opportunity to pursue an actual project was presented by a client in the university's Director of Sustainability. He came to the instructor with the need to raise the profile locally and globally of the sustainability activities on campus, both from the academic and the facility operations sides, and shift the culture of the campus towards sustainability awareness and practices. There were sixteen students and one instructor with other faculty, stakeholders and guest reviewers involved at each stage of the project.

Program philosophy

The BFA Design program at the University of Texas at Austin offers a general multi-disciplinary design degree that emphasises developing design thinking skills along with the process of thinking-through-making to create systems and artefacts to address cultural situations in context while making sense of the world through a personal lens. The program seeks to create individuals that are both ready for practice in a variety of design disciplines and prepared to extend their training in specialized graduate studies and advanced design explorations.

Coursework progresses from formal investigations to critical thinking activities that employ obtained formal skills for execution. In their foundations year, students learn to recognize visual structures and gain valuable perceptual skills, as well as being introduced to the potentials of a range of digital and traditional technologies. The second year students expand their formal skills while exploring readings and exercises based on methods, theory and criticism. The final two years of study, structured upon the framework of integrated learning, collaboration and project-based learning, are laboratories in which students work with form and context to explore and develop meaningful design.

Project organization

The class was treated as a professional design studio around groups of students working in teams operating within the *problem-space* (Cross and Dorst 98) of the project itself. This was done to allow for the structure and solutions to organically emerge from within the process rather than being handed down from the instructor as in the *guided project method* (Lee, 549) The project was set up along activities according to the core design problem-solving sequence: (Goel & Pirolli, 397)

1. An exploration and decomposition of the problem (i.e., analysis).
2. An identification of the interconnections among the components.
3. The solution of the subproblems in isolation.
4. The combination (taking into account the interconnections) of the partial solutions into the problem solution (i.e., synthesis).

This afforded two desirable outcomes. The first being to have the students better know the topics they were researching by having to present information that they themselves decided to research to their peers as well as clients and stakeholders. The second being experience of operating in a working design office environment in which students were confronted with project realities identified as *design tasks* by Goel and Pirollli (Box 1) beyond that of a traditional academic project.

Box 1: Design tasks: Overt features of design task environments

Source: Goel and Pirolli, 1992

> A. Distribution of information. As initially noted by Reitman (1964), there is a lack of information in each of the three components of design problems. The start state is incompletely specified, the goal state is specified to an even lesser extent, and the transformation function from the start to goal states is completely unspecified.
> B. Nature of constraints. The constraints on design task environments are generally of two types: (a) nomological, and (b) social, political, legal, economic, and so on. The latter consists of rules and conventions and are always negotiable. The former consists of natural laws and are never negotiable. However, the constraints of natural law vastly under determine design solutions. Design constraints are rarely, if ever, logical (i.e., they are not constitutive of the task).
> C. Size and complexity of problems. Design problems are generally large and complex spanning time scales on the order of days, months, or even years.
> D. Component parts. Being large and complex, design problems have many parts. But there is little in the structure of design problems to dictate the lines of decomposition. Decomposition is substantially dictated
> by the practice and experience of the designer.
> E. Interconnectivity of parts. The components of design problems are not logically interconnected. There are, however, many contingent interconnections among them.
> F. Right and wrong answers. Design problems do not have right or wrong answers,only better and worse ones (Rittel & Webber, 1973).
> G. Input/output. The input to design problems consists of information about the people who will use the artifact, the goals they want to satisfy, and the behavior believed to lead to goal satisfication.

> The output consists of the artifact specification. Functional information in many ways mediates between the input and output information. This is a rather standard characterization adapted from Wade (1977).
> H. Feedback loop. There is no genuine feedback from the world during the problem-solving session, It must be simulated or generated by the designer during the problem-solving session. Feedback from the world comes only after the design is completed and the artifact is constructed and allowed to function in its intended environment. But, of course, at this point, the feedback cannot influence the current project, only the next "similar" project.
> I. Costs of errors. There are costs associated with each and every action in the world, and the penalty for being wrong can be high (Rittel & Webber, 1973).
> J. Independent functioning of artifact. The artifact is required to function independently of the designer.
> K. Distinction between specification and delivery. There is a distinction to be made between t he specification of the artifact and the construction and delivery of the artifact.
> L. Temporal separation between specification and delivery. There is a temporal separation between the specification and delivery or construction of the artifact. The specification precedes delivery.

A traditional academic project would address areas of conceptualizing and presentation incorporated in design task items A-F, while the development of an actual project with a client and stakeholders ups the ante on those items while adding items G-L to the experience and allowing students to take on more responsibility as well as pressure to perform for important university staff and outside reviewers with real stakes.

Research

For the exploration activities, rather than simply lecture and prescribe research topics and practices about sustainability where the instructor did the exploration, it was decided to create a class environment where an equal share of the structure for the design solution came from exploring the *problem space* (Cross and Dorst, 98), which shifted the responsibility for learning about sustainable topics to the student. This required students to perform an *independent inquiry method* (Lee, 548) of research where students were guided towards general topic areas, but they were given the freedom to choose specific topics they found significant to the project or that were of personal interest. Meetings between instructor and teams provided guidance for scope as well as content definitions while keeping the instructor attuned to student interests for later proposal phases of the project.

Topic: Sustainability

Research was conducted for this complex problem in the areas of sustainability, campus ethnography, and social media and technologies. Initial research occurred in sustainability loosely based on Thorpe's conceptual sustainability landscape categories of Ecology, Economic and Culture (Thorpe, 2007) in the global areas of:

- sustainability definitions (what does "sustainability" mean?, etc.)
- sustainability issues and practices (consumption, materials production, recycling, etc.)

and on the local campus and city level:

- official, staff and student programs (recycling, commuting, waste disposal)
- centers of research
- student organizations
- official policies and initiatives (university, departmental, housing and dining)
- grass-roots activities and initiatives (swap meets, etc.)
- local "green" businesses

Topic: Campus ethnography

For campus ethnographic research, students interviewed staff and students and produced videos, charts and written evaluation of information gathered from Facebook surveys, written and online survey methods. Questions asked paralleled those asked at the beginning of the semester of them, plus those that were prompted by their early findings and technologies being considered for use in proposals. Demographics were collected from university sources on ethnicity, age, etc. for staff and students on campus.

Topic: Technology and social media

Areas of social media were investigated as potential devices to communicate to a technologically savy student body. It was found through student administered surveys that about 80%of the students owned some sort of smart phone capable of texting with internet browsing capabilities. Of those, about half were found to own iPhones or iTouches and the other half to be Blackberry compatible devices which have applications available specifically for them. This makes social media like Facebook (with 100% of respondents using it), Twitter or others very attractive avenues for marketing and connection. Specific areas investigated by students were:

- viral marketing
- context marketing
- iPhone technology
- social networks such as Twitter Facebook
- social gaming
- photo and content sharing sites

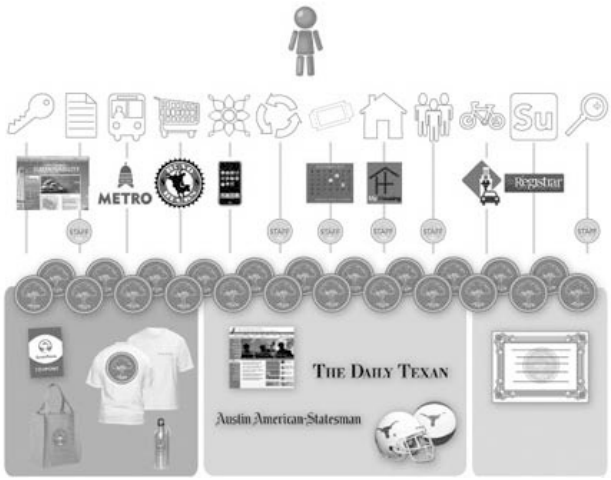
Results from each topic were gathered and presented by teams at each stage of the project in order to inform peers, client and stakeholders as well as to develop presentation skills. A blog (http://designsustainability.blogspot.com) was updated during the project to act as an archive and public outreach device and to provide students another opportunity to analyse and explain their findings. The ideas for proposals came directly from the student research, and the teams chose mainly to employ techniques and technologies they had researched, with minor appropriations of other teams research as needed.

Student Proposals

Five teams chose unique subproblems and methods to address to provide a broad set of interconnected projects to accomplish the project goals. The projects were GreenPoints program, Wayfinding system, Green Tips, AARG and a unifying web site for these projects and all of the existing sustainable activities on campus.

GreenPoints

Figure 1: GreenPoints system diagram



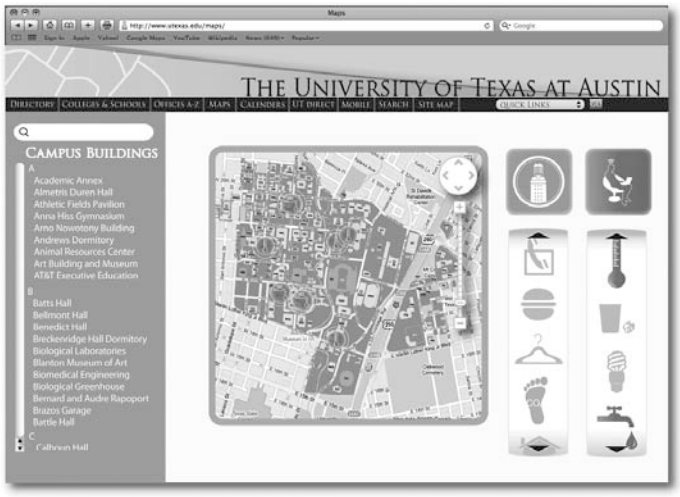
This project proposed creating an incentive system for students that would involve the university and local businesses in order to encourage and promote personal and business sustainable activities. From the student description:

> GreenPoints is a program designed to educate the University of Texas community about sustainable practices in order to change daily habits to protect the future of our planet. The GreenPoints program is structured to encourage user awareness, ways in which students are already living sustainably, and to educate in regard to how lifestyles can be adjusted to reduce carbon footprints. GreenPoints is a place for members of the UT community who are interested in sustainability to converge.

The proposal called for a point system based on personal, academic and consumption activities of students during their undergraduate years at university. Accumulated points would be rewarded with prizes and public recognition each academic year, and high-achieving participants would be awarded with university recognition at graduation. Emails and web site updates would keep the program in front of students throughout the year.

Wayfinding system

Figure 2: Wayfinding web interface



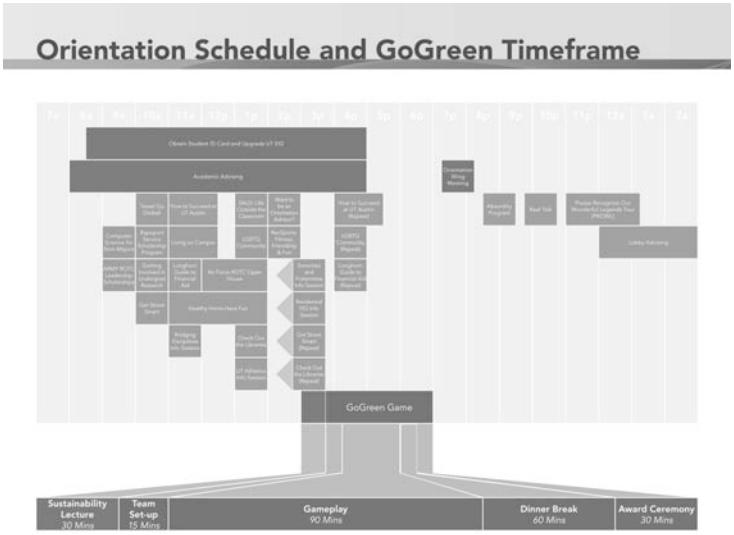
During research, it was discovered that the university was developing new maps for campus and separately an iPhone application with campus news and events. Student saw an opportunity to combine these in wayfinding system that incorporated sustainable landmarks, businesses and a problem reporting component. Local businesses that were certified as "green" would be included on university maps of the area to support such business practices. A problem reporting system would be available for user identification of dripping faucets, wasteful energy usage, neglected recycling bins, and these reports would be located on campus maps with accompanying information. The resulting proposal included new map and identity graphic devices and an interactive map and reporting system.

Augmented alternate reality game

The game is proposed as a freshman orientation activity that would then care through the first year of school. A narrative that contains a sustainability content at its core evolves and unfolds in scavenger-hunt, puzzle and other individual and team activities. The game would involve creators, actors and technicians and settings from several departments on campus and would serve to disseminate sustainable information to become a common cultural grounding to all incoming students. The student description of the project:

> Our team developed an AARG (Augmented Alternate Reality Game), a game where participants are unsure whether they are actually playing a game, or solving a real life mystery. Using augmented reality viewers on mobile devices, players navigate through clues in the digital realm and in the physical world trying to solve the mystery of a disappearing architecture student, while inadvertently engaging in and learning about sustainability practices.

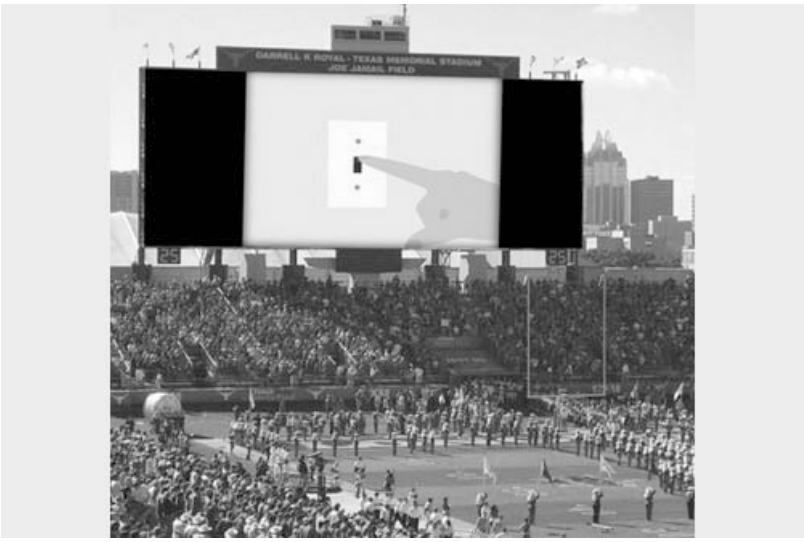
Figure 3: Time structure of orientation component of AARG



The game involves the use of information systems already in place on campus plus the development of iPhone application that is tied into the proposed wayfinding system developed in another team. Integration into existing systems is used as a cost-saving as well as a viral strategy to reach as many points in the campus consciousness as possible.

Marketing and Twitter feeds

Figure 4: Campaign to turn off lights on stadium scoreboard



This project developed a marketing campaign involving dissemination of everyday sustainability practices linked to a Twitter feed that would be run by the university sustainability director's office. The basis of the marketing was to use existing portals such as sports arena scoreboards and desktop computer screen savers as a method for introducing a different everyday practice each month. Using these existing outlets would involve very low overhead and effort by those administrating the campaign. Coupled with this would be a Twitter promotions campaign that would highlight information regarding the everyday practice throughout the month in conjunction with incentives offered to only those that followed the Twitter feed for discounts at local businesses and other special offers.

Web portal

Figure 5: Web portal home page

A crucial component of the proposals is a central hub of information and interaction between students on campus. There was no clearing house for existing activities, and there were several dispersed web sites belonging to organizations and research centers on campus. From the student description:
The goal of the website is to promote UT as a leader of sustainability efforts and to act as the central hub for all sustainable groups to access information efficiently and effectively.

> The website contains a social network that allows members or officers of green groups to access discussion forums, Greenpoints scoring system, and a customizable calendar of events. The sustainability network module helps to give equal attention to all green organizations on campus. The colors are vivid and bold to catch the viewer's attention. To keep the website dynamic, the background image changes for each new page that loads. The top blue navigation bar is for administrative operations and the left green module allows for more personal and interactivity.

All of the other teams' activities are connected to the web portal for maximum exposure and ease of accessibility. Active components linked to the various other established web sites would serve to unite the online presence of sustainable activities and be a convenient access point for those outside the campus community.

Beyond

The projects proposed above have been embraced by the university's director of sustainability and several are currently being developed for implementation on campus. One student from the class has been employed by the director to continue to develop and to implement the first stages of these projects. It has been indicated that these proposals will continue to be developed in the coming year, and the possibility has been discussed regarding future design classes engaging in these proposals as they develop.

Effect on student knowledge of sustainability

Upon beginning the course, the design students were informally polled to ascertain there level of engagement with the concept and practices of sustainably ideas. This is compared to same survey questions the students made of the general student population. (Table 1)

Table 1: General survey

	Design class students	General student population
Can define sustainability	100.00%	75.00%
Know of any campus sustainability-focussed organizations	63.00%	34.00%
Practice smart commuting	94.00%	95.00%
Perform recycling on a regular basis	50.00%	48.00%

The results indicate that beginning the course, design students were already aware of sustainability as a topic, which is a result of not only program curricular emphasis on sustainable practices, but that the general student population is well informed about such topics.

When asked in informal sessions during and at the end of the coursework about qualitative changes in their knowledge, design students responded in a manner that suggests the inclusion of sustainability as a subject in a project-based courses had a positive effect on their overall sustainability knowledge, attitudes and considerations.

Table 2: Sustainable attitudes of design students

	Before	After
Definition of sustainability changed	n/a	94.00%
Consider sustainability issues in design work	19.00%	94.00%
Have done a project (other than current one) dealing with sustainability issues	0.00%	31.00%
Feel you know a lot about sustainability issues	38.00%	100.00%
Understand the complexities of sustainable practices	13.00%	88.00%

In addition, open-ended questions were asked of the students regarding their experience with the project. It was indicated by many that they enjoyed the “real world” aspect of the project and that what they were doing in the classroom “mattered” outside of it. There was also a expressed a desire to do more projects in this manner.

Comments about the topic of sustainability involved being surprised at whether or not a practice was actual “green” or “green-washed.” this became a running point of discussion with almost every idea or assumption challenged on this point. At one point, a well-known anti-sustainability voice on campus was invited into the classroom by students wanting another view of campus practices. The effect on the students seemed to be a positive one, as they were less inclined to embrace common rhetoric and more apt to question it, often demanding source information or quantitative supporting statements of peers and guest experts.

Conclusion

Using sustainability as a topic itself to immerse students in the core concepts, general and design-specific practices appears to have exposed and made relevant several key components of responsible understanding of sustainability. The necessity of presenting newly-acquired information can be stressful, but it follows real world professional practices, and it seems to have instilled a majority of the responsibility for

learning in the student. The format of the working design office provided a comprehensive workplace experience with some added pressure to perform because of the "realness" of the project.

Future attempts at such a course structure might include more explicit facts and sources for students to draw on to quicken the start of their research phase, but it is feared that this will remove the sense of independence and responsibility that a lightly guided approach affords for self-directed research.

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the Learning Network on Sustainability

A recycling experience on industrial design and materials science lab

The PET case

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Nowadays, recycling has become a subject of great interest for all industrial sectors. In case of plastic processing, major interest has focused on the reduction and recycling of waste generated during the transformation processes and also after products end use. Polyethylene terephtalate (PET) is one of the polymers that have experienced a considerable growth in its use in recent years, its importance regarding post-use recycling is mainly joined with its extensively use in bottles. In present project we made the process followed by post-consumer bottles to be successively transformed into designed industrial parts and later into test specimens for the material science laboratory. The aims are, first contributing and promoting the use of recycled plastics as substitutive materials for industrial applications. In second term, we want to take profit of the Centre Catalá del Plástic (CCP) background to show some of the educational possibilities in the field of plastics recycling. On the first stage, using recycled PET obtained by post-consumer bottles to design electronic parts, and in a second recycling cicle, using injected testing specimens we will be able to teach about polymer behavoiur while introducing students into enviromental concepts during laboratory teaching activities. The main results of the project show that both recycling can be carried out without a great decrease in the mechanical and thermal properties, and the material was used on the design of some industrial electronic parts. On the other hand, using the test specimens obtained in this work, an enviromental didactic laboratory activity is nowadays being introduced into different subjects of current UPC degrees. A rough approximation to the life cycle analysis associated to PET recycling was carried out. Although these consumption are higher than the required for other common thermoplastics, the global balance yield a reduction of about 55% regarding the energy required to produce the same amount of test samples but using virgin PET instead

Material and processing

Initially PET flakes were obtained after washing and grinding post-consumer soft drink bottles (figure 1). Part of these flakes (1) were used as a raw material for the production of TV components (first recycling). This components were designed by The scraps and defective parts as well as all usable PET wastes arising from the previous project were collected and grinded again to obtain new flakes (2). Finally, testing specimens made with two times recycled PET were obtained reprocessing flakes (2) by injection moulding. The cycle followed by the polymer is shown in figure 1.

Previously to injection moulding, PET flakes were dried in a dehumidifying drier during 4 hours at 140 ºC. The injection moulding profile from hopper to die was 140-240-250-260-270 ºC and mould temperature was set to 25 ºC. Careful was taken to account for energetic balance as well as generated resi-

dues. Tensile test were performed in a universal-testing machine at a crosshead speed of 10 mm/min. From the recorded curves the Young's modulus (E) and stress (σ_y) and strain (ε_y) at yield were determined. To investigate the influence of crystalline differences on the component properties, calorimetric analysis were carried out in a Perkin-Elmer DSC-7 calorimeter. Samples from injected specimens, were heated from 30 to 270 ºC at 10 ºC/min to take account the thermal history. From the scans, the enthalpy of crystallization (ΔH_c), the enthalpy of melting (ΔH_m) and the cristallinity (X_c) were found.

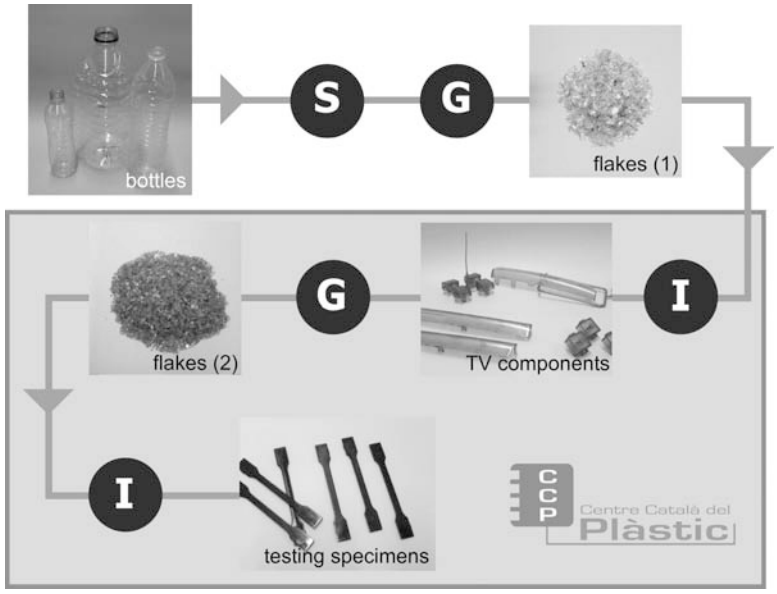

Figure 1. PET cycle

S: Sorting, G: grinding, I: injection moulding. The stages contained in the frame of figure 1 belong activities performed at CCP.

Results

Mechanical and thermal properties

The results of the tensile test performed over the first and second recycled samples are shown in Table 1. From the table, it arises that a loss in the stress at yield occurred between first and second recycling. The explanation can be attributed to differences in the specimens crystallinity produced during cooling or by a certain degree of PET thermal degradation. PET is characterised by a low crystallization rate, so, it can be obtained either in a fully amorphous/partially crystalline state depending on the cooling rate applied. In our case, same quenching conditions were applied in the mould to prevent the development of crystallization. On the other hand, when PET undergoes degradation a certain degree of chain breaking is produced. A lower size of chains means a greater facility for the polymer to crystallise. This fact was experimentally determined by calorimetry as shown in table 1. Furthermore, in contrast with PET R1 samples, during tensile testing it was observed a greater proportion of PET R2 samples that showed brittle break. In order to compare, the results for PET R1 and PET R2 of table 1 belong to that specimens with ductile behaviour.

Table 1. Properties of PET after recycling (PET-R)

Material	Tensile properties (10 mm/min)			Thermal properties (10 ºC/min)		
	E (MPa)	σ_y (MPa)	ε_y (%)	ΔH_c (J/g)	ΔH_m (J/g)	χ_c (%)
PET R1	2329 ± 55	54 ± 0.1	3.8 ± 0.1	-36	41	3.7
PET R2	2445 ± 212	48 ± 1.5	3.8 ± 0.8	-40	53	9.3

R1: after first recycling cycle. R2: after second recycling cycle.

Considerations about PET-R life cycle analysis

In order to consider the environmental contributions of PET recycling in terms of raw materials, wastes and energy, a balance of the process was made. The system under study is shown in figure 2. The inputs of the system were water, energy and the grind PET-R flakes from bottles, and the outputs were the PET specimens and the generated wastes. Water consumption was considered negligible because the transformation machines operated under close loop. Atmosphere emissions, basically from the injection machine, were considered negligible too.

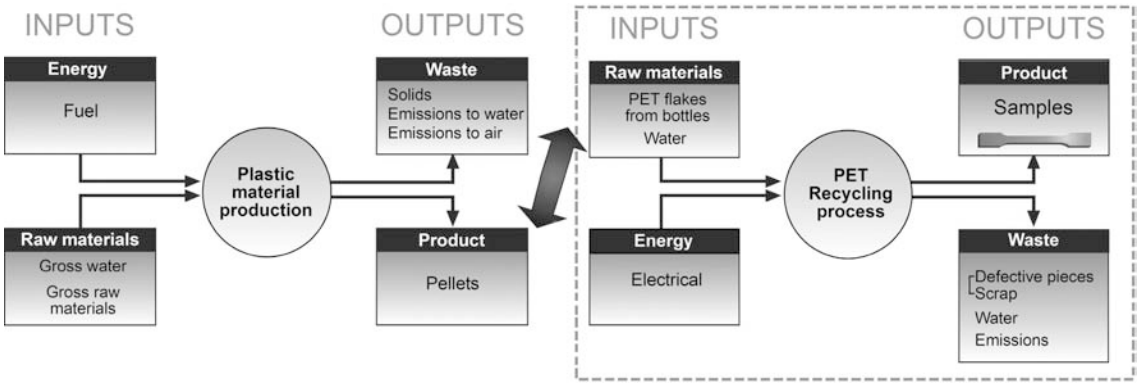

Figure 2. Balance associated to the production and recycling of PET

The total energy to transform PET-R into specimens was electrical and was obtained from the consumption of the operating equipment (injection machine, grinder and dryer). With the aim of comparing the use of virgin or recycling PET, the equivalency of 1 Kg of virgin PET was transformed into its raw materials using the data published by Boustead [4]. The net balance of producing 1Kg of recycled PET specimens was the sum of the energy required during the process and the generated wastes. On the other hand, using PET from a recycled source means a save of resources equivalent to the energy, wastes and raw materials necessaries to produce the equivalent amount of virgin PET (table 2). It is necessary to point out that the balance does not account for the needs associated to the sorting and grinding stages to produce flakes (1) in figure 1, because of lack of data available.

The energy consumption associated to production of virgin PET was of 77.23 MJ/kg and the recycling process needed 62.11 MJ/Kg. The need of dehumidification and the high temperatures applied during its transformation makes PET highly energy consumer in comparison with other common thermoplastics. When virgin material is used the total energy required to inject the material is only slightly lower (61.39 MJ/kg.) because grinding is not required. Therefore, the global balance yields a save of about 55 % when recycled PET is used instead of virgin.

Table 2. Resume of the energy consumption during recycling and necessities to fabricate 1 Kg of Virgin PET [4].

Energy consumption (MJ/Kg)		Raw materials (g/Kg)		Water emissions (g/Kg)		Air emissions (g/Kg)		Solid wastes (g/Kg)	
Production	77.23	Air	480	Na^+	19	CO_2	3100	Mineral	60
Transformation	61.39	N_2	190	Cl^-	1.2	HC	12	Ashes	16
Recycling	62.11	Water	30000	BOD	2.2	SO_X	23	Plastics	2

The efficiency of the production of PET recycled specimens was very low. It was necessary to use 2.5 Kg of PET-R to produce only 1Kg of testing samples. This output (of about 40%) was the consequence of the small quantity of material available (4 kg.). From our estimations the output can reach of about 98% of efficiency when working in a continuous injection moulding recycling process.

Conclusions

The main results of the project show that both recycling cycles can be carried out without a great decrease in the mechanical and thermal material properties. On the other hand, using the test specimens obtained in this work, an environmental didactic laboratory activity is nowadays being introduced into different subjects of current UPC degrees (Material Science Eng. & . A rough approximation to the life cycle analysis associated to PET recycling was carried out. It was concluded that the greater energy consumption was the associated to the injection process followed by the drying stage. Although these consumption are higher than the required for other common thermoplastics, the global balance yield a reduction of about 55% regarding the energy required to produce the same amount of test samples but using virgin PET instead.

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the Learning Network on Sustainability

Sustainable design process for Thai micro-to-small craft entrepreneurs

A case study of vetiver grass handicraft product

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Unlike the mass-produced industrial products, handicrafts employ different paradigm of product development and production process. Believing that sustainability in design education can be cultivated through trans-disciplinary and holistic approach by means of sharing, planning and decision making activities, the design process consisting of conceptualization, visualization, materialization and validation is re-investigated in this paper. This paper therefore aims to portray the effective mechanism and sustainable collaboration between design students and local craftsmen, by taking vetiver grass handicrafts as a case study. The project utilized the conceptual framework of Dr. Prateep Veerapattananirun's Loop Sustainable Collaborative Learning Model, which include the five major stages - Collecting, Co-Planning, Co-Actualizing, Co-Realizing, Co-Cherishing.

The results from the design students and Baan Aoy village collaborative learning process show that sustainable learning in Thai communities reveals cultural uniqueness in various aspects. These include the Thai's sensitivity to profit sharing, leadership requirements, knowledge transfer mechanism, and social flexibility. The Baan Aoy project also defined roles of design and craft in sustainable learning mechanism. More specifically, the mechanism stresses pivotal stages of Co-Actualizing and Co-Realizing in the loop of sustainable learning. It also emphasizes the importance of 3D media and tactile prototypes for successful collaborative learning and the support of design and craft as an organic learning process.

Thailand craft product development background

The development of small-scale handicrafts product communities was first introduced by the Thai government in a national project titled "Thailand Department of Industrial Promotions" in 1994. Its main purposes were to help improve the quality of life in rural areas and to establish the strength of community as a qualified and standardized source of craft products and cottage industry, resulting in self-learning environment on a self-reliable ground and sustainability, eventually. As a consequence, strategic policies of the country were set up through several national economic and social development plans on indigenous knowledge and wisdom of Thailand, whose main objective was to improve community economic in district level.

In 2001, the Thai government created several programs to assist villagers in their craft product development. The "Thailand Village Fund Portal" provided financial assistance in the amount of 1 million baht for each village. "One Tambon One Product" was created to help educate villagers in their craft product development (Thailand Knowledge Center, 2004). Government agencies and academic researchers worked in collaboration to push community attitudes to become more in line with the government's community development policies. The program encouraged villagers to "market" their indigenous knowl-

edge in the form of producing "consumerable" crafts. In essence, the government focused mainly only on revenue development, rather than creating local craft businesses that are built on learning and self-reliance, the key elements to economic sustainability. Such a sole focus on the commercial aspect of craft production naturally caused an imbalance between the economic versus the environmental/social aspects in the sustainable development model.

In the OTOP project, where various government agencies tried to assist each village in developing its own product, problems arose due to a lack of unified and centralized assistance. Another serious problem was the lack of understanding on the part of the organizers in their approach to sustainable development for businesses. For instance, a great deal of assistance was given to communities that already enjoyed commercial success with their products, while not enough was given to those that were in greater need. Also, a "universal" plan of action developed by the government for community sustainable development could not be applied to the numerous communities with unique and individual needs and requirements. These caused the most serious problem such that unclear guidelines caused confusion and distrust between community members and government officials, resulting in a lack of mutual learning atmosphere. In the end, most of the OTOP community projects fell short of the developmental goals that OTOP initially set. These problematic aspects were from the sub-par staffs, that is, hiring or outsourcing staffs from outside with an incomplete understanding of goals and details of the project (Office of the Auditor General of Thailand, 2005).

Thai small and micro community enterprise

In 2003, the idea of Small and Micro Community Enterprise was introduced as a community resources management program to achieve creative and self-sufficient minor-sized enterprise (Thongthaing, 2003). Apart from local funding, the other forms of community resources considered significant consist of natural resources, local products, indigenous knowledge, culture, tradition, fraternity and trust among members. The guideline to establish successful Small and Micro Community Enterprise includes: 1) the ownership and management of community, 2) productivity from analysis procedures of community, 3) creativity and innovation, 4) indigenous knowledge integrated in global level, 5) systematic integration and cooperation, 6) learning process, and 7) self-sufficient orientation. Benefits from Small and Micro Community Enterprise encouraged self-production for consumption, resulting in the decrease of household payments as well as increasing their extra income from selling local products .

As a result, community survived as people remained in their home community for work. The community was able to carefully manage the village's natural resources, essential for sustainable development. Community health as a whole improved. The enterprise community created strength within and joined with others to create a thriving network of enterprising communities. Eventually, it gave the community the true self-sufficient sustainability.

Baan Aoy village: water-hyacinth handicraft community enterprise

Baan Aoy village in Chainat Province is one of the Community Enterprises which set its goal in producing Water Hyacinth Handicrafts following the self-sufficiency scheme. Its members are basically farmers who, in their free time, produce water hyacinth handicraft through inherited indigenous knowledge of bamboo basketry. Like other OTOP villages, their water hyacinth craft production was initially supported by the government in terms of funding, design and product development, and marketing. Later on, Thailand's economic crisis in 1997 caused the decline of both government's funding support and the product orders. Consequently, community leaders and members started to adjust their mindset toward self-reliance and created community network to overcome the higher cost of living such as healthcare and education expenses.

From that point, the members began to develop their products such as baskets, boxes and handbags on the foundation of the existing Thai local markets and export markets. Their product development strategy is based on minor changes in sizes, forms, integrated patterns, and decorations on the product exterior.

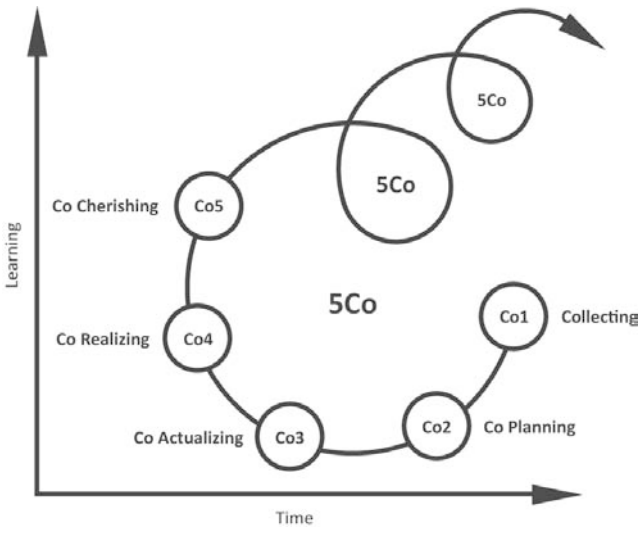
Regarding informal interview on roles of being craft product makers versus designers, when asked to select the preferred one, members were eager to be the latter and mentioned that they were happy to create their own design and have a chance to see the whole process and final outcomes. The community leader mentioned that, she would buy beautiful handbag from local market for studying its form and plotting the weaving, or try to remember pretty products in magazines or television and later started creating new design.

Discussing with Baan Aoy community enterprise also reveals that inspiration is needed for their product development. The researchers thus attempt to find the process that helps develop design-learning process for the community in a sustainable way. By initially studying the Baan Aoy community's life perspective, way of life and shared goals, the team later examines the ground information of sustainable learning, knowledge management, and Interaction Learning Through Action (Institute of Administration Development, 2009) as to find mechanism of the collaborative learning between KMUTT industrial design students and members of Baan Aoy. As dynamics and diversity are the key concepts, the collaborative project was set on the basis of that the learning must co-exist with the socio-cultural context, economy, environment, culture and tradition of the community, which could differ from one community to others (Institute of Administration Development, 2009). Therefore, the project goal is to empower learning ability among design students and community members as well as school instructors, to appreciating and realizing in human interaction as powerful learning source.

Conceptual framework

The 4 months collaborative learning between KMUTT design students and instructors is to be conducted with members of Baan Aoy community by using conceptual framework on "Loop" Sustainable Collaborative Learning Model of Dr. Prateep Veerapattananirun, 1999 (Figure 1). Each loop details are as the following:

Figure 1: Sustainable Collaborative Learning Model by Dr. Prateep Veerapattananirun



1. Collecting

The concept of this stage is to collect ones who share the same interest, realization and goal to create a team spirit for further success in each process. For the department of Industrial Design, the project had been introduced as an elective course for students in 3rd and 4th year. Instructors had presented details and learning stages with the community crafters to students in the first hours. With regard to the stage of "Collecting" in community, Baan Aoy villagers were originally introduced to the project by the coordinate of craft experts at the Department of Industrial Promotions (DIP), since they acquainted with Baan

Aoy villagers and know their exact strength and learning potential. Collaboration in developing design skill and knowledge transfer in craft and design are the key goals of this learning mechanism. The craftsmen in community wanted to learn more of modern design development and expected that participating in the project would enhance their inspiration and opportunity to better their craft design and production. Meanwhile, besides studying in classes, students had the anticipation of successfully obtain indigenous knowledge and skills in basketry through this Learning-by-Doing project.

2. Co-Planning

This stage is focused on brainstorming for mutual understanding, changing mindsets and developing shared visions. The "Co-Planning" in the collaborative learning processes occurred twice in this project. The first "Co-Planning" occurred before the project was launched as instructors and design experts from DIP discussed the direction of the collaborative learning activities. The second "Co-Planning" occurred during students shaped up their craft product concept. Instructors and craft experts as well as students took part in brainstorming of craft product opportunities, and students collected related data for further development.

3. Co-Actualizing

This stage is of running action plans as the integration of design and production processes by sharing ideas between both counterparts. As the first "Co-Actualizing" between the students and the craft experts, the training in basketry was delivered to adjust mindsets and equip the necessary skills to the students. Unfamiliar new material of vetiver grass together with new craft techniques was to be introduced through a fundamental activity of a 3-day workshop (Figure 2). Lessons were included material preparation, twisting, braiding, forming, patterns making and finishing. This learning process belonged to the concept of "Learning by Doing" as they themselves practiced basketry craft by interacting with meaningfully self - engagement environment and thus produce their own knowledge in the forms of Assimilation and Accommodation. (Harel and Papert, 1991)

Figure 2: Students and Craft Expert during Co-Planning and Co-Actualizing Stages

After students had full understanding of material and skills, students had the opportunity to design vetiver grass products, following the conventional design process of Conceptualization, Visualization, Materialization and Validation. Students were then requested to construct their own craft models as for visualizing and truly understanding their own designs. The second "Co-Actualizing" then took place in the Materialization stage through direct discussion with craftsmen for form developing and solving problem occurred during production stage (Figure 3). These stages triggered both counterparts to absorb knowledge and adjust themselves to new concurrent changes leading to sustainable self-learning. (Harel and Papert, 1991)

Figure 3: Students and Craftsmen Collaboration during Co-Planning and Co-Actualizing Stages

4. Co-Realizing

This stage comprises processes of self-assessing and evaluating outcomes as well as presenting their works. Students were assigned to conclude session of “Lesson Learned” in terms of skills, knowledge and experience gained during taking the course. However, the true “Co-Realizing” was administrated only between instructors and leading craftsman through brainstorming session in order to identify the prototypes’ potential. The leading craftsman confirmed and showed their ideas extension through their new designs inspired from students’ collaborative prototype. The momentum of “Co-Realizing” stage was consequently initiated craftsmen’s new learning loops and repeated without ending.

5. Co-Cherishing

This stage is of creating pride and praises. Unfortunately, the project failed to achieve the stage for its limited time and transportation factors. However, students’ working journal and the re-visit to the community revealed that its members were proud of being able to create and develop their new products which were inspired by the works of students. This therefore ignited pride and happiness among students, instructors and experts eventually.

Results

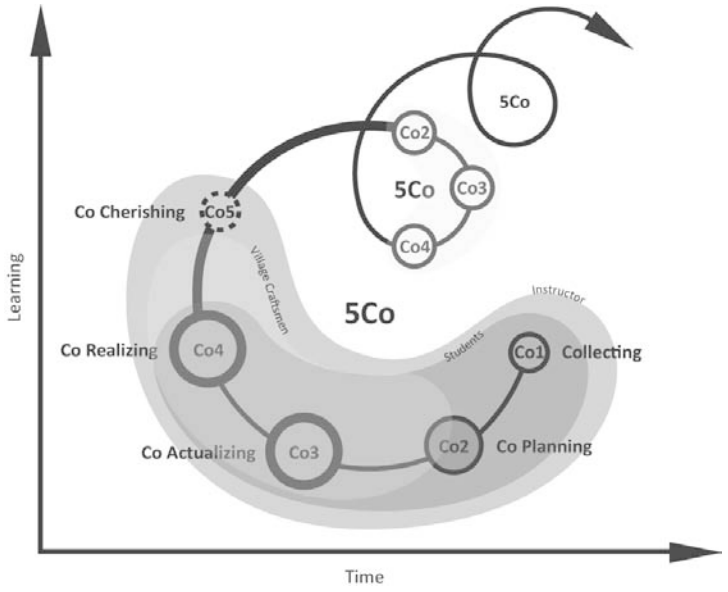
1. Collaborative learning process

This design and craft collaborative process was comprehended based on “Constructionism” approach as both students and craftsmen built up and expanded their individual knowledge. They freely chose their choices of practices without conforming to the conventional ones. By bringing the two groups of people with different background, their alienation to each other turned out to be an eye-opening experience and

become powerful creative resources through the synergy of ideas, mix-and-match working style with the open-ended expectation, rather than goal-oriented solidified solution. In essence, especially during the "Co-Actualizing" stage, students were able to materialize their design intentions through a real understanding in craft material and technique while village craftsmen were encouraged to apply their craft skills to functions and forms made by students that were outside of traditional and conventional craft.

Unlike the traditional way of learning design, the collaborative process encourages the physical interaction between the young designers and craftsmen more than the distribution of academic/professional design knowledge itself, which made both stakeholders realize in human interaction as other sources of knowledge. These had proved to all participants to believe in the power of community collaboration and social integration. Other significant phenomenon also occurred after the collaborative process which craftsmen had expanded themselves into their very own second learning process (Figure 4). These had proved the sustainability of this collaborative learning. Even though the collaborative process did not happen at all stages due to the limited semester timeframe of the academic system, it should be noted that the true collaboration can be done at one will at all time.

Figure 4: Sustainable Collaborative Learning between Design Students and Baan Aoy Craftsmen



2. Lesson learned: reflection from design students

Feedback from the students mentioning their attitudes and mindsets towards this course are ranged from the preference over multi-expertises in a project-based learning environment, the fun and enthusiastic environment which encourage the real making of their products. According to the reflection from the ones who prefer 'Instructionism' learning approach and hence, felt uncomfortable and gave up the course, there should be a session for adjusting mindsets and tuning attitude towards the shared goal. Further, a workshop-based activity which more time and interaction would be collaboratively spent among the participants is considered necessary.

3. Design outcomes

A) First prototypes

It was found that students were eager to invent the new techniques that need less skilful basketry techniques to form the products, such as coiling and a few of skinning techniques. Other crafting techniques were borrowed and applied to vetiver grass, i.e. sewing, crocheting and weaving.

B) Collaborative prototypes

Using the first prototypes produced in the design studio as unfinished, tangible and inspiring media, the students and craftsmen now passed on into a "Co-Actualizing" stage to help each other generate their ideas further. A varieties of design outcomes occurred during this process is included the rediscovery of local long-lost vernacular technique of "San Pla Chon" trimming technique which villagers reincarnated into their sophisticated forms of products. These are the cases that the researchers have found as the utmost value that collaborative process provided. Learning outcomes are also involved in their collaborative in problem solving, their inter-assimilation-accommodation in their knowledge through the actual interaction learning. The craftsmen actually reapplied some of the techniques found during the collaboration into their other existing high-demand products and such a method was simplified enough that the villagers can distribute the work to the elderly, the handicapped, and the children, thereby expanding the workforce and increasing production for the crafts community.

While focusing on finding some revenue for their community, villagers have also planned to apply the idea of sustainability to the way in which they approach their craft business model, by replacing vetiver grass with their local agricultural waste which is plentiful and accessible in the area. Whereas before, the locals looked to outsource some certain non-local materials, they have now learned to aim for craft designs that are hundred percent made in Baan Aoy. Lastly, the collaborative project has taught the students and the villagers the importance of self-reliance as the main ingredient towards achieving sustainable learning success.

Figure 5: Collaborative prototypes between design students and Baan Aoy village craftsmen

C) Craftsmen idea-extension prototypes

Villagers mentioned their inspirations and drives achieved were such meaningful to them that would later on engage them to work on their products in the future. The instructors, afterwards, persuade them to generate new designs based on students' prototypes for their familiar markets: Thailand, USA and Japan. At the end, the leader of the group showed the potential in applying inspiration to her very own design development and solving problems of size, product usability and production as she can make production plans for work distribution to Baan Aoy's connection fellows.

Figure 6: Craftsmen Idea-Extension Prototypes

Discussion

1. Sustainable learning with Thai community: cultural uniqueness

A) Sensitivity to Profit Sharing

One main characteristic of Thai society is its long-inherited cultures, traditions and lifestyles that have been passed on to upcoming generations. Thai society is based on mutual reliance and cooperation, for example, the act of barn-raising (in a form of rice harvesting). Revenue and earnings received had never been problematic as labor and outcomes were unmeasured (Petchmak, 2004). Nevertheless, participating in this local economic creativity project, the main goal of community members was geared towards revenue and profit sharing. As a result, if the community lacks the strength, conflicts can easily happen. Leaders of the community thence must possess the capability to be the center of the community.

B) Leadership

It can be said that Thai society concerns with seniority. As Thais in the past gave much respect to the elderly or more senior people who would in return pass on their knowledge and experience to the next generation. Yet today Thais give importance to qualification: profession, education, prestige and wealth. Hence, leaders of the community should acquire both seniority and qualification to gain respects from followers and be the center and pillar of the community. Thai society is different from others as it depends firstly on leaders as the success of those leaders relies on trust of group members which cannot be evaluated in figures, while others might focus on systems and management which give solid numbers and can be audited to find related efficiency.

C) Sensitivity to knowledge transfer

According to Prof. Dr. Prawase Wasi, Thai Society now lacks "Knowledge Mapping" between people and knowledge, that is, who possesses what kind of knowledge. This is the result of Thai learning process in the past which was done without recording; learning by memorizing became common practice until these days. Furthermore, dialoguing, demonstrating and making seem to be the main learning methods due to nature of craft making. Therefore, while learning with the village craftsmen, students were supposed to record what they learn as one way to compile indigenous knowledge and prevent it from extinction.

In the past, Thais believed that individual knowledge was for family members only; they would prefer keeping it secret till on the deathbed to disclosing to others (Buranakhet, 2004). During the learning process, thus, there might be some of this problematic aspect for students being perceived as the outsiders. Beside trust, efficient communication skill is important that students must own before participating in the collaborative session with villagers for this matter of fact.

D) Outsiders and insiders

One important consideration is the outsider/insider issue as students, the outsiders, who step in the targeted area would normally get greetings from villagers with respect and humbleness. As Thai society is based on the perspective of consideration to others, activities that help getting feedbacks indirectly from different stakeholders (students and villagers) therefore should be done to avoid conflicts and negative attitudes.

E) Flexibility

"People and communities are differed regarding their economy, society and culture, natural resource, environment and etc., so implementing one successful learning approach in one community to another or from the central authority to local communities tends to fail," (Wasi, 2001). This results in varied processes and strategies in planning and collaborating. If government or agencies are interested to participate in this project of developing product design from indigenous craft knowledge with any community, they need to have the thorough study about that community beforehand. Community Development Department under the Ministry of Interior owns this related data and the close relationship with villagers. Collaboration with them or those with close connection to community such as Local Administration Network, thence, should be made to create proper planning that agrees to community the most. Besides, most of village craftsmen have the main profession as being agriculturist so producing crafts—considered a part-time job—is to scheduled in accordance with their farming timetable as well as their attendance to local social and cultural events. Flexibility therefore is the key element in the project approach to the community.

2. Design & craft roles in sustainable learning mechanism

A) Sustainable Learning: Pivotal Stages in Design and Craft Collaboration

Each stage of "Collective Learning Model" is essential as it promotes the continuity of the learning process, however, when being analyzed, with its design process integrated, it was found that the stages of "Co-Planning" and "Co-Actualizing" usually coexisted in the same time. And critical stage that lie within the stages of "Co-Planning" and "Co-Cherishing" would change the role of designers and relocate their design knowledge with shared experience in the same level of villagers, not in the superior one often found in government design training programs. The limitations of this pilot project are time and distance of the two learner groups: craftsmen and young designers. As a consequence, these important stages were failed to gain the complete foundation of collaborative learning. Goals and wills of learners are also needed for learning achievement and thus should be articulated in the stage of "Co-Planning". And when all processes are finished, the stage of "Co-cherishing" should be made to accomplish what is the goal of the project.

For "Co-Planning", besides making plans together, some activities for an open-eyed experience should be managed, for instance, visiting exhibitions and trade fairs, in a pleasurable way for stimulating learners' creativity. In terms of design practice, this stage would lead to characteristics of the design brief. Challenging brief with incentives from everyone is a real fruit of this stage. Government agencies often

have the design briefs that are stereotypes focusing on only the aspect of value addition. Design brief that also gives value to the other dimension of life such as self-development, community-reliance, society and culture, is subjected to be explored for the purpose of the true sustainable development (Wasi, 2003).

B) Media for collaborative learning in design

While the conventional design procedures of brainstorming and sketching proved problematic and unsuited to the collaborative learning between academic and village craftsmen, the actual real-world prototype as the media had proved to be the appropriate tools to stimulate the creative dialogue between the design students and craftsmen. Therefore, if one were to assist local craftspeople, one must strike a balance between the less theoretical aspects of design and the more of real-world tactility of craft.

In the stage of "Co-Actualizing", it can be seen that designer tool and media need to be adjusted to efficiently communicate with non-design background craftsmen. Also the roles and needs of media in the context of developing local crafts products through collaboration are different from professional design context. Using the first prototype as media not only solves the technical problems in production, but also encourages village craftsmen to have inspiration and "extend" their ideas for new products. Experiencing materialized prototypes enables craftsmen to connect market possibility—the existing information from working experience—with "ideas". With the main characteristic of Thai craftsmen preferring adapting and applying, this learning process completely agrees with Thai villagers

C) Design & craft as organic learning process

Typically design process is clearly structured and focused in terms of time constraint and clarification of the objectives. While the product development process among Micro-to-small Craft Entrepreneurs is comparatively more flexible due to many factors: uncomplicated nature of craft making process, small lot production, accessibility to various distribution channel network. Village craftsmen thus have potential to create unlimited new products as possible as their availability allows. As a result, each working cycle tends to be a small, repetitive yet dynamic loop of activities generating numerous visual and tactile outputs as the source of ideas for driving the next round of their product development.

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Approaches, methods and tools to support education on PSS and social inovation for sustainability

the Learning Network on Sustainability

Making User Centered Design more affordable for collaborative service design

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Collaborative services are between the most significant opportunities for the creation of local sustainable solutions and for social activation. While this kind of services sometime are generated spontaneously by groups of people, professional designers can give a significant contribution generating new service concepts, and making more effective and efficient the existing solutions. The design of collaborative services requires an in depth understanding of ground motivation and needs of all the actors involved in order to facilitate the active contribution of the participants; furthermore, a full understanding of the context (from the cultural, economical and technological points of view), should be the base for the definition of all the physical aspects of the designed solution. A great help to this respect is provided by a number of design techniques developed for the User Centered Design.

Introduction

The User Centered Design (UCD) techniques have been developed to support the design of interactive products, services and systems in particular in the field of ICT, and are taught in academic settings as part of the interaction design courses. In this article we present the results of the application of the UCD methods outside the interaction design in other design areas in which this approach is not frequently used. The focus will be placed on the persona method, and we will explain how the method was adjusted in order to be employed in various pedagogical contexts. More specifically we propose the extension of the method's focus from single individuals to clusters and groups of interest and to communities of people. In order to achieve this shift we introduce a new instrument, a map of the critical aspects encountered in the observation of the context, that when tested, proved to be useful in the articulation of individual and subjective demands. The map highlights the contradictions and the complex issues that have to be addressed in the project. The experiments conducted underline how the UCD could be improved to be more robust therefore easier to be used in an efficient manner.

1. The service design project and traditional User Centred Design techniques

In the next chapter we will refer to several activities that have been conducted in the area of service design at the faculty of design of the Polimi. In particular we will discuss the area of collaborative services. In the collaborative services the final users have also an active role in the design of the solutions they will use. Even if the collaborative services could spring spontaneously from the capacity of the community to

self organize (Manzini et al., 2009) (Manzini in Meroni ed. 2007) the design could play an important role in generating new innovative services, by proposing specific and qualified enabling solutions (Cippola, 2007). The User Centered Design is a solid and mature approach to the project of interactive products, services and systems, aimed to the optimization of user satisfaction. The interactive artifacts imply a cognitive effort from the part of the user, in order to understand the actions and modalities to access them. Moreover they require a keen critical sense from the part of the designer, asking her/him to act as if being the user. This is necessary in order to understand their motivations, mental processes and behavior involved in the actions that will be made possible by the product or service to be designed.

UCD is generally based on three activities: 1. people and context observation and analysis to ascertain user needs, design constraints and goals. 2. early and intense prototyping of all the most significant or critical aspects in the project, with respect to both physical and non tangible features of the product or system that must be designed. 3. evaluation activities aimed to test the suitability of each design choice, and support decision making on practical results. In this article we focus on the concept generation phase in the design of services. We can therefore underline two main categories for this phase: the first one refers to the observation techniques in the field research, finalized in the study of the different behaviors, needs and activities in the context of the project. The field research techniques include observations, interviews, guided conversations and specific documentation. This implies extensive and time consuming research sessions supported by professional equipment. Among the first authors who contributed to the literature, Hugh Beyer and Karen Holtzblatt (Holtzblatt et al., 2005), formalized this family of techniques under the name of Contextual Design. The field observation activities have to always be conducted taking in consideration the overall design project and its hypothesis. The second category refers to the laboratory techniques employed in the absence of a direct contact with the end users. Both in the UCD projects and in the projects that involve the users in the solution development, the designers have to combine the lab activities with inclusive activities. The designers use the experience acquired in the field research to generate the hypothesis and simulate the users' reactions to the proposed solution. This is why it is important to re-elaborate the information gathered in the field research and make it available for sharing with all the participating members. One of the methods that proved to be successfully employed for this purpose is the persona method introduced for the first time by Alan Cooper (Cooper 1997). The technique consists in three passages. The construction of archetypal characters – personas – fictitious but realistic, the analysis of the critical issues that could emerge in their relation with project's characteristics, and finally the designers proceed to work taking into account the most critical user profile. If properly employed, the technique allows the designers not to be self-referential and keep the focus on the users their constraints and resources. The UCD could be employed even in the absence of a definite solution, to better individuate the specificity of the context before identifying the project hypothesis, and in the same time, could help verify the direction the project has to take and suggest guidelines for future actions. In both cases statistic and synthetic representations of the knowledge acquired using the techniques have to be complemented by narrative techniques and storyboarding exercises either based on real situations or constructed scenarios. The above mentioned passages are particularly relevant in the design of intangible artifacts such as service and interaction design that present complex organizational models brought to life by the actions of the participants and having a time based development. This emerges particularly in the case where the process relays too much on the development of various prototypes and their cyclical adjustments. This is why it is fundamental to follow the approach, encountered also in product design, in which the designer has to address the complex issues of the project before the prototype phase, which means in the case of the service design, before enacting the service. The UCD allows us to develop an approach to service design in which the project focuses on the needs of the users, in the same time enhancing the robustness of the project through an analysis of the critical factors during all the phases of the design process. The observation techniques specific to UCD, in which the study of the users' behavior is based in real life contexts, encourages the designer to think from a different perspective either then his or her own point of view. In didactical settings the use of UCD helps the students brake free from predetermined stereotypes.

2. Analyzing custom made solutions for UCD

Due to the relevance of UCD in the design of collaborative services, UCD techniques should be suitably modified and updated in order to be affordable and more robust (some, like "Personas" by Alan Cooper

are tricky and require skilled use to provide good results). As stated before professionals trained to use them have generated the UCD techniques in the majority of cases to support the design activity of the multidisciplinary groups. The mechanical, unaware use of observation and analysis procedures could only lead to an unsuccessful project. The study of cognitive processes in relation to the interactive products and services is conducted systematically in industry settings. The elevated costs of organizing the above mentioned observation is justified in the case of commercial projects by the revenues obtained from selling the projects' outcome. We argue that the user-centered approach should not be confined by the financial constraints, but instead made widely available. This is why focalizing the attention on making more affordable the approach and its related techniques, we propose three aspects that we retain most relevant: the passage from observation of the context, actors and their actions to the formulation of the first project hypothesis; the forms of visual representation useful for the design development in the case of collaborative services and the analysis of the behavioral traits of the actors that take the role of active subjects in the participative services, in relation to their belonging to the community.

2.1 Concept generation for service design and context observation

As Bill Buxton stressed out in his book Sketching User Experience (Buxton, 2007) designers, and especially student designers, have the tendency to develop a strong attachment to the first idea they had in the concept generation phase. This phenomenon is highly risky for the advancement of the project and hinders designer's capacity to explore other directions. Moreover the fixation on one idea could seriously alter the innovative aspect of the result. In the UCD the designer has to envision user's perspective without imposing his/her stereotypes and prejudice in order to be able to consciously acknowledge the user's needs and expectations (Sclavi, 2003). Especially in this phase, the rush to move forward with the first idea has to be channeled in activities that will allow the designer to open up to the complexity of the design project. Designer's task stays in observing the critical aspect of the project and address it in an innovative solution. The observation phase by facilitating the gathering of particularities, stories and unusual episodes has to provide significant information that will enable the designer to choose the most valuable solution.

We can illustrate the application of this critical observation with the help of an example, this time from the interaction design class at the Polimi. Following a theoretical lecture on UCD techniques, the students have been asked to carry on a field research inquiry in a market place located in the vicinity of the university. This allowed them to put in application and verify the validity of the lecture's content. Their task was to generate interactive services and products for the vendors and buyers. The students were divided in groups and they documented the research using photos and videos. Afterwards they had to explain the work done in a visual representation designing a poster. (fig. 1). the visualization show how the students managed to sense the specificity of the context.

Figure 1: An image of one of the posters generated by the students

The street markets in Italy are busy and somehow chaotic but also fascinating in the richness of sounds, smells and colors. In the same time they could be dangerous places due to the presence of thieves and fake vendors. This picturesque richness is entwined with critical issues such as the restrained access for elderly or handicapped persons or the increased accumulation of residues of all sorts that have to be removed afterwards. Even though the students managed to successfully identify the characteristics and con-

tradictions of the context, only a few of them implemented the observations and underlined their value in the actual project proposals. Most design interventions tended to suggest re-organizing solutions that worked towards the "normalization" of the system. The mental prejudice according to which the service has to bring order and efficiency, prevailed with respect to the desire to maintain an antique chaotic quality of the context that follows its own rules.

The question we are faced with is how to help designers preserve the original and qualifying factors of a context? How to avoid the re-cycling of pre-existent and rigid schemes? In an effort to accommodate the contradictory nature of the results gathered from observation we propose an alternative representational instrument that we called the critical issues' matrix. The tool will be explained in detail in the chapter 5 of the paper.

3. Generating visual representations for UCD. Examples from academic setting.

The next chapter will focalize the discussion on the methods and techniques employed to understand and profile the users who in the specific case of the collaborative services are also active participants with different roles. Using examples from several concept design courses, the two parts of the chapter aim to highlight the main components that enable the above mentioned understanding. Although presented in a sequence, the three steps to be taken evolve in parallel, each of them helping the definition of the other. As an example, while it is essential to start with the main characteristics of the participants, the building of the narrative could reveal certain important features of the actors involved. In the same time the storyboard visualization can bring to light important actions that have been overlooked in the scenario.

3.1 User profiling. Visualizing the participants

While from the beginning of the concept definition the designer has to have a strong intuition on the target user, the conscious acknowledgement of the needs and expectations comes from understanding of their different identities. Literature findings show how the profiling of the possible users has to come from the study of both qualitative and quantitative data (Pruitt & Grudin, 2003) gathered in field research observation of real life situations. In order to introduce a more extended discussion on the personas method, we will focus on the visualizations of the indentified profile as a prior step to the creation of archetypal characters. In this sense the examples shown have the common thread of being intended to the specific purpose of only one design exercise and have not been "recycled" in other occasions as the personas are intended to be used in the corporate settings (Cooper, 1999).

Four types of visualizations have been individuated: 1. photographs of an actual potential user, 2. stock photo, 3. hand drawn or computer generated sketch that embody the overall characteristics of the actors, 4. outlined figure in a contextualized photograph. (fig.2)

Figure 2: Examples of visualizations

3.2 Scenario building and story boarding

While the context observation brings useful insights on the real life situation in which a service will be located, the construction of a narrative helps understanding the role of all the actors involved and shape their identity. The scenario is also a mean of communication, presenting a narrative description easy to understand for all stakeholders (Kantola, et. al., 2007) . If the actors' profile are revealed from field research, the scenario will help envision their actions in the service to be designed. This however will help the designer understand if the profile identified performs realistic actions in a certain time span. The scenario brings into discussion the temporal facet of the service that cannot be otherwise comprehended. The actions completed into a certain time sequence might not be relevant in a second instance. To give an example we can think of a public transportation service in which the rhythm of the sequence of actions is completely different at 9:00 am in the morning at the rush hour than two hours later at 11:00 am. This will have an impact on the behavior of the characters who will act differently in two different moments, revealing perhaps critical aspects of the service. In the same time the storyboard technique borrowed from the film and animation industry (Katz, 1991) offers a simple and inexpensive way to visualize the story told in the scenario - which in the case of service design relates to the action flow of the activities. The storyboards encapsulate in a nutshell several essential elements such as the context, the users, their goals and the plans in which they decide to reach their goals, the actions taken and the response from the system, in the case of the digital services and most important the interaction with the other users (Truong et al.,2006) (Shyba et. al.,2005).

Discussion
4. Personas method. An overview

In his seminal work "The inmates are running the asylum" (Cooper, 1999), Alan Cooper introduces the concept of persona as a fictional character, which can help designers identify one or several archetypal users. Ever since its creation the method has been employed in the field of HCI where given the intangible nature of the product and the fast speed of the software development, the traditional ethnographic research could not be fully employed due to time and financial constraints. However more updated applications of the method proposed alternative persona creation methods that enriched its fictitious nature with more specific behavioral insights acquired from ethnographic inquiry (Khalayli et al., 2007) (idem 3.3) and also proposed new ways in using the method in the design practice (Chang et al., 2008). Offering an almost standardized image of the end user, the drawbacks of the persona method stays in the almost complete elimination of the human complexity forcing, in the worst cases an idealized untrue image of the participants in the case of the collaborative service design project. The methods' critics stress out how personas encourage a "safe" distance from the people we design, this generating a lack of empathy to the actual needs of the users, creating in Steven Portigal's view, a façade of user centeredness while merely reinforcing who we want to be designing for and selling to (Portigal, 2008). In the next chapter the two main phases of the persona development will be taken into consideration. The analysis intends to pin down the critical aspects using concrete examples and in this way anticipating possible new ways to make use of the method.

4.1 Phase 1: Personas identification

An important phase in the passage from the observation of the context to the actual definition of personas is the identification of behavioral patterns and the various typologies of actors that will take part in the service. It is important at this point to focus on the roles played by the various actors in the context of the service and understand the various categories to which the individuals belong. Having clearly outlined the categories, the next step is to create a classification of the components of each group. To take the example the market exercise we can think as the street vendors as being one category of actors and the buyers as being another. At this point we can delineate the general characteristics of the category and divide it into sub-categories according to the specificity of the of the different participants. We can say that the vendor category is sub-divided in regular, authorized vendors that purchased their place in the market and own a stand and un-authorized vendors that have to move their improvised stand according to the availability of

places and run the risk to be caught selling without having the permit. This is just an example of an exercise that could allow the designer to start delineating the individual characteristics of the personas but also keep in consideration the group to which the character belongs. This is essential in balancing the critical aspects embodied in the characters identity and will help the designer to trace the outlines that will lead to the persona creation.

4.2 Phase 2: Personas creation

Persona generation implies the use of a series of representations, visual or not, that will become the identikit of the characters created. The traditional, consolidated practice asks, as shown previously for quantitative and qualitative data in order to assemble the profile of a persona. The age, profession, occupation, marital status and other information have to be complemented by the description of the role the persona will play in the service and according to the scenario, the actions she/he will accomplish. The visual representations could either take form of a hand drawn or computer generated sketch, or a realistic photo of a possible or existing actor. The description of the profile will have to combine real data with more specific but fictitious details. It is important to pay attention to the correlation of the narrative scenario and the visual representation of the storyboard with the style in which the persona is described. From this point of view different representations will tell different stories about the characters involved and therefore a coordinated communication strategy is necessary.

5. Re-interpreting the personas method

5.1 Individual personas

The personas technique formalizes the information about single individuals who will use a product or service. The technique is referred to individual characters because it focuses on the behavior, cognitive and decisional processes that lead to action, highlighting the individual subjectivity. Cooper insists on the veridicity of the profile in order to buildup the identity of the reference personas. He proposes naming and visually picturing the personas to make them become almost real actors in the project. Even if in the UCD the users are treated as single characters for concentrating on their subjective point of view, in real life situations peoples' behavior is seldom related only to their belonging to one specific context. To give an example each of us tends to act differently when walking on the sidewalk from when driving a car on the streets of the city. Or in another stance, both women and men have a different relation to the household when being by her/his own and when have to manage an entire family. As a consequence it is important to have the right tools for studying not only the individual but also the group.

5.2 From individuals to groups of users

Seeing all the above, we have conducted various experiments related to the application of the persona method to groups of users considered as communities. Their needs are expressed as a synthesis of the individual requirements and expectations mediated by an internal organizational model.

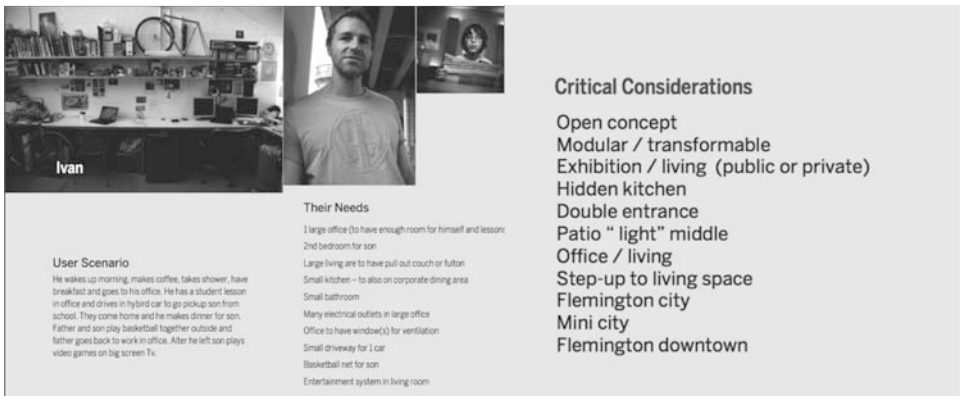

Figure 3: Example of persona exercise at the Institute Without Boundaries

First opportunities to test the hypothesis arise when invited by IWB at George Brown College to introduce UCD techniques in a project of social housing residential clusters. The exercise was particularly interesting because allowed the experimentation of the techniques in the architecture project with the scope of improving the living solutions and the quality of life of a low-income community. In this case the UCD methods weren't employed to represent individual needs, but to analyze realistic family models based on real information about the existing situation. The study was intended to support the brief definition and to inform the work of the architects dealing with the design of the interior space. (fig. 3) The use of narrative techniques based on storyboarding proved to be efficient in the majority of cases and the results were optimized with respect to the specificity of the context. The actors referred to the families, each of them with their own character and particularities given by the number of members, typology and organizational models which related to the cultural background.

5.3 Profiling a community with the help of personas method

Continuing the exploration in the improvement of the UCD techniques, the service design course recently completed at the Politecnico di Milano, provided the chance to continue the experimentation. If in the previous example the focus was placed on the families as unit of analysis, this time the method was applied to communities of socially involved individuals. The service was located in the suburban area of Milan and the brief aimed to address the segregation between the city and its agricultural hinterland. In particular the students were asked to create services that will link the inhabitants of Milan to the Parco Agricolo Sud, situated in the southern outskirts of the city. In order to explore the potentialities of the green agricultural area, and the farms located there it was important to understand the typologies of users that could be interested in what the local farms had to offer. The UCD techniques were used to profile the various communities that will most likely establish a connection with the local farms: schools, purchasing groups, or other communities brought together by a specific passion or interest. The representation of various scenarios placed in different contexts allowed the generation of new project proposals. Consequently the most successful hypothesis has been chosen for further analysis and development. In this case the study of scenarios and actions took into account the farm owners or managers and the groups that could constitute the main users.

5.4 Critical issues matrix

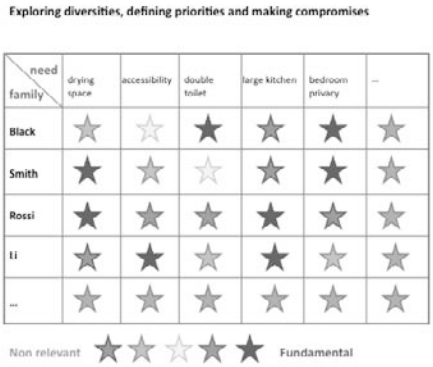

Figure 4: Critical issues matrix

A service could be represented as an organizational system, supported by enabling solutions (idem 1), that will bring advantages to the actors that offer the service and the ones that benefit from it. The application of the persona method to the single individual, the community and the different actors underline the critical factors of the project. It also enables the designers to put in evidence the critical factors of the project, the ones that require a specific attention in order to resolve the difficult issues and contradictions. To support this activity and clarify the constraints in an early phase (as mentioned in chapter 2) we introduced a new representation instrument that we called critical issues matrix. This type of tool allows the designer to visualize in a synthetic manner the perspectives of the different actors in relation to the main variables in which the designer has to operate. (fig. 4)

6. Conclusion and future work

In the previous chapters we presented an overview of the traditional UCD methods and argued that in order to serve better the purpose of collaborative services, the methods have to be constantly reviewed and updated. Most important the paper underlined the need to balance the individual needs with the requirements and expectations of the community and introduced the critical issues matrix as a new tool that proved useful when tested in academic setting with different groups of students. Finally we suggest that future experimentations with the alternative approach to UCD explained in the paper could bring an interesting contribution to the field of design for collaborative services.

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the Learning Network on Sustainability

Sustainability in design education

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Sustainability can eliminate negative social and environmental impacts in the design process. Incorporating this in design education can help create development and wealth for and with future generations, in a healthy environment for a healthy society
The SCALES core Principles can expand the context of design life and can form one of the new approaches for designers. These principles – the main focus of this paper – can help create change agents and design leaders who can in turn take hold of the sustainability agenda. The focus of the paper is to show the usage of DEEDS core principles in experimental DFS education activities in Design and Fashion education in the Indo-Global context – Indian yet globally relevant. This paper discuses these principles with reference to a design project as case in example.

Introduction

If the purpose of Sustainable Design is creating new societal values to balance human happiness with ecological truths, then Design Education needs to reflect this aspect. Sustainability has the potential to eliminate negative social and environment impacts in the design process. This makes its inclusion in Design Education an essential requirement for the present, to safeguard the future.

Design education is an aspect of design approach / framework and like most design approaches, is issue led, addressing contemporary issues. The concept of sustainability is a – Meta Challenge today – it challenges the capitalistic nature of consumption and production of current times. Sustainable Design recognizes the need to balance nature, people and economic growth.

Table 1: Characteristics and contemporary issues associated with design approaches / frameworks

Source - 'Design Activism – beautiful strangeness for a sustainable world, by Alastair Fuad-Luke

Design approach / framework	Typical characteristics	Key contemporary issues
Conceptual	Speculative future scenarios, futurology	Cultural and social transformation
Cross-cultural	Issues of hegemony, cultural power, values	Cultural, social and political aspects of globalization / localization
Eco-	Issues related to the environmental and sustainability impacts of design	Environment, Sustainability
Design Education	Design and delivery of specialist courses in design	Any contemporary issues
Design Research	Allocation and management of design-related resources	Any contemporary issues
Green	Considers issues of the environmental impacts of design	Environment, Sustainability
Participatory	A collaborative approach to the design of products, services, spaces, spaces or systems that involves actors / stakeholders in the design process	Cultural, social, political – Participation and democracy
Re-	'Refining, improving or reinterpreting an already existing functional design'	Economic, environmental, cultural (consumerism)

Design approach / framework	Typical characteristics	Key contemporary issues
Slow	'An approach that encourages a slower, more considered and reflective process, with the goal of positive well-being for individuals, societies, environments and economies	Any contemporary issues
Universal	An approach that encourages designs that should be equally accessible and can be experienced by the largest possible number of people.	Cultural, social, political – participation and democracy
Metadesign	Design that designs itself, within the whole, in order to redefine and synergize social and technical infrastructures, collaboratively and co-adaptively	Cultural, social, political – participation and democracy
Co-design	Design that brings users, actors and stakeholders into the design process on the basis that everyone likely to use a design has a voice in its conception	Cultural, social, political – participation and democracy
Sustainable design	Design to deliver sustainable development and deliver the 'triple bottom line' – by balancing profit, people, planet	Balancing economic, ecological and social concerns

Design has shown that it can have a positive impact on economic, social and ecological capital and rise to the challenges of sustainability. The imparting of knowledge and skills and development of concepts is central to Design Education. The synergy between design and sustainability in design education begins with the question – What does 'integrating sustainability in design education' encompass and the ways to implement this.

Sustainability and Design Activism

The synergy between sustainability and design through Sustainable Design activity may be considered as Design Activism. Design Activism looks beyond the challenges of ecological issues to include Social Design, Co-Design, Slow design and Metadesign. By integrating sustainability in design education designers can be change agents resulting in Design led activism. Activism is about motivating people, activating and transforming them. Designers along with government agencies have been working as activists in the lifestyle sector particularly the handicrafts sector in India. Design has been a tool to deliver the triple bottom line of people, planet and profit in the handicraft sector of India. We, in NIFT have been privileged to be a part of this movement through our craft cluster initiative.

Sustainability in Fashion

The issue of sustainability has challenged us to come up with ideas and strategies that simultaneously improve economy, community and environment. For 'Fashion' which has been fed by consumerist and selfish values this is a paradox.

Design education can build the bridge between the two diametrically (till now) opposite beliefs by inculcating in design thinkers the values and skill sets that help fuse sustainability factors.

Sustainability has to form the heart of fashion future. Concerns raised in ecological and ethical areas have moved this to the centre of the fashion and apparel industry.

One major and positive impact has been that this has led to alternative visions for fashion and clothing and how to clothe people. Sustainable fashion has promoted both material and technological innovations and social change through use of lower impact materials, fairer employment models and efficient and effective processing. It has also championed design concepts of recycle, up – cycle and pre – cycle – promoting new ways to produce.

Design and fashion are highly experimental by nature. There is the element of risk, working on a problem from various perspectives, coming up with alternatives, prototyping / modelling those alternatives and finally choosing the best / optimal option(s).

In some of the student projects that have been mentored, we have found that the SCALES principles have been used as a part of the design process activities from conceptualization to final actualization. One of the projects is presented as the case for 'experiences in experimental DfS education activities'. The student designer in this case has been both a visionary and a visualizer.

The Design Case

The case elaborated here is a Graduation Project done by Asit Barik, student of Leather Design, NIFT, New Delhi. The project has been first separated into its different stages, assessed using the SCALES principles and reassembled in a whole to show the DfS experience in experimental education.

The project started with the idea of creating wearable art using unusual materials. This brought the idea of junk as one of the materials which could be used and was further pursued in this project. The initial problem identified was the excess amount of waste being generated and find solutions to transform this waste into a more sustainable product for the fashion consumer. This took the concept of recycle to up – cycle.

The waste identified was: waste leather, used and discarded shoe uppers and belts and used garment components like used and discarded jackets. The project aimed at using what already exists but as waste, thereby reducing the need for creating new material as well as reducing the need to send the existing waste to landfills. The intervention of new material was minimized and whatever already existed was up – cycled and enhanced.

The four sustainability dimensions – economic, social, institutional and environmental perspectives were taken into consideration throughout the project. The best practices of product life cycle thinking ensured sustainable consumption and production for future generation. The student designer in this project followed the simple mantra of cyclic and safe. The product that was eventually created was not only economically viable but also successful in creating a social awareness thereby projecting the very essence of the need of a sustainable environment.

The materials used in this project were completely waste that was up – cycled to not only create a wearable art but also to create a social awareness. The waste cut pieces and yarns, discarded shoe uppers were the main raw materials for this entire collection. Thus, through this case study, it is evident that the life cycle of the product which was considered to be discarded was further extended by the creation of a new product due to the greater life of the materials.

The student designer explored the possibilities outside of the current paradigm of style, use, technology and economics. Thus, design education and design practice moved towards a more sustainable approach. The design practice thus indicates the eco – friendly aspect where design is gradually moving towards a more sustainable practice to ensure green environment for the future generation.

The designer applied his knowledge of product life cycle, technology know – how, and reusability/recyclability in this project. Along with the guiding faculty, the authors, the student used the knowledge and skills acquired over the study period which was in sync with the SCALES principles in extending product life by recycling / up - cycling.

There was a creation of satisfaction at various levels, by improving the quality of life for disadvantaged sectors of society – which is ‘rag pickers’ in this case and providing a novel product for the consumer. The human dimensions were also influenced in this process. The design fertile product offers all stakeholders experience, emotions, relation, pride, self – esteem and awareness.

There was a systematic intelligence involved in this project. Keeping in view the concept of sustainability, the project involved increased participation of the rag pickers, promoting industrial ecology and the user experience was also enhanced through pride in creating closed loops of materials that were of a zero value before recycling.

Concept design often emerges from design explorations and practices. Consciousness/awareness can be developed amongst the consumers though incorporating sustainable practices, manifesting in every day design solutions. The sustainability context expands the design context in thinking and practice. One of the biggest challenges of this project was to change perception by making use of the diversity of ‘value – added’ outcomes of design for sustainability. The age old perception that scraps of leather are a waste, and used garments and belts can only be treated as junk were challenged in the entire process of this design project. Thus, the designer became a change agent and a change leader.

The designer along with the other stakeholders (the rag pickers, tailors in this case) became the key driver of this project. The project holds a sustainable business value which involves a wide range of stakeholders who contribute to the creation of new value to the existing range of product. The final outcome of the design collection includes intellectual value which adds to human, society and environment as well.

Thus, there is awareness in the society which identified an alternative approach of value addition to waste/used material, thereby benefitting the weaker section in the supply chain. Alternatively, the focus of the project aimed at a sustainable way of living, working and producing. Thus the project created

awareness and perception by generating new and eco – friendly design solutions. The designer made use of the existing resources and socials innovation to introduce a positive social change. The project, took into consideration, the factor of resource depletion by generating value – added product line from waste, thereby reducing the need for new material.

In the design project, the designer learnt jointly with and from the stakeholders through participation. Inter – disciplinary learning also happened in the areas of design and material technology, leather and non – leather and waste utility. It can be observed that the designer established a strong bonding with the workers for achieving a meaningful production. The rag – pickers have been given due importance who have contributed as a catalyst and facilitator in achieving the final range of product line. Thus the entire case study is an appropriate example of mutual learning and team working as a way to stimulate creativity. Participating with the peers to practice teaching and learning in community are thus the ways of framing sustainable design practice. All the stakeholders were actively involved in the project to respond to the future needs.

Though the primary purpose project was creating a collection of garments that could be classified as wearable art for an avant – garde consumer, the project also fulfilled the context of social design through the satisfaction of human needs. Right from the supplier to the consumer in the entire supply chain, the project was instrumental in improving the 'social quality'.

Ethical responsibilities are of paramount relevance to sustainable design practice which focussed on the experience of the design process rather than the final object. Taking this into account, it can be considered that the presented case study was well oriented around the fact. The developed designs contributed to a sustainable way by being responsible design and providing a platform for social cohesion. The overall experience of the project was far beyond the form and function of the product line. There exists an emotional bonding attached with the experience of this project which included the chain of events from contextualization, ideation, conceptualization, prototyping and after life or reuse. The participants of this creative chain were active contributors rather than passive recipients.

Conclusions

Sustainability also attempts to regeneration and renewal of the available resources for restoring our fractured and unequal societies. Designer potential to realize and bring together these societies to create peer groups and enhance bonding is relevant in creating awareness.

The designers need to evaluate and re-look at the available resource ad create efficient designs for the future generation. Sustainability in design now primarily must aim at affordability, practicality, functionality and utility. Designers can provide solutions to the problem – that sustainability must involve greater efficiency in the use of resources and greater equity in the distribution of economic benefits.

The essential features of sustainability can be described as:

1. Efficiency in the optimal use of scarce resources
2. Redefining inputs to the transformation process
3. Value addition through innovation or technology
4. Redefining outputs to include distribution effects to all stakeholders

Design activity becomes a major strategic tool for enhancing these features. The design project given here as a case provides relevant information to this regard. The two key pre-requisites of sustainability - efficiency and equity have been well utilised, in this case. Efficiency here is in the (re)use of environmental resources instead of efficiency in the use of financial resources. Equity, which requires as a minimum, satisfaction of all stakeholders, is visible here as well.

The ability to integrate sustainability in the design process requires the ability to envision how things are interconnected. This needs incorporating sustainability in the design curriculum at the beginning. The orientation of all design thinking has to be – optimal, effective and efficient use of resources and equitable distribution of the benefits (social, economic and emotional) to all stakeholders.

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the Learning Network on Sustainability

Teaching PSS in business practice

A win-win-win approach

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This paper presents our findings gained through the implementation of our renewed Product Service Systems (PSS) course in 2010. Based upon the outcomes of our recent PSS research projects in practice and evaluation of the earlier PSS courses a new setup was proposed. The main starting point for restructuring the course was the conclusion that co-operation and mutual understanding between "creative" designers and "commercial" entrepreneurs are important conditions for success of a new PSS. The course setup is based upon the structured step-by-step approach (www.d4s-sbs.org) in combination with an interactive character by which the students have frequent meetings with the company representatives who gave the assignments as well as with the involved PhD-candidates of the current research projects within the faculty. It was concluded that interaction of students with real life actors increases the feasibility of developed projects (benefit for the companies) and the engagement of students with the real life context (benefit for the students). In addition this new teaching approach delivered valuable research materials (benefit for the PhD-candidates).

Background

This paper presents our findings gained through the implementation of our renewed Product Service Systems (PSS) course at the Faculty of Industrial Design Engineering (IDE) at the Delft University of Technology in 2010. The course is oriented at the development of new product-service systems (PSS), as a next strategy for dematerialization. Dematerialization of products by relatively increasing the service part of PSS is considered to be an important element of a sustainable economic development, after the Ecodesign of -physical- products. By taking the immaterial part of product-systems and the optimization of the use of existing physical infrastructures as point of departures, industrial design engineers can create new artifacts that are fostering the adoption of these new, dematerialized product-service systems (Mont 2002; Tukker and Tischner 2006).

The PSS course is being taught for over 10 years at the faculty of Industrial Design Engineering. Each year the course is evaluated and adjusted to the current state of the art knowledge on PSS. Based upon the outcomes of the recent PSS research projects in practice and evaluation of the earlier PSS courses a new setup was proposed for the academic year of 2009-2010. The main starting point for restructuring the course was the conclusion that co-operation and mutual understanding between creative designers and commercial entrepreneurs are important conditions for success for a new PSS (Keskin, Brezet et al. 2009). Therefore, the new PSS course is oriented on knowledge transfer in the field of entrepreneurship and business development in relation to PSS-innovation. In addition it was decided to focus on generating innovative 'new businesses' and 'new ventures' particularly within small and medium sized firms. Young and small firms are responsible for a substantial part of the economy in Europe and the USA as well as are characterized by a more open attitude for radical sustainable innovation.

In addition, the interaction between students and PhD-researchers during the coursework could potentially create a win-win situation. PhD-researchers provide the students with more in-depth academic knowledge and research skills. In return the PhD candidates get worked out cases, which contribute to their thesis work. Working with 'real' entrepreneurs provides the students a good insight in the opportunities and barriers in practice as well as an understanding of the commercial considerations.

Based upon these inputs the setup and assignment were adjusted to bring the PSS one step further to developing it as a business reality. Not only developing new innovative and sustainable PSS concepts, but also to develop the PSS concepts to a level that they could be directly introduced commercially into the market.

Within the following paragraphs we will first introduce the outline of the new PSS course. Next the result of the evaluation of the course by the students and the entrepreneurs will be discussed. We will finalize this paper with a conclusion and recommendations for further improvement of the course.

Course outline

Course objectives

The goal of the revised PSS course was to bring together different perspectives on PSS as well as to combine theory (literature) and practice (working with companies). Based upon these principles the four key course objectives were defined (Keskin and Brezet 2010). From a theoretical point of view the PSS course should provide students with basic essential knowledge on the theory, concepts, approaches, methods and tools for the development of PSS. Practice wise the PSS course should provide students with insight in and understanding of the conditions, drivers and obstacles for PSS implementation in practice. Next to this the learning path should offer students the knowledge related to the development and assessment of business plans that support the successful introduction of new PSS via existing businesses or new ventures. Last but not least the course should offer the student the opportunity to develop his or her skills in understanding of and co-operation with business venture oriented specialists.

Course setup

The course setup is based upon the structured step-by-step approach (www.d4s-sbs.org) in combination with an interactive character by which the students have frequent meetings with the company representatives as well as with the involved PhD-candidates of the ongoing research projects at the Design for Sustainability program.

In total 55 students from four different master programs of Delft University of Technology participated in the PSS course: MSc. Integrated Product Design, MSc. Strategic Product Design, MSc. Design for Interaction and MSc. Industrial Ecology. At the beginning of the course teams of five students are being formed with a mixture of students from the four master programs. This way multidisciplinary teams were created with skills in strategy and business, creativity and product development, and sustainability.

The teams of students were matched from the beginning of the course with a company of one of our ongoing research projects of the Design for Sustainability (DfS) research program. At first instance all academic staff of DfS were approached to come up with suitable company cases. In a next stage the proposed cases were evaluated on their suitability to function as challenging assignment within the PSS course (for example if the company was open for more radical sustainable innovation approaches). This resulted in the following selected three research projects and accompanying companies:

- *Ecomind:* Energy Keeper, Qurrent, Sustainable Dance Club, Shifft, BioFutura
- *LivinGreen:* De Witte Roos
- *Cradle2Cradle Islands:* Vrachtfiets, Municipality of Texel

The main assignment for each team was to design a challenging, new and sustainable PSS, including a focus on needed radical novel products for these companies. To support the students in the PSS development process two methodologies were selected. The first one is the PSS module (Tischner, Ryan et al. 2009) of the UNEP Design for Sustainability Step-by-Step (D4S-SBS) manual (Crul, Diehl et al. 2009), which functioned as the core of the PSS development. The PSS module exists of three parts: 1) a theoretical introduction, 2) methods and tools, and 3) worksheets. The second methodology chosen was the Eco-

costs / Value Ratio method (Vogtlander and Hendriks 2004), which was applied to evaluate and strengthen the business aspects of the cases. Both approaches are available on the Internet: www.d4s-sbs.org and www.ecocostsvalue.com.

During 8 weeks the students were provided with 2 lectures per week to introduce them the PSS approaches, tools and examples from practice. Moreover, related to each lecture additional reading materials (i.e. journal and conference papers) as well as slides of the presentation were made available at Blackboard, the e-learning environment in use at Delft University of Technology. For additional lectures on PSS was referred to the Lens Web-Site (www.lens.polimi.it).

In the second week each team could select one of the company cases and start working on the assignments. Consequently the student teams went through the steps of the PSS module of the D4S-SBS manual. During this process the PhD-researchers and teaching staff of the DfS research program supported the teams. The staff stimulated the teams to formulate innovative but feasible assignments.

Throughout the course the student teams did have at least three times a face-to-face interaction with the companies. In the beginning a visit to the company took place for the briefing of the assignment and learning more about the competencies of companies and their vision on sustainability. Half way, the companies were involved in selecting the preferred PSS concept as well as to provide additional needed information. At the end the company representatives were involved in the evaluation of the outcomes. In between communications took place by e-mail or telephone. The student teams themselves were responsible for arranging the meetings and communications with the companies.

Assessment

At the end of the course the teams did have to present the developed PSS as well as the evaluation of it on the People, Planet, Profit and EVR criteria during a workshop with sustainability experts and representatives from the companies. During this workshop the companies provided direct feedback to the feasibility of the outcomes from business, technological and market perspectives.

In addition the course student teams presented their projects in the form of a “journal paper” consisting of an analysis of the assignment, company, the process of PSS development, and evaluation of the developed PSS as well as the course methods and tools. Furthermore, a detailed business plan was presented for each project.

Evaluation by students

During the course the students often provided feedback to the course staff with regard to the setup of the course. In addition an online questionnaire was prepared for the evaluation of the course at the end of the period.

Feedback by students

In general the students were very enthusiastic about the new course setup. Within a short period they were introduced to a new approach (theory) as well an opportunity to work with ‘real’ entrepreneurs (practice). With regards to these two components of the course they had the following opinions.

Theory

In general the students were satisfied with the step-by-step approach of PSS module of the D4S-SBS manual. Within earlier courses they were used to develop products or product-systems. This was the first time that they were confronted with the development of a more complex product service system. The structured step-by-step approach of the D4S-SBS manual guided them throughout the whole design process as well as evaluating the concepts from a sustainability perspective.

On the other hand, there were drawbacks of this structured approach. One of the critics of the students on the PSS module of the D4S-SBS manual is that it was not intuitive and creative. Within the approach many checklists and guidelines are being used which does not stimulate ‘out of the box’ thinking and creativity. Especially in STEP 2: PSS Idea Generation, the students expressed a need for more freedom

and flexibility as well as for brainstorming techniques within the framework of developing a PSS. Some stated that "it does not really stir creative brainstorming".

For students without an industrial design background (i.e. the industrial ecology students) the manual was difficult to understand. They would prefer to get additional training in product development and examples of end results in the beginning of the course or incorporated in the D4S-SBS manual. This would make it easier to understand especially for non-design students.

Practice

The students were excited to work with real companies on real problems. This approach made the course very much 'hands-on'. In their opinion working with entrepreneurs brought their PSS concept more close to reality. In addition, the collaboration gave them a glimpse of how start-ups operate (many IDE graduates do want to start up their own company). In general the communications and interactions with companies went very well and their briefings were clear. One of the advantages was that most of the participating companies were start-ups and as such existing a young and small staff. As a result they were easy to approach without many arrangements. The student stated that the entrepreneurs were open for discussion and open minded for more radical sustainability approaches. One of the disadvantages of working with start-ups was that some of the participating companies did not yet have a clear vision and as such it was difficult to decide on the proper direction for the PSS development. Furthermore, in one case confidentiality aspects were a barrier for getting more detailed information on the company and its specific know-how.

Students questionnaire

In addition to the feedback of the students during the course, an online questionnaire was prepared to get more detailed insight in the opinion of the student at the end of the course. In total 30 of the 55 students filled in the online questionnaire. The online questionnaire was created in 'Survey Monkey' and consisted of three sections: 1) setup of the course, 2) D4S-SBS PSS approach, and 3) open questions about what students most liked and disliked about the course. For the setup of the course and D4S-SBS PSS approach students were asked to indicate on a list of statements if they strongly disagreed, disagreed, neither disagreed or agreed, agreed or strongly agreed. Based upon the input a value (average rating) was calculated in between 0 (strongly disagree) and 5 (strongly agree). In addition the students could enter their comments freely for each section of the survey. The last part of the survey consisted of open questions of what students liked and disliked about the course.

Evaluation course setup and outcomes

The students could provide their opinion on 11 aspects of the course setup. The most relevant and interesting ones are presented in table 1.

Table 1: Student evaluation of course setup and outcomes

Statement	Strongly disagree	Dis-agree	Neither disagree or agree	Agree	Strongly agree	Rating average
The course was very inspiring and I would like to continue working in the field of sustainability.	0%	7%	30%	**37%**	26%	3,81
The course provided a new perspective on combining products and services for sustainability.	0%	0%	15%	**59%**	26%	4.11
Working with a company on a real assignment was very motivating.	4%	11%	7%	**52%**	26%	3.85
The company was very motivated to interact with us.	15%	11%	15%	26%	**34%**	3.44
The concept we developed was very useful for the company.	4%	15%	26%	**29%**	26%	3.59
The company is planning to implement (part of) the concept.	4%	4%	**37%**	26%	29%	3.74
The evaluation of our PSS proved to be very sustainable.	0%	19%	26%	**48%**	7%	3.44

The results show that in general the students were satisfied with the course setup, in particular working with a real company in a real life context. Although some students expressed a difficulty in organizing meetings with company representatives, they in general stated that the companies gave interesting and challenging assignments and were open for new sustainable solutions. One challenge express by the students was the difficulty in finding the balance between course objectives and company goals. The focus of the course is on sustainability and new combination of products and services with a lower environmental impact. This sometimes conflicted with company goals, which in some cases was more focused on developing products without a service component. This insight proved that for the next versions of the course, a briefing of the PSS concepts to the participating companies would be very useful in helping students creating the balance between course objectives and company goals.

Evaluation D4S-SBS PSS approach

Subsequently, the students were asked their opinion on the D4S-SBS approach. First they were confronted with two question related to the total approach and next about each step of the approach specifically (see table 2)

Table 2: Student evaluation of UNEP D4S-SBS PSS approach

Statement	Strongly disagree	Dis-agree	Neither disagree or agree	Agree	Strongly agree	Rating average
To what extent gives the UNEP manual adequate information on Product-Service Systems?	0%	0%	**52%**	37%	11%	3.59
To what extend are the tools proposed in UNEP manual helpful in designing the PSS concept?	0%	15%	**52%**	30%	4%	3.22
STEP 1: Exploring opportunities was very useful in analyzing the existing reference system.	0%	0%	15%	**74%**	11%	3.96
STEP 2: PSS Idea Generation asked inspiring questions and helped us to think different aspects of sustainability.	7%	11%	**44%**	30%	7%	3.22
STEP 3: PSS Design helped us to prioritize certain aspects of sustainability that we wanted to focus on for our PSS concept.	7%	11%	**44%**	27%	7%	3.19
STEP 4: Evaluation of Detailed PSS was useful in evaluating our PSS concept.	11%	22%	**33%**	**33%**	0%	2.89
STEP 5: Planning PSS implementation was very useful in evaluating the feasibility of our PSS concept.	7%	15%	26%	**48%**	4%	3.00

The UNEP D4S-SBS manual was in general found to be clear and informative. Especially students find “STEP 1: Exploring opportunities” very useful in analyzing the existing references system, although in some assignments there was no existing reference system in which the students could search for opportunities. In such cases, they were advised to analyze the existing alternative systems, explore opportunities for improvement and learn lessons for the new PSS in development. For the steps related to design of the PSS, student stated that the amount of checklists decreased the time, freedom and creativity that could be devoted to idea generation and concept development. Some remarks were:

> “The PSS methodology is too complex and strict with a lot of checklists. For example, STEP 2 is too rigid not intuitive. Everything is fixed, no space for brainstorming.”

> “These tools were too generic to relate to the details of a specific concept. Also, the questions used to evaluate concepts were extremely redundant and often confusing.”

The steps related to the evaluation and implementation of PSS were found to be average. One challenge stated was related to the parameters, which are found to be too general. One student stated:

> "For the radar, we understood that it is important to consider 3Ps all together and I think it is pretty challenging and require a very broad view. Having all of requirements and checklists did not help us to find a truthful answer. There were too many questions that almost impossible to answer."

Like and dislike

The students were satisfied with the *course topic*: designing a system of product and services with a lower environmental impact. They stated that this new look on designing products in combination of services is very inspiring and give some new insights on new system development and links with sustainability. Then, students were in general very satisfied with *working with a real company*. Some stated that this setup created a strong link between sustainability and feasibility of the concepts, which asks for translating of visions and ideals into more marketing/ economic oriented language. Another aspect students find inspiring was the *lectures*. In addition to the lectures related to theory, the course involved many guest lecturers with different backgrounds from academia and industry. Especially some lectures given by the entrepreneurs themselves was found to be very inspiring case studies for especially those students who aims at developing their own companies.

The students expressed their dislikes mainly related to the worksheets, weekly assignments, and the balance between course objectives and company goals. According to the students the worksheets were not always clear, time consuming and sometimes repetitive. The students were requested to finish every week one step of the approach and to communicate it with their supervisors. This way the time pressure was high and to less flexibility was offered for the students to manage the process themselves. Besides the positive aspects of working with real companies, also small problems were mentioned. One of the students mentioned: "Managing the expectations of both our client (practice) and our coach (academic) was sometimes difficult and frustrating".

Benefits for the companies

All participating companies were invited to join a workshop at the end of the course. The first goal of this workshop was to present the students' work (PSS concept and the accompanying business plan and evaluation) to the participating companies. Company representatives provided direct feedback to the students. The second goal was to reflect and discuss with the entrepreneurs their experience an opinion with participating within the PSS course, the process, outcomes and potential follow-up.

Figure 1: Presentation by student teams for companies and sustainability experts

The main reactions of the companies are stated below. At the time of their reflection the companies had attended the five minutes presentations of each group. The final paper and business plan was still to be delivered afterwards.

The majority of companies found it very interesting to give assignments to young creative design students, which enabled them to get insights into new product-service ideas as well as new approaches like PSS. Companies also stated that coming together with other companies in a workshop enabled them to *learn from each other* and how others deal with complex issues like sustainability. Most of the new PSS

ideas were useful for the participating companies or at least provoked thinking about new business opportunities.

Products in combination with services were a very useful idea for some companies, and not for others due to the differences in business focus. In addition, it was concluded that a PSS approach might not be the most suitable approach for small entrepreneurial companies since it requires the involvement of various stakeholders, which requires considerable amount of time and effort. The size and low power of these companies in the value chain might hinder this process.

Since one of the requirements of PSS is the involvement of a broad range of stakeholders, and this requirement was present in many of the student projects, some companies questioned the *interest of other actors*, which were proposed by students to be involved in the PSS concepts.

For the companies the outcomes related to the target market, potential benefits and the business plan were the most important. They were asking the student teams additional information on willingness of potential customers to use the proposed PSS concepts, initial investments, specific characteristics of the customers, activities of competitors etc. They were less interested in translating the PSS scenarios into visuals. One company for example suggested that the students could focus more on detailed results than on fancy movies and nice looking storyboards.

Conclusions

The new setup of the PSS course proved to be a win-win-win situation for all involved stakeholders. It was concluded that interaction of students with real life actors increases the feasibility of developed projects (benefit for the companies) and the engagement of students with the real life context (benefit for the students). In addition this new teaching approach delivered valuable research materials (benefit for the PhD-candidates) and the entrepreneurs were provided new PSS concept ideas and accompanying business plans as well as a for the new insight in and understanding of the PSS concept (benefit for the companies).

The course also led to a range of learning experiences for the teaching staff and recommendations for improvement. With regard to the applied D4S-SBS PSS approach, it came to the front that according to the students that the current approach is to rigid and in some cases redundant. Another challenge will be to find a good balance between the expectations of the entrepreneurs (detailed business related aspects) and the ones of the academic supervisors (structured approach, evaluation on sustainability aspects and visualisation and communication of results). These and other recommendations will be incorporated into the next PSS course in 2011.

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the Learning Network on Sustainability

Sustainable social design

Essential principles for design educators

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Our world is changing rapidly. Notwithstanding the prospect of irrevocable climate change that could have disastrous consequences for our planet we are amidst an unprecedented financial crisis that will have an impact on our products, systems, infrastructures and society for generations. These epochal challenges must be faced head on. Designers and design education have the opportunity to be the catalyst for sustainable social change, using innovation, participatory design tools and creative processes to provide solutions to over consumption, climate change and dysfunctional systems and spaces. The curriculum in design education at higher and secondary levels must adapt rapidly to reflect societal attitudes to ensure that tomorrow's generation of creative designers have the skills, personal attributes moral and ethical codes to ensure we do not compromise the needs and quality of life of future generations.

Introduction

We could blame our innate ability to innovate or our desire to improve the quality of life through social and economic progress; or blame the engineers of the Industrial Revolution whose innovations eventually enabled post war over-capacity and mass consumption as being a way of life. Today, consumption has become a means to an end to satisfy our hunger for material ownership; where excessive wealth and brand loyalty have surpassed more basis human hierarchical instincts in a misguided belief that conspicuous consumption will make us happy and fulfilled.

Will tomorrow's consumers reject mass consumerism in the same way the Luddites rejected the new technologies and mechanization of the early nineteenth century? Is the time right to return to an era akin to the Arts and Craft movement where communities aspire to participate in the development of new business products, processes and systems with authentic values that sustain economic and social welfare?

Already we can site many examples of sustainable product, system and social development whose designs embody low tech functionality using locally sourced materials or the work of social entrepreneurs whose creativity is having an impact on local communities and disadvantaged groups. Can consumer power create a shift from mass consumption to the design of social systems that improve the quality of life and the well being of communities or will government legislation be needed to instruct consumers and dominate consumer behaviour? Can developed nations follow the example of the small Asian kingdom of Bhutan that measures its country's success not in gross domestic product (GDP) but in gross domestic happiness (GDH), where personal development goals, self-reliance, sustainability, efficiency and 'people's participation' are more important than product ownership and personal status?

Context

This paper outlines essential principles for design and sustainability education and questions the moral and ethical fabric of current design processes. Based on a review of literature this paper analyses the chal-

lenges faced by society and highlights the need for innovative design practice and thinking and a rapid shift towards social design tools. This will require adopting sustainable social innovation methodologies and radical changes in the role the designer plays in generating new solutions and approaches to difficult social problems. Design education must address the issues relating to social responsibility (Whiteley, 1993). For the purpose of this paper, addressing social, environmental, economic and political issues is defined as 'socially responsible design' (SRD). Community led SRD broadens the scope of design advantage purely for financial benefit and refocuses the benefits on ethical, emotional and humanitarian values (Davey et al, 2002). This paper will review the latest social design tools and sustainable business principles and aim to determine what factors will play a part in the future of design education.

Scope for change

We are living in a post consumerist society and our design education systems must embrace the challenges that the new operating environment presents. The UK is faced with an unprecedented budget deficit that will impact everyone. The status quo is not an option. Anti-consumption is being supported by advocates of the triple bottom line whereby benefits in social economic and environmental attributes are put ahead of stakeholder profitability. Sustainability must be measured using criteria that can assess our quality of life, infrastructure and security rather than on the potential of individuals and businesses to generate profit alone. Sustainable design is about social progress: design that meets the needs of and provides economic and environmental security for everyone. Societies can become more sustainable when environmental, social and economic needs are balanced; when the communities we live in our safe and desirable; when are communities are in harmony and the value added benefits are shared by all stakeholders. Good design is about social justice.

Today though, most developed societies use gross domestic profit (GDP) as the standard benchmark for policy makers for measuring overall economic output of a country in financial terms. But GDP does not reflect the levels of national satisfaction with its products, services or systems. GDP's main criticism is that it doesn't measure environmental sustainability or social well being. There are already alternatives to this system: the gross national happiness indicator is a measure of a nation's well-being and has been the subject of an annual European Commission initiative since 2007 after it hosted the Beyond GDP conference supported by the European Parliament, Club of Rome, Organisation for Economic Co-operation and Development (OECD) and the World Wildlife Fund (WWF).

Partnerships

In this new world, design will have a key role to play – not just in designing new products but in community engagement, looking local not global and adopting an altruistic approach rather than one simply of short term greed and profitability. Design educators must apply design methodologies to address the key social issues affecting society today. Priority should not be given to designing the next product but on solving local and global issues such as health, ageing, exclusion, social responsibility, wealth creation, community regeneration and urbanisation. Designers must also embrace a new breed of stakeholder – people without design education that want to design, influence and make change happen (Sanders, 2006).

Alternative criteria of measurement could be used to determine new principles for sustainable design and how best the fundamentals of the triple bottom line can be harnessed by designers to reshape our products, services and communities to improve our well being and quality of life to ensure that our communities are fit for the future. It is time that the emphasis is placed on the social benefits of design activity rather than on the physicality of products and often fallible justifications for further dependency on our planets finite resources. Sustainable design education has emphasised sustainable production and consumption, improving the environmental performance or impact on the planet of the products and services we consume. Rarely is the emphasis placed on sustainable well being and the scope of the designers brief expanded to consider social well being.

Time for design education to embrace social enterprise

In traditional product design teaching methods rarely site philanthropic designers and or engineers for their innovations. Our education programmes from secondary through to higher education often site modern day successful designers as those that have global recognition such as James Dyson, Phillipe Starck or Jonathan Ive. Yet there are other designers that rarely get the recognition they deserve - silent design hero's not motivated by the commercialisation of their ideas but on sharing the innovation for the benefit of society. In 1955 businessman Malcolm McLean and engineer Keith Tantlinger created a simple and unique steel container (Figure 1) that could be loaded and locked onto ships.

The social aspect of the innovation was that McLean gifted the patent to the industry enabling the international standardisation of the container. The modern container had worldwide impact - an omnipresent example of a product that has changed the distribution, value and volume of goods sold around the world today - a design that has had an effect on everything we use, buy and wear. The world would have been so different had Mclean decided to patent his innovation. Other examples of such conspicuous philanthropy in the field of product design are sadly, rare.

Figure 1: McLean's standard international container

Image source: www.FreeFoto.com

Socially responsible design

Socially responsible design (SRD) is one of the fastest growing areas of our economy and during unprecedented economic times designers must turn their creative skills to helping communities work in partnership for the benefit of all stakeholders. Despite this trend there are no courses available in the UK that blend the attributes of designers with the competencies required for developing social enterprises.

Social entrepreneurs are proven leaders whose approaches and solutions to social problems are helping to better the lives and circumstances of countless underserved or disadvantaged individuals. Design education has yet to adapt to the delivery of social models of the design process yet we face a unique opportunity to combine research, education, innovation and business methods in the generation of sustainable, social, environmental and economic capital at local and regional levels. Most design schools have a dominant culture that encourages conspicuous consumption, ignoring the broader issues of social, environmental and economic impact. Societal issues are becoming more pressing for the world and for design graduates as global citizens working at local levels.

There are many documented examples of social entrepreneurs operating in ingenious ways. Some obvious examples include Richard Branson and Anita Roddick and some less conspicuous but having a greater impact on communities such a Mohammed Yunus and the Grameen Bank; John Muir, naturalist and conservationist who established the National Park System in the United States or Ashoka the global association of the world's leading social entrepreneurs - ordinary people with system changing solutions for the world's most urgent social problems. Since 1981, Ashoka have elected over 2,000 leading social entrepreneurs as Ashoka Fellows, providing them with professional support, and access to a global network of peers in more than 60 countries.

Local challenges

Most communities can identify social, systems and structural shortcomings that affect the quality of their lives. These people are classified as the base of the pyramid (Elkington and Hartington). Designer and educators are able to help every level of our society by inviting participation with community stakeholders in creating better environments and regenerating deprived areas (Davey et al, 2003). Projects that address crime, health, social exclusion, consumerism, ageing, space planning, climate and environmental issues should become mainstream design challenges.

It is widely accepted that we have no more than 10 years to turn around our unsustainable ways of living. In this state of emergency designers have opportunities to play a part in creating positive solutions that improve the quality of life and well being of our communities. The days of designing physical products that rapidly become obsolete such as cameras, phones and MP3 players are behind us. Our landfills are full and resources are becoming depleted. Yet as we stand on the edge of the precipice, designers and design educators have opportunities too. Designers are uniquely placed to rethink and remake the products, services and systems that shape our spaces, communities, and address the social issues that affect the quality of life.

Britain is already preparing itself for radical changes to how design and regeneration projects are funded and how methods of effective collaboration at community level will be encouraged. Government initiatives such as the Big Society Bank will would use money from dormant bank accounts and elsewhere to access the funding which is so often the barrier to project implementation and become a key provider of finance to social investors.

Core competencies for sustainable social entrepreneurs

With such dramatic economic and environmental challenges and opportunities ahead of us, final year students of the Product Design undergraduate programme participated in a social enterprise project as part of an assessed module of Business Management. Business acumen has long been one of industry's key competencies that they seek in graduates and principle objectives of the module are to provide students with an understanding of the social, legal and economic constraints that affect the operation and management of an enterprise; to analyse the legal, economic and social factors which affect the start up and management of a commercial enterprise and to apply to the appropriate sources for financial support to establish a new enterprise.

The aim of the design brief was to employ social design tools and partner disadvantaged or vulnerable local communities to identify the social issues that affect them and use the creative design process to determine viable, sustainable social solutions in the form of products, businesses, processes, spaces or systems. As part of the creative process students were asked engage with experts, individuals, groups and other stakeholders and look broadly at the effect on the local economy, social and environmental aspects and accelerate societal change. Evaluation of their product, business and process proposals were made against the following criteria:

- ENHANCE: How does the proposal add value?
- REPLACE: what does it make less desirable?
- REVIVE: What does it bring back that was obsolete or discarded?
- BACKLASH: What could be the negative impact?

Figure 2: Student and community-led enterprise project

During the project the students expressed the predictable attributes of young designers when applying research, design and development tools to a problem. Many examples of community-led initiatives were developed including suggestions for efficient transport systems, regeneration of urban spaces, reclamation of disused buildings for community use and the retention of urban artefacts that could have been lost following land reclamation.

The following table highlights these attributes as well as an additional series of socially responsible attributes (SRD) and competencies that were unique to this social enterprise project brief.

Table 1: Additional student attributes required for SRD

Creative Attributes	SRD Attributes
• Enquiry and curiosity • Creativity and innovative • Technical and communication skills • Team working and leadership • Marketing skills • Research methods • Professionalism • Optimistic and confident • Motivation, ambitious and resourceful • Relentless tenacity • Organizational skills • Interdisciplinary	• Motivated by adding social value • High moral and ethical codes • Collaborative partnerships • Rule breaking • Opportunistic and philanthropic • Private sector funding resources • Entrepreneurial • Strategic • Pragmatic • Altruistic • Cause-led change seekers • Anti-established structures, • Questioning and visionary

These additional competencies reflect the multi-disciplinary nature of the skills required by graduating students to contribute effectively to the sustainable and social design agendas and to move the goalposts for mainstream design courses from one of products, packaging and processes to one of services, systems and society.

Driving change: policies and legislation

Governments around the world have been responding to changes in our environment, climate and society with a plethora of policies, guidelines and legislation. Design must respond swiftly to these directives and ensure that material used to educate modern design graduates provides them with the skills, knowledge and core competencies to meet these challenges. ‘Deep and serious reform’ (Cameron 2009) of public services will be met by new social enterprises.

The UK Government published a white paper 'Securing the Future' (2005) outlined its strategy for Sustainable Development. 'Sustainable development' is defined as a goal to 'enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life, without compromising the quality of life for future generations'. Wales has published a number of policies to support sustainable social enterprises including:

- Welsh Assembly Government (2003) Wales A Better Country: The Strategic Agenda of the Welsh Assembly Government.
- Welsh Assembly Government (2005) Wales A Vibrant Economy.
- Welsh Assembly Government (2004) Youth Enterprise and Entrepreneurship Strategy
- Social Enterprise Action Plan 2009, National Assembly Government for Wales.

Communicating social values in sustainable design education

If design is to become truly sustainable in every sense of the word, tomorrow's designers must understand their commitment to and definition of socially responsible design and entrepreneurship. There are three terms that must be clearly understood:

- Social Innovation: the exploitation of creative ideas to the benefit of stakeholders.
- Social Design: maximising social and environmental benefits rather than just financial.
- Social Enterprise: often 'not for profit' but usually 'more than profit' ventures.

(Gregory-Dees 2001) summarised the activities of the social entrepreneur as someone who is innovative, opportunity orientated, resourceful, value adding change agent. Social entrepreneurs differ to enterprising entrepreneurs in that a social entrepreneur will focus on adding social value. More simply, it is a measurement of sustainable social improvements in people's lives and not merely in the level of financial profit.

Design education has always played a role in generating economic activity at local and national levels. Embracing this new dynamic will require design educators to engage with policy makers to collaborate in meeting targets for community and manufacturing regeneration, resource efficiencies, and employment and economic activity. It is time for action: to educate the next generation to embed social and sustainable responsible attitudes; to employ design process methodologies to create effective solutions that engage with and work alongside local communities in developing new systems, services and products that improve the quality of life and well being for its residents. Design educators can employ the fundamentals of design methodologies to build creative capacity at local levels - to help up skill residents to identify social enterprises, business models, financing systems and improve business skills and employability.

The traditional model of the engineering design process as proposed by (Pugh, 1996) whilst appropriate for its time, placed emphasis on the physical attributes of products or processes and not the societal and intangible benefits that new products, systems and processes could offer communities at local or national levels. Whilst the basis of Pugh's process remains valid, students should no longer prioritise the design of physical artefacts but on the improvement of systems, services and communities. Evidence of this gap in focus is highlighted in the Design Council's comprehensive study of the UK design industry (Design Council, 2010) which illustrates that less than 1% of the design industry in Britain focuses on service design. A search of titles of undergraduate university courses starting 2009 will not reveal one programme where design and social innovation appear in the title. (Jones, 2000) highlights a number of new trends that are emerging in today's economy that must be adopted by design educators so designers can understand the drivers of the social enterprise business model. These drivers include:

- A search for innovative solutions that lead to sustainable improvements
- An increased openness to experimentation with market-based approaches and business methods in the social sector
- Heightened concerns about the effectiveness of traditional governmental and charitable approaches to meeting social needs
- A growing shift to the privatisation of public services leading to government contracting with both for-profit and non-profit businesses

There are dramatic changes in the macro environment and business models brought on by the epochal challenges brought about by the current recession. New opportunities are presenting themselves for stu-

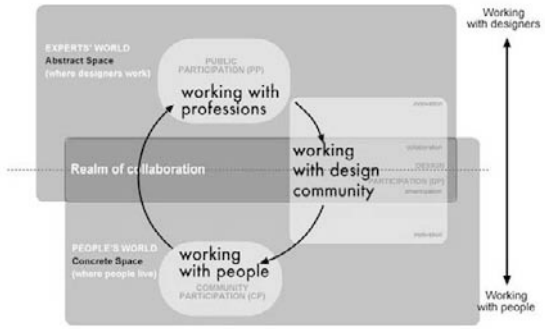
dents from the creative and business sectors to up-skill and meet these challenges. Service design, communications design, space planning, new products, systems and process will be designed to meet urban and community problems.

Socially responsible design methods should be applied to design projects in neighbourhood regeneration or retrofit programmes, adopting participatory design tools and engaging with the design community to look at improvements in products, systems and services in areas such as housing, communications, energy efficiency, climate change, economic activity, security, poverty, crime, health, community interaction and well being. This is participatory design at its best, a new era for the design and a re-evaluation of the designer's role in today's socially challenging circumstances. In 1971, Victor Papanek was one of many socially responsible designers to highlight the need to engage with communities who were better placed to solve local problems and mobilise communities to play an active role in the design process. In support of Papanek's position, (Moir, 2001) predicted that an emphasis on sustainable social inclusion would become the predominant sector in society. Latterly, (de Certeau, 1984) identified operational spaces and modes of participation that enabled efficient user participation towards design solutions.

Box 1: Design participation typology and tactics diagram

Source: de Certeau

> The DP analytical tool encourages a tactical way of designing that leads towards design user participation process as well as creative design solutions. There are three levels of identified tactics, which cross different spaces with different stakeholders and situations



Existing partnerships often lack the vision, organisation and creative processes to deliver appropriate, meaningful and effective change. In line with recent government policy, designers can be the driving force that will ensure the engagement of local communities in delivering community improvement programmes. Design educators could take a lead, providing creative processes, design resources and a commitment to engage with local communities and provide the impetus for innovative regeneration projects for new products, processes, systems and spaces to enable communities to achieve economic independence.

New government-led business models for out-sourced delivery of public services and processes are emerging that ensure engagement from a variety of stakeholders including local communities, action groups, local authorities and government, social enterprises, housing associations, private equity and funding providers. Universities can adopt these models and work in partnership with local communities enabling students to identify local needs and prepare product, system and service solutions that can become sustainable social enterprises that generate income. These in turn can use the profits to support other community based initiatives that do not have any opportunity to generate direct revenue themselves. This socially inclusive approach must be a design principle that is given greater prominence in the sustainable and social design curriculum.

Conclusion

Design educators need to prepare future design students with the competencies to address issues beyond traditional eco-design process and life-cycle models. As we face irreversible changes in our climate, environment and society, the emphasis of design tools and methodologies must break free of the institutionalised status quo. Models for product, plastics and process design must give way to policies and planning

for individuals and communities to experience better lives. New emphasis must be placed on finding creative solutions to social problems.

To some educators this is provocative language and will require a seismic shift in the creative and educational mindset. Collaborations between students, educators, communities and other stakeholders to form multi-disciplinary partnerships to tackle issues including our environment, transport and energy infrastructures, services, public spaces, crime and well being must be at the forefront of our sustainable design agenda so we can imagine and create a vision for our world in which we want to live. Design as an industry faces crisis as well as opportunities. Sustainable design *is* socially responsible design.

Moving forward, the authors realise that there are many individuals and groups in our local communities that are attempting to make change happen. Community needs have already been identified yet these entrepreneurs are facing many barriers and this is the point where design education can step in to develop initiatives using the creative methodologies and tools to identify solutions, benefits and funding opportunities.

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the Learning Network on Sustainability

A new beginning for teaching Design for Sustainability

Soumitri Varadarajan
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The project of design's engagement with sustainability over the past two decades has been fraught; one, the discourse has been about consumption and western lifestyles, and two, the construction of the practice of sustainability has been reactive. For a long time design positioned itself as a profession that would react to design briefs set by a client and this directly created a format for design for sustainability as an activity of re-design. When engineering adapted methodologies of manufacturing practice, such as TQM and value engineering, to include issues of pollution they created new specializations of engineering that could handle incremental transformation of product manufacturing towards more environmentally appropriate practice. The fact that big industry would not be needing designers to work of the eco-redesign of their products did not dawn on the profession of design and even less on design academies. This fact of being repeatedly rendered irrelevant in the discourse of sustainability is the essential character of design's engagement with sustainability over the past two decades. However this fact is not acknowledged and quite effectively hidden as the profusion of published outcomes allows design to talk within its community of practitioners without needing to seek acknowledgement from the wider world. As a marginal discourse sustainability is high profile and very visible in exhibitions, websites and books. Queried as a valid practice with examples of best practice design has little to show. I propose to create a still point where we can pause and ask if the new fascination with service design and social innovation is valid in its claim to be the new face of design for sustainability. I propose that it is not though it does expose a fundamental flaw in the way the practice of design was constructed in the last century. I then go on to show that the emerging trends point to interesting possibilities of reinventing the practice and for the complete transformation of the way we look at studio practice in design education.

Background

Edwin Conan, a student at RMIT Industrial Design in 2009, designed this car for his 4th year Project. Late that year images of the design went viral on the internet. RMIT marketing opened a special file cataloguing instances of its occurrence in print publication in Australia. The images of this project are still going around. The latest is that the design is now featured as a wall-paper.

While this project may well have been the outcome of a car styling studio it in reality was not. Edwin was one of four students who had come into a year-long fourth studio titled 'car of the future'. In 2009 January they were fed with speeches of Barack Obama, the president of the united states of America, and asked to speculate upon what cars would be like if the stranglehold of the car companies was removed (2009). While this was the context of the student projects, in the background was a larger project, an engagement with the transportation research and manufacture sector in Australia. The academic staff had constructed a larger project which would provide a laboratory for students to come into for studios and to do projects of their individual idealistic explorations within the paradigm of student culture that is training itself for work and employment in contemporary Australia (and potentially overseas). The staff re-

search is a sustainability project which has been set up as a platform for dialogue and engagement with a wide cross section of stakeholders in the transportation sector in Australia. Now both the existence of student designs and the research network owe their existence to a particular set of circumstances that are in some respects unique to the Australian Industrial Design condition and the project of engaging with design orientated sustainability discourses that are relevant to industry.

RMIT has been recognized for some time as a significant location for ecodesign discourse in Australia. This is in a large measure due to the work of the Centre for Design, which under the leadership of Chris Ryan in the latter half of the 1990s saw itself as a "catalyst(s) for change, a way of shifting the terrain of competition for new product development"(Ryan, 2003, 10-12). The Centre pushed EcoRedesign, both through the widely distributed video and through courses and training programs, as a definite process that designers could undertake in redesigning products to make them more eco-friendly. Yet today a decade or more later there is very little evidence of ecodesign education within the design schools in Australia (Ramirez, 2006).

With hindsight we see that while EcoRedesign, with Government funding, was being developed as a future way of design practice on another side Australia's manufacturing base was shrinking. Potential opportunities to practice eco-redesign in a mass-manufacturing contexts were being extinguished. With the very subject of design for manufacture getting gradually marginalized design began to privilege a discourse of making one off artifacts. EcoRedesign in the way it was proposed sat poorly with one-off manufacture. While this was happening in Australia elsewhere in countries such as Japan ecodesign became a subject within mechanical engineering as a specialization and big industry began to build ecoredesign as a component of best practices.

I therefore summarize this background as a proposition that the project of design's engagement with sustainability over the past two decades has been fraught; one, the discourse has been about consumption and western lifestyles, and two, the construction of the practice of sustainability has been reactive. For a long time design positioned itself as a profession that would react to design briefs set by a client and this directly created a format for design for sustainability as an activity of redesign. When engineering adapted methodologies of manufacturing practice, such as Total Quality Management and value engineering, to include issues of pollution they created new specializations of engineering that could handle incremental transformation of product manufacturing towards more environmentally appropriate practice. The fact that big industry would not be needing designers to work of the eco-redesign of their products did not dawn on the profession of design and even less on design academies. This fact of being repeatedly rendered irrelevant in the discourse of sustainability is the essential character of design's engagement with sustainability over the past two decades. However this fact is not acknowledged and quite effectively hidden as the profusion of published outcomes allows design to talk within its community of practitioners without needing to seek acknowledgement from the wider world. As a marginal discourse sustainability is high profile and very visible in exhibitions, websites and books. Queried as a valid practice with examples of best practice design has little to show.

While eco-redesign is no more, a larger take on sustainability is a strong suit of RMIT Industrial Design. A walk through the end of semester exhibitions in the Industrial Design department will show many examples of sustainability projects looking at issues such as mobility, leisure and work. Many of the projects have external partners and are collaborative projects that produce visions, artifacts and drawings. EcoRedesign is absent and so is any other take on a technical and material approach to sustainability. What is more visible is a social science and political take on sustainability as a way of thinking for social and societal change. Often such projects look like system design projects of old and others like design for development projects focusing upon an altruistic agenda. These are projects on service design and social innovation. The risk in such projects is that the environmental agenda is diluted and the promise of pure contribution to climate change is not met. These are fairly complex projects with really inspiring outcomes but it is their very complexity that keeps environmental thinking out.

This then is the still point where we can pause and ask if the new fascination with service design and social innovation is valid in its claim to be the new face of design for sustainability. For it is clear that a manufacturing base in reaction to which eco-redesign was constructed cannot be taken for granted. New forms of design practice have emerged and while old forms continue they are significantly diminished or transformed. Sustainability method and theory construction thus has new challenges and chief among those challenges is the apprehension of what constitutes contemporary design practice in locales like Melbourne. Then will come the task of abstracting a discourse that sets an environmental agenda.

Post-Professional Design Studio Practice

Design education the world over is characterized by a reliance upon projects as the main medium of education. Additionally a significant number of design schools bring in practitioners in the field to run these projects. From the perspective of theory this kind of education is referred to as being practice orientated and the mode of delivery is referred to as being studio based. RMIT Industrial Design too practices a form of studio based practice orientated design education. Which means designers based in Melbourne come in to teach courses as a part time activity. These designers are sometimes from small design consultancies and more often they are individual designers who either freelance or have a small design orientated enterprise. More and more designers from consultancy practices in product design are hard to come by and bring on board to teach part time in studio courses. This culture of circulating part time and sometimes itinerant teachers makes the curriculum on the ground very porous, freely allowing outside agendas to come into the program to influence the curricular content, and immediately reflective of the real world of design practice in Melbourne.

Now Design practice in Melbourne is potentially in a post professional era. There are two meanings of the term Post-Professional that are of significance here. One refers to a course that is taken by mature practitioners of a craft such as Architecture after working for a few years. The term post-professional here is an appellation used by many to denote 'after practicing as a professional for a bit'. Another meaning that is of real interest is the way Atkinson (2010, 137-155) and Stairs (2008) use it – to refer to new practices that have emerged from the ashes of a particular kind of design practice that was quite canonical and prescriptive. The professional was one who practiced a shared method of work, belonged to a guild and advanced that particular grouping of practitioners. This meaning refers to Industrial Designers and organizations that protected their sector and developed it as a specific construct of work. Ecodesign fitted within this structured universe by proposing a structured way of achieving incremental improvements to industrial products. Now post professional within this construct is a period where design is an activity not necessarily done by designers. In artefact creation, in the examples cited by Atkinson, this refers to the ability of anyone, not just trained designers, to make things using software and rapid prototyping apparatus. So the post-professional era killed of ecodesign!

However to develop a take on future sustainability practices in design we need a larger frame of reckoning, one in which key emerging forms of contemporary design practice are included. For the moment I see the design scene in Melbourne as revealing a frame that is constituted of four key trajectories: one, is the emergence of the new craftsperson which I label as *Industries of One*, two the resurgence of idealism which I label as *Hypersocial Activism*, three an interest in practice locales overseas which I label *Public Altruism* and four practices of futuristic thinking which I label *Heterocosmicas*. While design for mass manufacture is noticeable absent, the four categories amplify key aspects of the practice of design in Melbourne.

Industries of One

Outside the cafeteria in the city campus of RMIT one can often find a small stall manned by students, selling jewellery. What they are selling is laser cut brooches made in the student workshop laser cutter probably after midnight when the machine was less used. This is the unorganized face of a really large movement in the design community – where laser cutters, CNC machines and 3 D printers are routinely used to produce objects to be sold directly by the designer. I use the phrase *Industry of One* to describe this movement of self-manufacture that many designers have taken to (Campbell, 2006-2007). In the future there will be continuing focus upon self-manufacture in the urban and developed country contexts. The lack of access to manufacturing, and so stable jobs in large organizations, will define the nature of artefact practice, which will be a new kind of localization, and we are looking at a design practitioner who is the new artist-craftsperson. While in time more avenues for practice and new modes of income and survival in this sector will open up existing technologies such as 3D printing, laser, and micro manufacturing will become more common.

Hypersocial Activism

Writing about ICSID 2009 Bruce Nussbaum (2009) speaks of a western versus Asian design standoff in one session where the western designer dominated podium speaks for a post-consumerist practice of re-

sponsible design and the voice from the audience asks if it is wrong to design objects for wealthy classes in Asia. This dichotomy exists, but on the internet it is another story where a third dimension has emerged and this one is location, profession and age independent. The *like* button in Facebook gives instant access and linkages to social formations of many different ideologies. In design the term social has come to denote a particular specialization where design is more people centric. Separated from the world of manufacture and commerce this specialization has been fuelled by a greater licence to campaign views and opinions through social media, text-blogging, and self propagation. The area of online activism is a dynamic and exciting one, and when referred to as the Hypersocial it carries with it a resonance similar to Gossieaux and Moran's (2010) exhortations to business to use social media for economic purposes. Online activism is a growing field that includes many forms of political, environmental and social activism that takes place via the world wide web. This trajectory speaks in terms of social change through work in sustainability, service design, and social innovation. What is often mystifying to me is the way this economy is constructed and in local clusters in Melbourne I realize it is often not about money at all.

Public Altruism

The Cooper-Hewitt Museum Exhibition and subsequent book titled *Design for the other 90%* (Cynthia, 2007) sent the message of designing for the less privileged far and wide. Coming almost half a century after Papanek 's *Design for the Real World* (1985) the exhibition exposed a movement, underway in design schools and communities, that focused upon giving back to the world or upon working for the less fortunate. Exhibitions and websites are the public face of what may be fairly ineffectual interventions on the ground – but their effectiveness is not in contention usually. What is significant here is the availability of grants and public funds for projects that have first got to spend time and energy publicizing the projects locally, and often a much reduced fund is available for actually doing the project on the ground. This is Public Altruism where the focus is upon locations overseas. The focus upon "peripheries" is seen to contribute value to society and manifest ethical projects. For a design economy struggling for projects the route of grants and the availability of funds to high profile projects is welcome relief.

Heterocosmicas

A regular feature of most academic design projects these days are depictions of altered contexts and possible worlds. Often labelled scenarios these possible worlds bear a strong resemblance to current reality altered by an overlay of ethical or responsible behaviour. I borrow Dolezel 's notion of *Heterocosmica* (1998) to describe this trajectory, which is a theoretical discourse on the notion of the narrative world and contains an analytical framework for possible worlds. Significantly applied to story telling heterocosmica here can stand for a particular kind of design practice that engages with projects that work as campaigns to broaden notions of possible futures.

The key question now is what form does sustainability take in these trajectories. While ecodesign was a flat material discourse of the environment and when combined with life cycle thinking afforded quantitative analysis, these forms of design practice are more impenetrable to pure material reduction exercises. While it is true that some of these practices often are driven by designers with an ethical premise of their practice the impact of such activities are not necessarily targeted to bring any direct change to the environment. And herein lies a big question and a potential intellectual project for the near future – what manner of design for sustainability is appropriate for the kind of design practices that are to be seen in cities like Melbourne?

Conclusion

The paper was written with a desire to raise the issue of the loss of 'environment' from contemporary design education and practice in Australia. People who did eco-redesign projects in academia have has moved on to other things and now the very complexity of a service or social innovation project keeps them preoccupied and the environment is neglected. On the other side the loss of manufacturing has effectively destroyed any prestige or relevance for working on eco-redesign for mass manufacture. In this climate there can emerge a new movement from within and in line with current preoccupations of design

practitioners. While in one way this would be the greening of the new practices of design its ability to transfer real planet benefits is yet to be explored. While the possibility of design to once again be marginalized will be ever present at least at the theoretical level there is a potential for new ways and new theories of practice to be constructed with an eye on sustainability.

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the Learning Network on Sustainability

Traces of culture in students' concepts for sustainable product service systems

Experiences from three continents

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The output of industrial design education and practice has always been product-centric. In this 0073tudy Asian, Australian and Latin American students were challenged with a different approach to design briefs: not to design objects per se as an automatic response to satisfaction of wants, but to consider sustainable product-service systems (PSS). It was intriguing to see how students from different countries responded to the same briefs with proposals which are strongly tied to their cultural traditions.

Context

Throughout the history of industrial design education, students have been trained to satisfy human needs by offering consumers with tangible products, typically positioned as material objects of desire. It was therefore interesting to challenge Australian, Asian and Latin American students with a different approach to design briefs: not to design objects per se as an automatic response to the satisfaction of wants, but to consider product-service systems (PSS) which could potentially consume less material and energy resources throughout their lifecycles.

In 2004 half-day design exercises were simultaneously run at the University of Technology Sydney, the University of Western Sydney, and the University of New South Wales in Australia (Ramirez, Tonkinwise, & Andrews, 2004) to test the ability of design students to notice and elaborate PSS design solutions. There is a conjecture that it would be fundamentally difficult for industrial designers to arrive at dematerialized and less tangible outcomes instead of conventional products. Given the dematerialization ambitions of PSS, tools developed to facilitate PSS design need to explicitly take into account the extent to which they are going completely against the grain of conventional designing (Tonkinwise, 2003). The aim of the exercises then was to identify the best ways to teach designers to include PSS in their solution repertoires when designing. The results indicate that PSS design tasks appeal to students, and highlight the need to support designers' processes with "designerly" tools that orient the mood for novel design processes.

These Australian exercises were later extended into international student workshops on sustainable innovations, conducted by the author in tertiary design institutions in Asia in 2005 and in Latin America in 2008. The participating institutions are the National Institute of Design in Ahmadābād, India; Tsinghua University Academy of Arts and Design in Běijīng, China; Hong Kong Polytechnic University in Hong Kong, China; De La Salle College of Saint Benilde, University of Santo Tomas, and Mapúa Institute of Technology in Manila, Philippines; and Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM) in Monterrey, Mexico.

The Australian, Asian, and Latin American exercises were very similar in content but slightly differed in format. In all three, the workshops were preceded by lecture presentations on global examples and case studies of sustainable product development, anchored on the lifecycle design strategies wheel (Brezet & Van Hemel, 1997), as well as on the tools for sustainable PSS solutions from the Sustainable Everyday Project (Manzini & Jégou, 2003). In the Asian workshops, students participated in an intensive brain-

storming and sketching session the day after the lecture. In the Latin American case, the workshop was officially integrated as a two-week learning activity into the 7th semester ITESM course, DL00815 Industrial Design Workshop V, and was therefore more comprehensive.

In all the locations, the task was to generate fresh ideas on how a PSS can be "industrialized" to increase the likelihood of uptake of the PSS amongst the general population, such as by reducing such barriers as high costs of labor in service-intensive solutions. The PSS topic can be chosen from either food, clothing, mobility or lawn care. During the brainstorming sessions students were encouraged to first consider the various PSS cases which existed in their home countries prior to conceptualizing new ones. In the Latin American and Asian schools, the student groups were required to reflect and mind-map the traditional innovations, inventions and PSS solutions in their countries which may be considered as successful local examples of ecological or social sustainability. This was necessary so that the author could have an understanding of PSS examples that were already at work in their national contexts. (In the original Australian workshops the activity of reflecting on local and westernized PSS examples also occurred but wasn't documented since all students and tutors had a contextualized understanding of Australian PSS cases; at that time we didn't know that the exercises would be expanded overseas.)

Results

Latin American and Asian students engaged in retrospections of the pleasantries and lack of conveniences of daily living during their childhood, to reminisce what they knew of ways of life during the time of their parents and grandparents, and to compare these reflections with the amenities of the present. All participants were encouraged to present various PSS which are either operating at present or have been practiced in their society in the past. The workshops resulted in the documentation of numerous local PSS innovations, some of which are presented below by country.

When comparing and contrasting the design outcomes of the workshop, the variances in the economic wealth and development of nations (Table 1) should not be ignored, as personal incomes directly affect the capacity of people to acquire products and services. Prosperity can also result in people to behave less conscientiously or become more wasteful (De Mooij, 2004; Hofstede, 1984).

Table 1: Economic status of countries studied

Source: [1]WB (2010); [2]IMF (2010); [3]UNDP (2009)

	Australia	Hong Kong	Mexico	China	Philippines	India
World Bank Income Groups[1]	High income	High income	Upper-middle income	Lower-middle income	Lower-middle income	Lower-middle income
International Monetary Fund[2]	Advanced economy	Advanced economy	Emerging and developing economy	Emerging and developing economy	Emerging and developing economy	Emerging and developing economy
GDP per capita PPP[2]	$38,911	$42,748	$13,628	$6,567	$3,521	$2,941
Human Development Index[3]	0.970 Very high human development	0.944 Very high human development	0.854 High human development	0.772 Medium human development	0.751 Medium human development	0.612 Medium human development

India

Indian participants working on the garment care topic illustrated many scenarios for extending the lifecycle of the traditional Indian woman's garment, the sārī. One of them shows how older sārī fabrics are progressively dyed into darker colors when the previous color has faded, when the fabric has become stained or spoiled, or when the owner desires to revitalize the garment (Figure 1). One such business is Sri Ramlok & Co in Chennai (www.ramlok.com). Old sārī fabrics are also recycled into quilts, furniture covers and curtains.

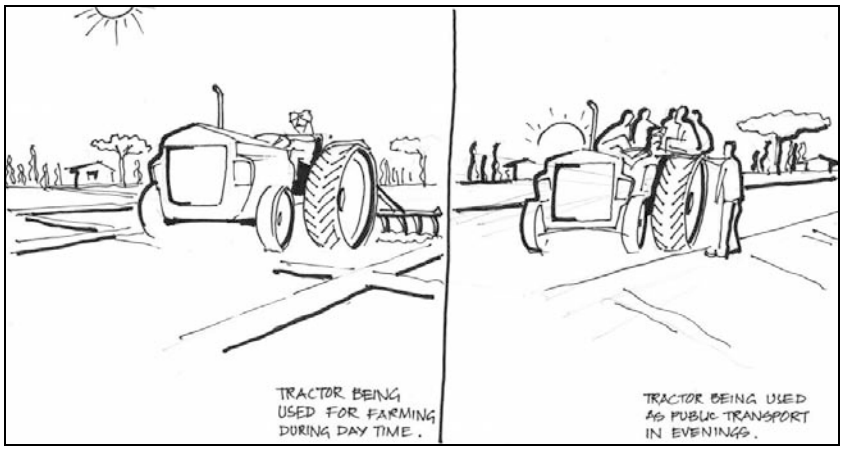
Figure 1: Example of garment-care PSS in India

Sketched by students at National Institute of Design, Ahmedabad

In the transport provision theme, students presented a traditional scheme where a farm tractor is being used to till the farms throughout the daylight hours, and in the evening the vehicle doubles as transport for farm workers back to their homes in the villages (Figure 2).

Figure 2: Example of transport-provision PSS in India

Sketched by students at National Institute of Design, Ahmedabad



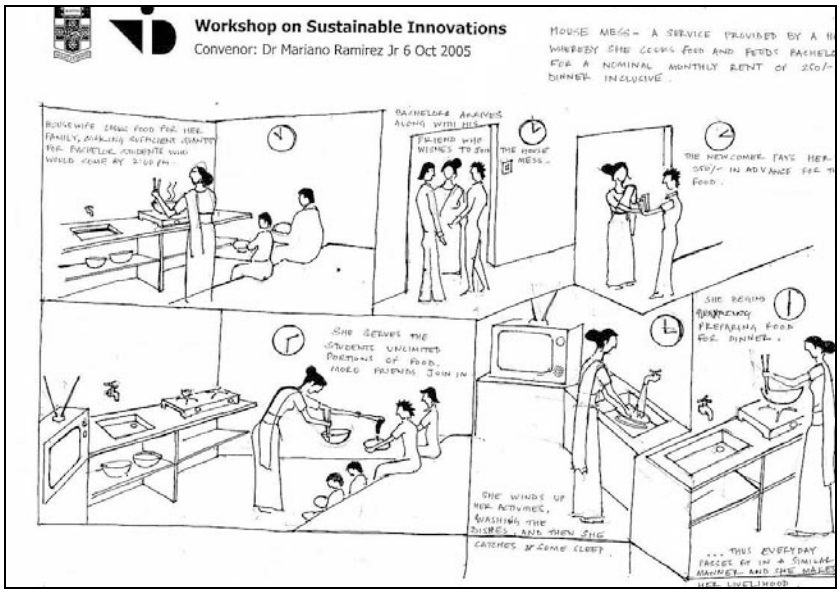
An interesting PSS example was given by a group of students in the food provision topic. In the city of Pune, there is a common form of livelihood called the "house mess" (Figure 3), where housewives cook for their own families as well as for university students who, for a nominal monthly subscription, come to eat lunches and dinners in their households.

Among the many Indian traditional PSS that surfaced in the discussion was the well-publicized example called the *dabbawallah* (packed lunch delivery) system. In this highly specialized trade that is over a century old, around 5,000 men deliver 200,000 hot home-cooked meals in color-coded lunch boxes from the kitchens of suburban middle-class households to schools, colleges, factories and offices spread across

Mumbai. The *dabbawallah* system has been recognized as one of the most reliable supply chains in the world – one mistake in every 6 million transactions (www.dabbawallah.com) – in spite of not using any computers or modern technology and most of the delivery staff being illiterate.

Figure 3: Example of food-provision PSS in India

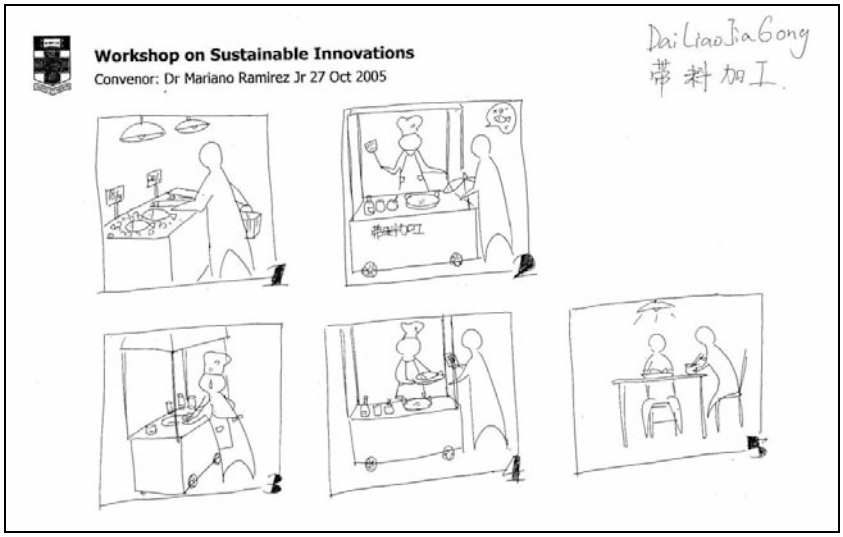
Sketched by students at National Institute of Design, Ahmedabad



Another Indian PSS discussed was the *kabadiwallah* (junk recycling) system, where waste merchants in bicycles or carts go door-to-door to buy old newspapers, books, bottles, clothes, utensils, and electronic appliances, which they then sell to second hand shops and recyclers. Related to this is the *khattewallah* (waste picking) system, where pickers collect reusable or recyclable waste from roadsides, landfill sites and dumping grounds to sell to recyclers.

Figure 4: Example of food-provision PSS in China

Sketched by students at Tsinghua University Academy of Arts & Design, Beijing



China

Chinese participants in the food topic presented a PSS called *dailiao jiagong* 带料加工 (Figure 4), wherein urban residents would purchase fresh fish and ingredients from a stall or food cart, have it

cooked to order by a street vendor for a fee, and then enjoy the meal at home or in the roadside tables. This traditional term, which means "bring material + add work", has been extended to the concept of OEM (original equipment manufacturer), where an external company pays a Chinese company to manufacture a product for retailing under the external company's brand name.

Another PSS example given is the traditional *nongjiale* 农家乐 ("farmhouse fun"), wherein rural Chinese peasants provide family travelers a summer countryside experience by offering farm-fresh food and accommodations in their own house.

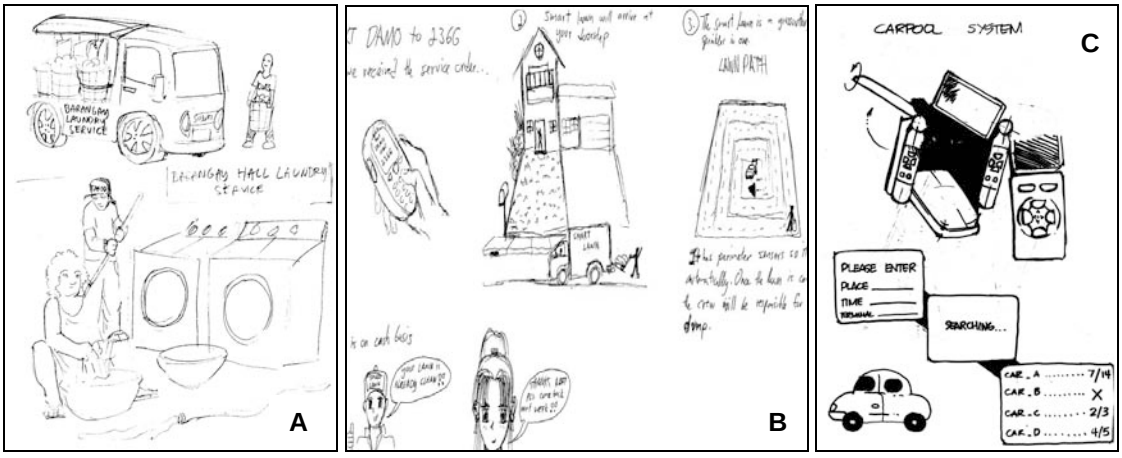
Philippines

A distinctive proposal that students from the Philippines came up with revolves around the *barangay* (village) hall, which is a central hut for community meetings. The hall grounds would be equipped with a laundry facility where the women of the village could converge for laundering sessions and accept other people's washing as well for fees (Figure 5a); the multipurpose mini-truck of the village could be used to collect laundry from the households and transport them to and from the community hall.

It is remarkable that a number of concepts presented by the Filipino designers employed SMS (short message service) technology, employing digital mobile phones to interact with automated ordering systems using text. Arguably the Philippines is one of the most prolific text messaging centers in the world, with an average of 1 billion text messages sent through the mobile networks every day (Francisco, 2008). Notably such proposals using SMS technology have not been received from students in the other countries. One such concept is a PSS involving a homeowner sending a text message to a lawn maintenance company (Figure 5b), who will set the appointment for periodically mowing and sprinkling the grass and removing the cuttings. Another PSS idea that uses mobile phone technology exploits GPS (global positioning satellite) features on those phones to search for identified car-pool club members who are passing by, headed for the same destination, and willing to take in passengers for their empty seats for a fee (Figure 5c).

Figure 5: Student proposals for PSS in the Philippines

Sketched by students at College of Saint Benilde, University of Santo Tomas, and Mapúa Institute of Technology



Hong Kong

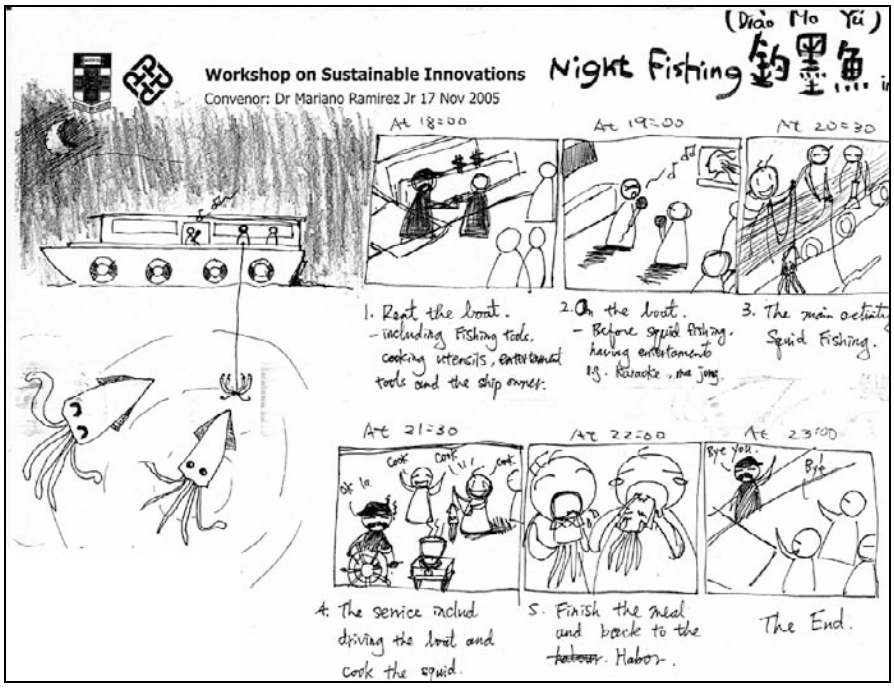
Students mentioned the unique and successful business scheme in Hong Kong known as the "Milan Station" (www.milanstation.com.hk), which is a retail outlet that buys and sells used high-end designer handbags and luggage. The store cleans and polishes the second-hand articles of fashion, presenting them as if they're brand new; in fact many tourists are surprised to find out that the luxury items in Milan Station are pre-loved.

A PSS known as *dīàomoyü* (squid fishing) involves fishing boats that ply the islets in the South China Sea (Figure 6). Families and groups of friends often rent these boats to spend a weekend evening leisurely catching cuttlefish and squid, which are active at night. The boat hire includes all fishing gear,

on-board audiovisual entertainment, cooking equipment, buffet meal, and the services of the boat captain, who also cooks or grills the squid that has been caught on the nets and on the fishing lines.

Figure 6: Example of food-provision PSS in Hong Kong

Sketched by students at Hong Kong Polytechnic University



Australia

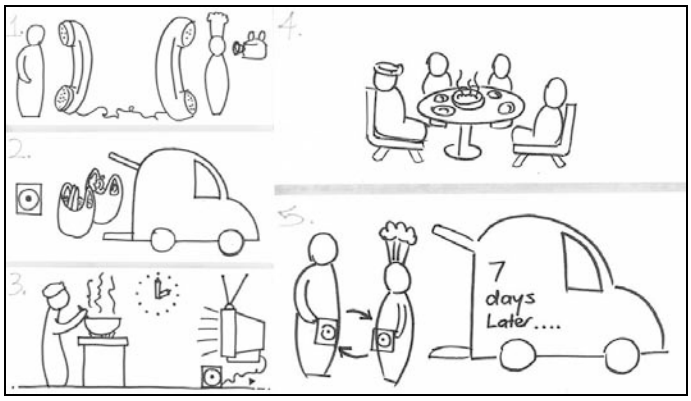
Like Hong Kong, Australia is a developed country whose citizens enjoy one of the highest standards of living and highest per capita incomes in the world. It could thus be expected that the PSS concepts which students propose would be markedly different to those from the developing countries. In response to the challenge of designing PSS for clothes washing, meal provision, and lawn care, students responded with a variety of concepts which ranged from pure product to almost pure service (Figure 8).

Some of the uniquely Australian concepts for meal provision PSS included: a central kitchen or “food hub”, shared by residents in the same street, equipped with community-sized refrigerator that has lockable cold storage compartments for each family, thereby avoiding the need for individual fridges in every household. A similar approach is to have shared hostel-style kitchens in apartment buildings; this idea is not far-fetched as many apartment complexes already have shared laundries. The use of kitchens can be either free-of-charge or pay-per-use, so that residents who use the kitchens less are incentivized by paying less quarterly fees with the apartment management.

During the discussions reference was made to online food ordering and delivery PSS, such as www.MenuLog.com.au and www.MyDelivery.com.au. These portals allow members to search for participating restaurants by postcode and by the types of cuisine available, the show the online menus of the matching restaurants, along with customer reviews and ratings. Most restaurants in the scheme offer free delivery and various promotional deals.

Figure 7: Student proposal for food delivery PSS in Australia

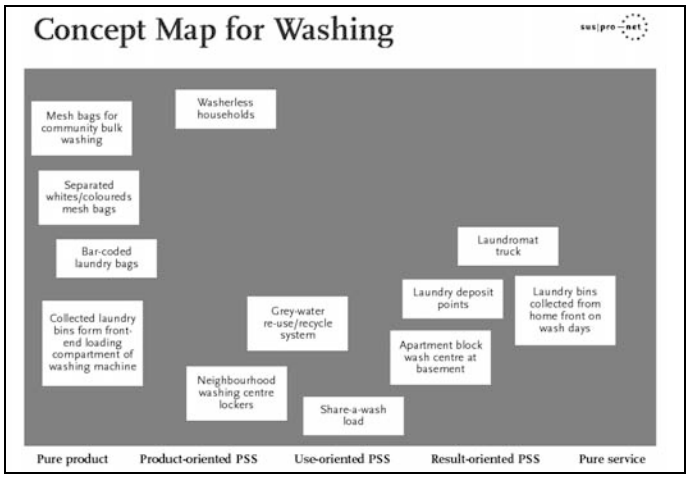
Sketched by students at University of New South Wales, Sydney

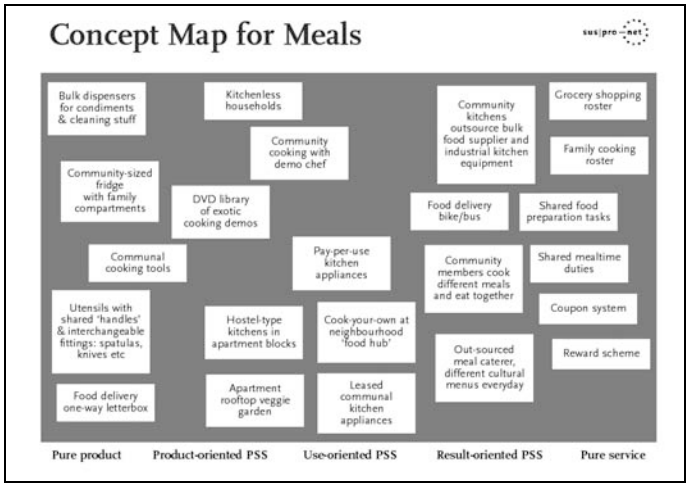


One PSS proposal factored in the multicultural cuisines in Australia (Figure 7). Members would request their meal service provider to deliver a kit of ingredients and special utensils for a particular set of dishes and desserts from one of Australia's many cultures, along with a DVD on how to prepare and cook the dishes in that cuisine. Instead of ordering pre-cooked meals, this service will enable householders to experience the joy of learning to cook a new multicultural menu every week. When the service comes back to deliver a new kit of ingredients, the DVD for the previous menu will be returned.

Figure 8: Range of student proposals for PSS in Australia

Compiled from concepts received from students at University of New South Wales, University of Western Sydney, and University of Technology Sydney





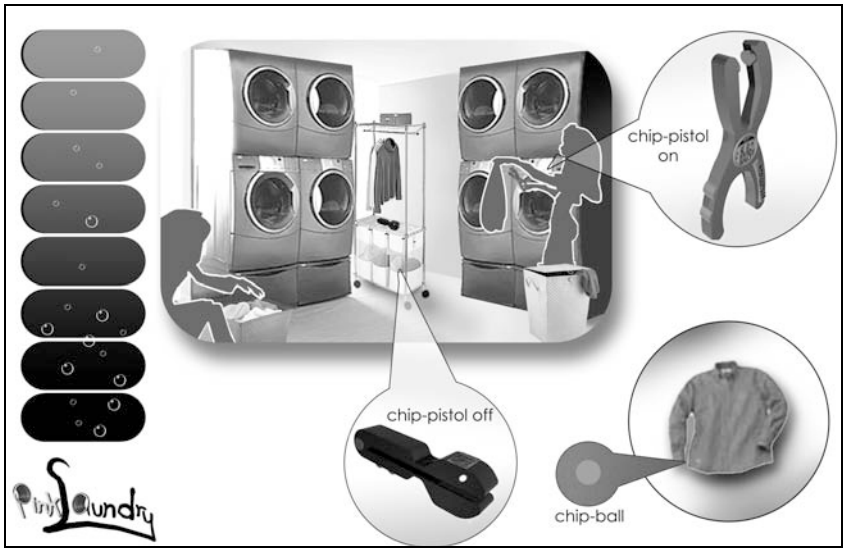
Mexico

An existing PSS mentioned by students in Mexico is a traditional grill service that is part of the *carniceria* (meat market). Weekend social barbecues are customary in Northern Mexico, a practice which has now spread to the rest of Mexico and the American Southwest. In this PSS *carne asada* (charcoal-grilled marinated steaks) are sold in the butchery, with the option of buying the usual accompaniments of *tortillas* (flat bread), *salsa* (spicy tomato sauce) and *guacamole* (avocado dip). In Monterrey, two of the fresh meat sellers which promote this PSS are Carniceria Vigar (www.vigar.com.mx), which offers *asada gratis* (free roasting of purchased meats); and the Texas-based H-E-B meat market, which has a *Martes de asador* (Tuesday grill) special. This PSS is very similar to the British takeaway fish-and-chips which are fried-while-you-wait in fresh fish markets.

A novel PSS concept proposed by one of the Mexican groups involved a communal Lavandería Rosa ("Pink Laundry"), wherein members' clothes are tagged with microchips to enable sorting by colors or fabric type (Figure 9). The microchips also facilitate sorting by customer at the end of the process. A percentage of the earnings are to be donated to breast cancer research.

Figure 9: Student proposal for garment care PSS in Mexico

Sketched by students at Instituto Tecnológico y de Estudios Superiores de Monterrey, Mexico

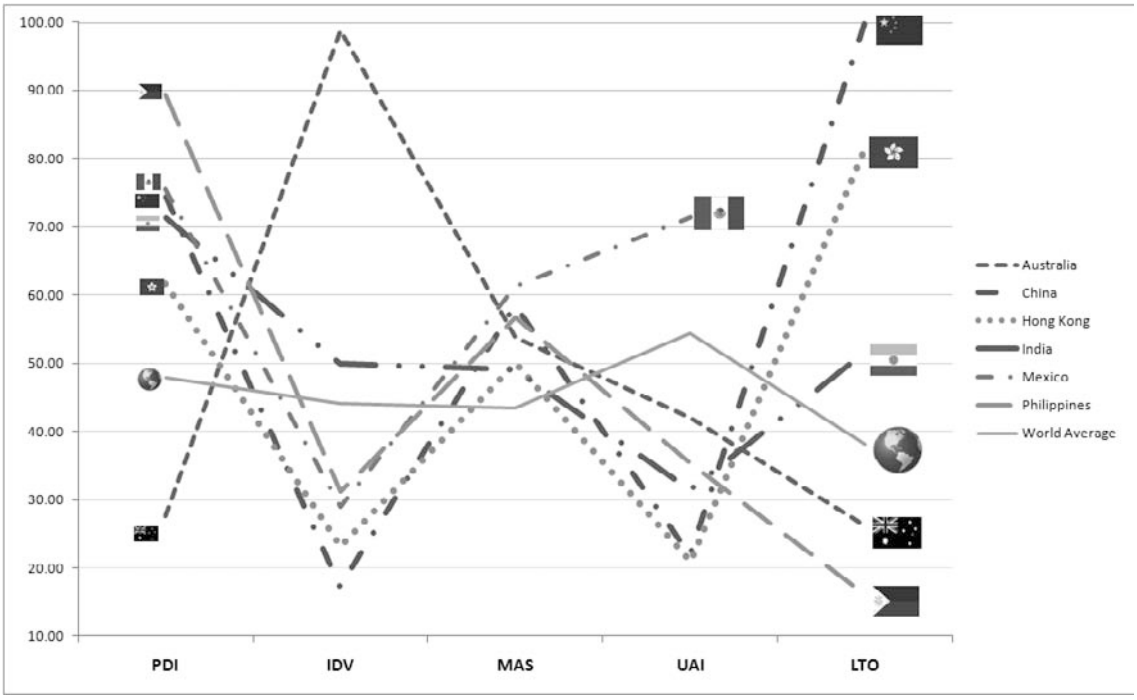


Analysis

The cultural diversity of the design workshop results can be viewed as stemming from the cultural values of their designers. One method to understand and interpret these design differences and similarities is by looking through the lens of cultural dimensions (Razzaghi & Ramirez, 2005), which organize the countless cultural values into a limited number of cultural variables on which societies can be compared. Several paradigms for cultural dimensions exist, of which Hofstede's model is one of the most popularly referred to.

Hofstede (1984) argues that people carry within themselves patterns of thinking, feeling, and potential actions which are learned throughout their lifetimes. He asserts that culture influences not only individual behaviors and practices but also the shared distinctive beliefs and customs of communities. He was able to empirically identify five dimension scales of national culture. Using Hofstede's data, the cultural dimension scores for the countries of the student designers were plotted in Figure 10. Based on the connotations of the cultural indexes, the following observations on the student concepts could be associated.

Figure 10: Relative country scores according to Hofstede's cultural dimension scales



Power Distance Index [PDI]

This cultural dimension measures the extent to which the less powerful members of society within a country expect and accept that authority and wealth are distributed unequally (Hofstede, 1984). In high PDI cultures, hierarchy, status and old age are important to demonstrate position in society and respect; in low PDI cultures, equality of rights and opportunity is stressed and powerful people try to look less powerful and older people try to look younger (De Mooij, 2004). All the countries in this study except Australia scored higher than the world average on power distance.

It was probably not coincidental then that one of the PSS examples given by the Chinese students was the *xingxiangsheji* , an "image design" consultancy which offers professional grooming and body fitness advice as well as a selection of clothes or hairstyles to help people upgrade their personal outlook. In high PDI cultures such as China the position of people in the social hierarchy is defined by the stylish clothes they wear, their shoes, posture, makeup and grooming; on the contrary in low PDI cultures such as Australia, people take less care of their outer appearance and wear in public what they wear in private (De Mooij, 2010).

Power distance could also be a motivator which drove the Philippine students to the concept of a laundry facility within the grounds of the community hall. The hall is a domicile of authority and power, and housing the laundry in a place which can be overseen by the local peace-and-order volunteers means that the facility can be kept safe and secure.

The student examples of historical transport in India by *pàlkī* (palanquin bearers) and *qulī* (slave-like laborers who carry customers on their backs or heads) are reminders of the social stratification in the Hindu caste system and the acceptance of this discriminatory concept in the subcontinent.

Individualism vs. Collectivism [IDV]

This shows the degree to which individuals in a society are integrated into groups (Hofstede, 1984). People in individualistic cultures are "I" conscious and want to differentiate themselves from others; they express private opinions, prioritize variety and adventure, and value self-actualization and individual decisions more than group decisions. Those in collectivistic cultures are "we" conscious; they secure identity through belongingness to their social network, value harmony with in-group members and avoid loss of face (De Mooij, 2004). Living alone in single households is common in individualistic countries; such would be highly unusual in collectivistic countries.

East Asian and Latin American countries are rated as collectivistic on this scale. It could thus be expected that designers in China, Hong Kong, Mexico and the Philippines are most likely to design with their families, community or country in mind. The proposed community laundry and the GPS-enabled car-pooling in the Philippines is a good example of Asian collectivism values at work. Extended families are typical in collectivistic cultures, and the rentable fishing boats PSS in Hong Kong is a good example that focuses on the in-group benefits, harmony, interdependence and togetherness in a very large family.

Australia is the second most individualistic country in the world after the United States; most Western countries are individualistic too. As such personal design preferences could be postulated to be more important than group preferences. Interestingly the Australian students successfully rose to the challenge by coming up with community-type PSS concepts that are radically against their individualistic culture: communal food hubs; hostel-type shared kitchens; and laundry bins and nets for communal washing.

Masculinity vs. Femininity [MAS]

This cultural dimension, aka “gender of nations” or “tough vs. tender”, refers to the value placed on traditionally male or female gender roles (Hofstede, 1984). The dominant values in a masculine or tough society are achievement, performance, competition, status and success: winning, big, strong and fast are desirable. In a feminine or tender society caring for others and quality of life are more important: service-oriented, people-oriented: underdog and small are beautiful. Modesty is valued in feminine cultures: if one excels it need not be shown, so there are no “employee of the month” displays in these countries. Role differentiation is small in feminine societies and large in masculine: in feminine cultures males can take typical female jobs, do household shopping, share in housework, help raise children, etc without being seen as a sissy. In masculine societies people consume “for show”; in feminine societies people consume “for use”.

All six countries are clustered around the same central spot on this scale above the world average. Thus all participant cultures could be said to be moderately “masculine” or “tough”, suggesting a degree of assertiveness and materialism in their peoples.

The Milan Station and fashion accessories businesses in Hong Kong are perhaps testimony to the aspirations of this culture for the accumulation of material possessions and for showing off status symbols, a decidedly masculine value. Moreover, the “image design” service in China are aimed at developing individuals to become more assertive, more self-centered, and geared towards personal achievement, which are all aspirations found important in masculine societies.

Uncertainty Avoidance [UAI]

This indexes the rate by which the members of a culture tolerate unknown, unstructured or ambiguous situations (Hofstede, 1984). Cultures which have a high UAI score need rules and formality to structure life; they have a strong belief in experts; are less open to change and innovation; distrust second hand goods so buy more brand new (De Mooij, 2004). High UAI cultures have a passive attitude to health, focusing on medication and pure drinks and foods; low UAI cultures take an active attitude, and focus on fitness and sports. Most of the countries scored below the world average on this index, except Mexico. Thus Mexico could be said to have a strong uncertainty avoidance culture.

The Pink Laundry concept from ITESM is a demonstration of the desire of Mexicans to be assured of quality in the service provided. Customers would not trust laundry services that couldn’t promise them that they would get their clean clothes back and not those of other people; or that would mix their white garments with colored ones.

Long- vs Short-Term Orientation [LTO]

According to this dimension, aka “Confucian work dynamism”, a society’s “time horizon” is the importance it attaches to the future versus the past and present. In long term orientation, there is acceptance of change, perseverance, thrift and pursuit of peace of mind. In short term orientation, spending is more important than saving for tomorrow.

As expected, the “Confucian” cultures of China and Hong Kong rank highest in long-term orientation, indicative of their respect for tradition, perseverance and parsimony. India is likewise deeply rooted in tradition and ranks above the world LTO average. It is amazing to find the contemporary everyday gar-

ments of Indian ladies have changed very little from the early sārī designs that we find carved or painted in ancient temple murals. Thus many students submitted various PSS scenarios for the Indian sārī.

The Philippines and Australia are rather short-term oriented, suggesting that change can occur more rapidly in these countries since long-term commitments do not become impediments to change. The radical concepts of the Australian students requiring revolutionary changes in everyday living may probably be attributed to short-term orientation. Likewise the prevalence of SMS and GPS mobile business concepts among the Filipino students shows how these relatively new technologies have been easily embedded into everyday living in the Philippines.

Conclusions

It was fascinating to witness the diversity of the PSS solutions from the young Asian, Australian and Latin American designers who participated in these international workshops. The concepts and examples that surfaced through the activities show heavy influences from the students' unique cultures. While these can be partly attributed to the nature of the briefs to which they were responding, the embedding of culture in their responses is likely to have sprung naturally due to the values, norms, institutions and artifacts in the environments where they live and in the society to which they belong.

Students often get pleasantly surprised to find sustainable and less material-intensive product-service systems already existing in their cultures, in one form or another. It was opportune to look back to those days when modern human lives were not yet so intricately intertwined with advanced technologies that require a high intensity of material and energy consumption to deliver. It would be desirable for the relatively simpler but more value-laden product-service systems to be employed as drivers for culturally-appropriate innovation and sustainable solution development. Moreover, the resource-sparing strategies from the developing economies could provide inspiration for reducing the material consumptive practices in the developed world.

The workshops showed that industrial design students can live up to the challenge of designing product-service solutions and consider whole systems when required to, and to digress from the product-centric approach of conventional industrial design processes. It is up to design educators, therefore, to consider sustainable product-service systems and to integrate these constructs in their studio teaching. By doing so we lay the foundation for the next generation of industrial designers to think beyond products and to understand that less resource intensive solutions are indeed possible.

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Notes

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About the author

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Education experiences and proposals on (Product-Service) System design for sustainability

the Learning Network on Sustainability

From evolution to revolution – can design students change the world?

A study of final year project selection and the future design practices of graduating designers

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Emily Pilloton, in her book *Design Revolution* (2009), calls upon designers and design schools to stand firm against the coupling of design and consumption in order to create a more sustainable ethical and equitable model of practice.

Students from the Bachelor of Design, College of Fine Arts, University of New South Wales undertake a final graduating project (Fourth Year Project) that is positioned in a "real" context, developed in conjunction with design academics, selected professionals and a client or mentor, and address design scenarios by solving actual design problems, either contemporary or future situations, consistent with design challenges in the professional context. All projects involve designing and – coherent with the long term philosophy of the degree – address environmental, social, cultural or development issues.

This paper identifies the founding conceptual and academic premises that shape the Design program at COFA and its core focus on ethical, relevant and sustainable practice. It seeks to discern alignments between the selection of graduating projects and career outcomes in order to provide some insights into bridging students to a career in design. In so doing, it traces the development of three Fourth Year Projects and identifies the place of these projects in the early career trajectory of the students.

Background

In late June 2010, rescinding his role as Prime Minister of Australia, Kevin Rudd delivered a lengthy farewell speech cataloguing the extent of his achievements in the position. The leader of a newly elected, socially progressive regime during its first two years in power, these were not insubstantial. However, despite significant reforms to health care, education and indigenous affairs, it was his government's response to the 2009 global economic malaise that Mr Rudd singled out as his most notable success. Indeed Australia, it seems, rode out the financial storm in a blaze of household spending fuelled by cash payments from the government to most adult individuals. Fashion houses and department stores buzzed with commerce as an advertising blitz promoted the national benefits of liberal spending.[1]

The remedial strategy prescribed by the Rudd Government was a textbook response founded on the conservative western economic model of consumption – trade in goods, irrespective of their utility, durability or origin – as a pivotal element in maintaining buoyancy in the national economy. For even the

[1] "…to strengthen the national economy and …kick start stimulatory activity until direct Government investment measures take effect". Fact Sheet 2009 Updated Economic and Fiscal Outlook: Household Stimulus Package; Office of Deputy Prime Minister and Treasurer, the Hon Wayne Swan MP.
file:///Volumes/Data/Users/z9800148/Desktop/print_Lens/2009%20UEFO%20Fact%20Sheet%20-%20Household%20Stimulus%20Package%20%5B13:02:2009%5D.webarchive, viewed July 8, 2010

most distracted shopper, this approach, although apparently successful in the short-term, was bewilderingly at odds with commonly held understandings of the radical change in consumptive behaviours required to tackle the concurrent international emergency of climate change and environmental decline.

The economic paradox

These profound contradictions stem from an overriding imperative assumed by elected governments that stability (and thereby, electoral standing) be maintained at all costs. Under prevailing economic models, stability has been understood as "bought" and secured by growth and, conversely, its absence is understood to trigger the worst effects of recession, social dislocation and loss of community well being.

Over the last several years, however, these verities have been tackled by a number of commentators who propose a contrary economic model that supports positive social impacts in a zero or slow-growth state. Indeed, Clive Hamilton (2003) points to the example of Japan, a country subject to extended recession during the 1990s. Throughout, it was predicted that Japan's position in the world would decline in line with its plunging annual average growth rate. In fact, reports Hamilton, the reduction in growth (to around 1%) gave the Japanese population an opportunity to reflect on – and amend – a damaging workplace culture and to deliver a social renaissance that reinstated the central role of family, community and the environment.[2]

Similarly, in his recent book *Prosperity without Growth*, British academic Tim Johnson (2009) points to the work of economist Peter Victor and his extended models of the Canadian economy under hypothetical zero-growth conditions. Remarkably, with only relatively straightforward adjustments to macroeconomic variables, Victor's model forecasts not only stability but enhanced social circumstances, including substantial reductions in both unemployment and poverty.[3]

But powerful indicators of looming environmental decline linked to human overconsumption and exploitation of the ecosphere are hardly new, nor have they been poorly disseminated. The Club of Rome's *Limits to Growth*, released in the early 1970s, was published in 30 languages and has sold some 30 million copies worldwide. *Blueprint for Survival* was issued as a special edition of the journal *The Ecologist* in 1972 and was later released in book form due to widespread public demand.

Blueprint for Survival is of particular interest for its insistence on fundamental links between the global environment, resource usage, prosperity/poverty, community cohesion and individual wellbeing. Its authors were early proponents of ideas now expressed in the maxim "Think global, act local", and advocated strongly for changes in the conventional values and beliefs that underpin destructive first-world systems.

Evolution to revolution

As George Bernard Shaw quipped, "All great truths begin as blasphemies"[4]. But how is it that forty years after the publication of *Limits to Growth* little of substance has changed and the thesis it explores remains heretical? Could it be, as Hamilton (2010) suggests, that there is comfort in stasis; that individuals overwhelmed by the magnitude of all that climate change entails, retreat from short term alarm to long term passivity. If evolution is construed as gradual development to an improved form, then plainly, the momentum of the '70s has stalled and evolution is in delay. Revolution, the more dramatic form of change, may be understood as upheaval and insurgency, but equally it denotes transformation or more literally, rotation, a turn. Importantly, though, under any of these definitions, revolution overrides inertia and passivity. Those who question growth are deemed, as Tim Johnson puts it, "lunatics, idealists and revolutionaries".[5] By this description then, they are already enlisted to speak for the fundamental shifts required to secure meaningful change!

[2] Hamilton, Clive, 2003, *Growth Fetish*. Sydney, Allen and Unwin, p226 – 227
[3] Johnson, Tim, 2009, *Prosperity without Growth, Economics for a Finite Planet*. London, Earthscan Publications
[4] quoted Hamilton, 2003, unnumbered front page
[5] Johnson, 2009, p. 14

Revolution in the design school

If the radical economists are distinguished by models that reject the inevitability of growth and the consequent burden on natural and human resources, their convictions intersect decisively with those of designers and educators who seek to amend perceptions of the profession as bound merely to form, aesthetic, novelty, trends and commercial popularity – or as the Indian Nobel Laureate Amartya Sen may characterise it, "opulence" and "utility". [6] Instead, these individuals seek to define design by its agency in socially and environmentally responsible change. And here too, the inference and language of revolution are at play. Indeed, for Emily Pilloton, founder of Project H Design, revolution is both a key concept and an extended metaphor. In calling upon designers to stand firm against the coupling of design and consumption in order to create a more sustainable, ethical and equitable future, Pilloton (2009) unambiguously echoes the sentiments of the zero-growth sector. Equally, in directing her attention to the failings of industrial design, she moves the call for revolution firmly into the realm of education and the design school experience.

> We need nothing short of an industrial design revolution to shake us from our consumption – for – consumption's sake momentum. We must elevate 'design for the greater good' beyond charity and toward a socially sustainable and economically viable model taught in design schools and executed in design firms, one that defines the ways in which we prototype, relate to clients, distribute, measure and understand.[7]

As Pilloton asserts, models of design are crucial in calibrating a young designer's awareness and ambition. Fundamental to design education is a responsibility to provide students with the means of **experiencing** their potential to 'make a difference' and to enact socially responsible change in real-community settings. These principles constitute the bedrock of the Bachelor of Design program at the College of Fine Arts, University of New South Wales, Sydney, Australia (COFA). This paper indentifies the founding conceptual and academic premises that shape the program and seeks to discern alignments between the selection of graduating projects and career outcomes in order to provide some insights into bridging students from the institution to a career in design. In so doing, it traces the development of three Fourth Year Projects and identifies the place of these projects in the early career trajectory of the students since graduation.

Since its inception nineteen years ago, the COFA design program has declared a commitment to transdiscipinary professional education, and a belief in integration as "the driver for responsible and innovative design"[8]. Initially, the integrated platform saw all students engaged in comprehensive studio studies spanning the spatial, object and graphic design domains. As the program evolved, ceramic, jewellery and textile design were added to the suite of studio options, extending the reach of an inclusive, interdisciplinary approach coherent with the multidimensional nature of contemporary design practice. This model runs counter to the prevailing archetype of deep skilling in a single discipline that continues, more generally, to distinguish Australian design schools. Without question, the specialist approach provides well prepared graduates for discipline specific destinations in the design industry. Nonetheless, the alternative paradigm championed by the COFA program has flourished.

In addition to breadth of reach, the program articulates a fundamental commitment to sustainable design thinking and a core focus on ethical, relevant and sustainable practice. Student experiences are constructed such that they are impelled to "challenge conventional applications of materials, systems, processes and technologies"[9] and are brought into immediate contact with diverse social and cultural contexts.

Central to realising the core objectives of the degree are key pre-professional experiences required of students in their fourth year of study. These include both a professional placement of 560 hours (Professional Employment Program) and the Fourth Year Project, a student's final or graduating project.

Fourth Year Projects are positioned in a "real" context, developed in conjunction with design academics, selected professionals and a client or mentor, and address design scenarios by solving actual design problems, either contemporary or future situations, consistent with design challenges in the professional arena. All projects involve designing and – consistent with the long term philosophy of the degree – address environmental, social, cultural or development issues; design to benefit a specific group; sustainable

[6] Sen, Amartya, 1999, *Development as Freedom.* Oxford, Oxford University Press, quoted Sustainable Development Commission report *Prosperity without Growth*, 2009, London, p.30
[7] Pilloton, Emily, 2009, *Design Revolution*, New York, Metropolis Books, p.10
[8] COFA/UNSW undergraduate prospectus 2010, p36
[9] ibid

design or designing to improve the way we live. Students are encouraged to select project briefs that are aligned with their skills, abilities and design enthusiasms in order to optimise creativity, risk taking and the potential for innovative outcomes. Furthermore, guidelines encourage students to be entrepreneurial and strategic in selecting and developing their final studio project, recognising the opportunity it offers for engaging and testing their emerging design ambitions.

Current global challenges galvanise calls for designers to develop solutions commensurate with revisions in the perceived role of design and its contribution to consumptive behaviours. Ideally, design curricula afford students an opportunity to participate in these debates and contribute to solutions. By self-selecting projects located in 'real' contexts, students have the opportunity to become active agents of change, creating flexible and adaptable design that responds to the social/cultural needs of their profession and community.

The projects described in this paper represent a range of student academic experience in the three years prior to undertaking Fourth Year Project and a cross section of ambitions on completing the degree. Importantly, each illustrates a core intention of the degree – that a student's design experience is shaped and enriched by inputs from the program, but that their individual histories and ambitions are acknowledged and preserved in their outputs. In other words, the "community of activism" to which Pilloton refers in speaking of a student population[10] is nurtured in parallel with a build toward increasing complexity and sophistication in their approach to design, in the expectation that each student will thereby enter the world with the capacity for thoughtful contribution to a meaningful design 'revolution'.

Project The Lichen
Elliat Rich

The Lichen is a sheltering system designed to support and encourage the development of nomadic culture within the urban environment. The system consists of two components, the permanent and the portable. The permanent is a simple platform suited to short-term occupancy built into awnings over specific, readily accessible buildings throughout the central business district. The portable element is a canvas structure which, in its different formations, can be adapted to a number of uses, including a 'swag' (protective sleeping bag), tarpaulin or coat.

The Lichen was shown at the Sherman Galleries Sydney in the year that it was produced (2004); it was selected for the New Design exhibition at Object Galleries, Sydney (2004) and the prestigious international exhibition Talente, Germany (2005). The success of this system is due to its acute understanding of the experience and exigencies of itinerant travel. Indeed, the insights of its student designer, Elliat Rich, were drawn from formative years spent travelling around Australia with her family, and during the two years 2000 – 2001 an epic 2000 kilometre trek with a train of camels. The Fourth Year Project allowed Elliat, on her return, to envisage a scenario that provided for nomadic travellers across Sydney and positioned the City of Sydney Council as its hypothetical client, bringing the reality and constraints of urban municipal planning regulations to bear on its development.

Elliat's system embeds the values of freedom, responsibility, simplicity and empowerment into our immediate environment. It supports the experience of belonging to place without ownership of place, where the implications and rewards of decision making are immediately felt. The design provides a gift to the user of autonomy and independence; usership is largely interpretive, lending itself to the varying requirements of individuals. Implementation of this design allows use of public space without surcharge and registers this option as viable.

Transitioning from Fourth Year Project to the Professional Experience Program (PEP), Elliat chose to work with the Centre for Appropriate Technology located at Alice Springs in the Northern Territory.[0] This relocation afforded Elliat close observation of small communities and brought her into contact with the distinctive manner of communication by which they are sustained. Returning to COFA to undertake an Honours project, Elliat designed the *Urban Billy* (water vessel), a portable glass unit that combines all the components necessary for two people to prepare and share tea – and the intimacies this implies – in any situation, whether the urban kitchen or the outback chat, seated on the earth, under the sky, in an Aboriginal community.

[10] Pilloton, op cit., p.

[0] The Centre's core business is design for the particular requirements of indigenous communities in and around Alice Springs in the heart of central Australia.

Figure 1: *The Lichen*

Source: Alex Kershaw

Figure 2 and 3: *Urban Billy* assembled and in use

Source: Steve Strike

Figure 4: Elliat Rich (r) and *Urban Billy*

Source: Steve Strike

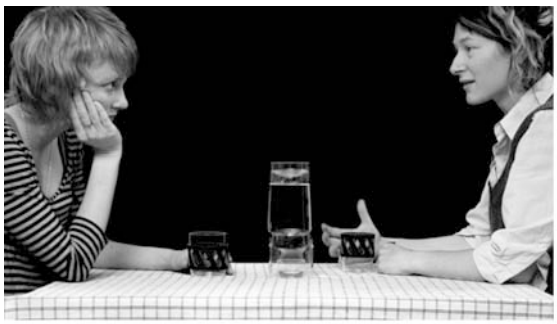


Figure 5: *Urban Billy* outdoors

Source: Steve Strike

Elliat's works are active reflections on the passage of time: time that is required to make a cup of tea, or have a conversation with a friend. Underlying her work is an ongoing desire to create sustainable options through an approach to sustainability that focuses the moment rather than the material. *Urban Billy* refers to the relationships found in objects that come alive with the sharing of time in the company of others. It also references Elliat's links to her environment, the importance of community, and the clarity that personal experience and observation brings to her work. In these aspects its lineage and association with *The Lichen* and the Fourth Year Project is unequivocal.

Project Sign Stool
Trent Jansen

In the two years immediately following his graduation, Trent Jansen's Fourth Year Project, the *Sign Stool* and its offshoots, were a recurring feature in design publications and popular press across the country. From the outset, the project was founded on constraints, both external and self imposed. In the first instance, consistent with his deeply held commitment to minimal resource impact from studio outcomes, Trent enumerated a range of prescriptions that shaped his endeavour. Foremost among these was a requirement that all material be sourced from a discard stream and not otherwise destined for alternative applications.

As he focused on the ecology of design, Trent observed the rapid replacement of freeway roadsigns – large sheets of aluminium – and traced the abandoned signs to a city warehouse. The initial version of *Sign Stool* is modular, designed to stack vertically and nest horizontally, an act of 'play' that results in a suite of functional arrangements – seating, a tabletop, a storage system... The signs are used as found, complete with their coloured lettering and evidence of use, a reminder of their history and reinvention.

At the time of their construction, Trent saw the *Sign Stool* as:

> The embodiment of what I believe to be the future of design. It has taken no toll on the environment, while combining an interesting and purposeful concept with an innovative use of materials, driving a very human-centred brand of design with is to be interacted with, both intellectually in its ironic sense of context and physically in its buildable form.[11]

Figure 6: *Sign Stool*

Source: Trent Jansen

While it is still the starting point for every project, as his experiences have broadened, Trent's perspective on sustainability, has matured. Mindful of the dizzying availability of cheap consumer goods in the marketplaces of the developed world, Trent's objective is to design objects that are so cherished and so deeply integrated into the lives of their owners that they are never outgrown, a proposition extensively developed by Krippendorff (2006) in describing the centrality of meaning in human action. Trent's conceptual reference for the most recent objects are the deep, personal relationships experienced by individuals, observations that have generated *Kissing Pendants* and *Pregnant Chair*.

Kissing Pendants, a set of two lights, hang side by side when not in use. When switched on, the two shades move gently together and stay in contact whilst they remain illuminated. In 2008, *Kissing Pendants* was awarded Australia's Bombay Sapphire Design Discovery Award and across the globe in Europe, Moooi showed Trent's *Pregnant Chair* in Milan. *Pregnant Chair*, which references the relationship

[11] http://www.designboom.com/contest/view.php?contest_pk=6&item_pk=1053&p=3

between a mother and her child, is a favourite of its designer and was the focus of an extended sojourn overseas.

Australia's relative isolation from the traditions and resources of the Northern hemisphere are a compelling motivation for such travel. A period in Japan and a lengthy stay in Europe sharpened Trent's connection to the power of heritage, traditional culture and the value of community. His commitment to sustainable practice remains his compass, but its exploration via community-based projects in developing countries is an emerging priority.

Figure 7: *Kissing Pendants*

Source: Trent Jansen

Figure 8: *Pregnant Chair*

Source: Moooi

Project Gaawaa Miyay
Lucy Simpson

Lucy Simpson is a Sydney based indigenous designer whose identity is profoundly shaped by her affiliations with the traditional Aboriginal Yuwaalaraay country of north-west New South Wales. Lucy's early steps in storytelling, a feature of her emerging design practice, occurred in 2008, the third year of her degree, when she was selected to represent COFA in an international online photography project *My Home is Myself*. Lucy's initial sequence of images, her definition of self, introduce the idea of 'saltwater country', a reference to her mother's oceanside origins in Sydney to which she attaches strong cultural and family ties, and her father's inland 'freshwater country' "where my roots lie".[12] As a Yuwaalaraay woman, Lucy shares the stories and indigenous tongue of the region, a factor that permeates her visual language.

In 2009, for the Fourth Year Project, Lucy developed a range of printed textiles that drew directly from the landscape and ecology of her freshwater (inland) home. Naturally enough, Lucy's printed textiles are scrupulously considered with respect to sourcing of the substrate and the potential impact of the inks. In that sense, the more immediate aspects of responsible print is well managed. More fundamental, however, is Lucy's commitment to her practice as a means of sustaining, supporting, communicating and celebrating key relationships: family, place and community.

[12] http://carightway.ning.com/profiles/blogs/lucy-simpson-in-landscapes-a

Figure 9: *Gaawaa*, *Dhinawan*, *Walgett* and *Burrigan*

Source: Lucy Simpson

The textile range presents an indigenous perspective of country, an expression of contemporary Aboriginal culture and for Lucy, each print encodes both a story of family and a memory. The project she explains, "is a continuation of traditional practice of culture through … an integrated approach to storytelling, and is expressed in a contemporary context [printed fabric]."[13] The work invokes the indigenous tradition of cultural mapping, image-based storytelling and the transmission of language through visual representation. Each of the four prints developed for the project Gaawaa, Dhinawan, Walgett and Burrigan tells a story that refers to and conjures her Yuwaalaraay language.

> This incorporation of an illustrated version of language associated with everyday objects aims to add to the use of Yuwaalaraay; bringing the words and their meanings to new lips and ears, and future generations – while acknowledging those that have gone before.[14]

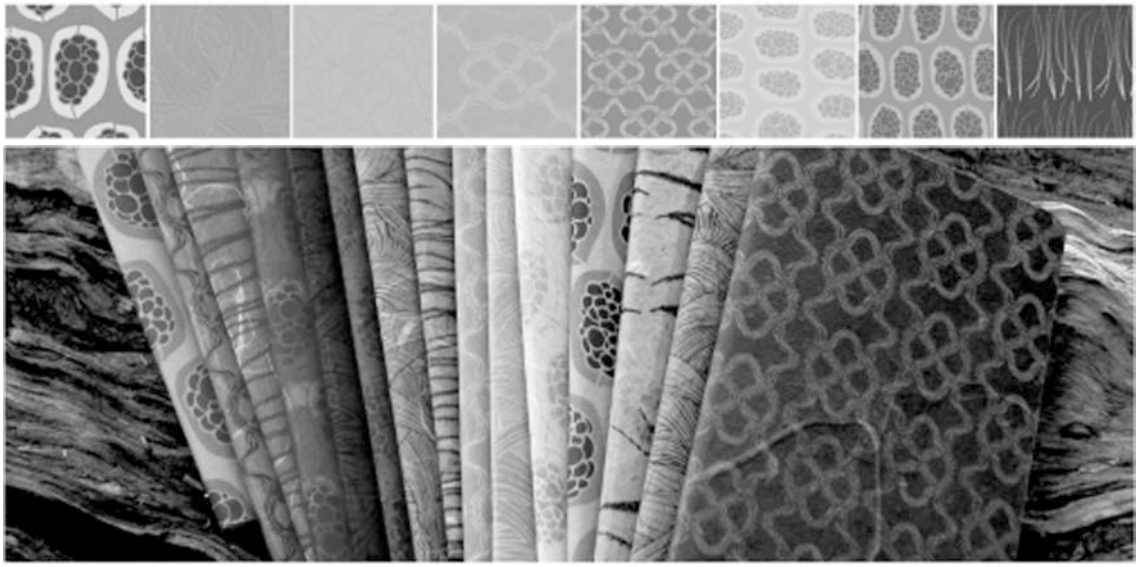
Lucy's Fourth Year Project was selected for the 2009 national Australian graduate exhibition *Design Now!*, an event that toured between the two major Eastern cities of Sydney and Melbourne, assuring maximum exposure for the small group of invited participants. The project precipitated an invitation to speak at the at the 2009 indigeneous textile conference *Selling Yarns* and astonishingly, while still an enrolled student it propelled her, also, into the ranks of *Monument* magazine's "Ten Names to Watch in Architecture and Design", hitherto the preserve of a cohort considerably her senior.

Having completed the academic requirements of the Fourth Year Project, Lucy recently established Gaawaa Miyay (River Daughter) designs and has extended the range, further developing its capacity to mediate narrative of indigenous affiliation, country, and culture. A graduate of the integrated design program, Lucy manages the full range of tasks associated with her business including branding, promotional outputs, publication of work by exhibition and online, as well as the core studio work of textile design and production.

[13] abstract, Lucy Simpson, *Selling Yarns* conference, 2009, Powerhouse Museum, Sydney
[14] Lucy Simpson, briefing notes, 8/7/2011

Figure 10: *Gaawaa Miyay*, *River Daughter* prints

Source: Lucy Simpson



Conclusion

Whilst world leaders struggle to accept the short term political risks associated with shifts to a more sustainable and equitable future, educational institutions must acknowledge and manage the contradictions of public policy and private alarm. The Design program at COFA endeavours to support young designers in finding their own language and enabling change. Our role as educators is to work with students as they first find, then test their own voice, and develop an understanding of what truly responsible design can be. By self-selecting projects located in 'real' contexts, students have the opportunity to commit with enthusiasm to the challenge of creating flexible and adaptable design that responds to the social/cultural needs of their profession and community.

The three examples cited in this paper are typical of students in this context who readily embrace the prospect of cultural change at a local or grass roots level: the place of 'revolution'. They are "acting local" and model examples of responsible action in the world.

Each young designer has re-directed mainstream design towards a more culturally sustainable vision, and found ways to contribute to society with the consideration, respect and joy that places the designed artefact within a system of sustainment rather than a structure of growth and consumption. They act with a sense of purpose and ethical consideration towards the profession, their end users and ultimately themselves.

From little things big things grow… Can design students change the world? Yes they can – one community at a time!

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the Learning Network on Sustainability

Imagine Milan

Storytelling for sustainable city mobility

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"Imagine Milan" is an educational project with a great experimental character for experiencing communication formats capable of promoting social dialogue and innovation, focusing on the theme of sustainable mobility and the city of Milan. We would like to present the results of an initial exploratory phase, which involved teachers and students of the Faculty of Design (Politecnico di Milano) in the draft strategy and artifacts of audiovisual communication, in collaboration with Comune di Milano (Milan Municipality). The videos are instruments for the common and internal dialogue among decision makers involved in the design of infrastructure and, above all, promoters of a new idea of Milan as a sustainable city. In fact, our city is facing many challenging changes towards the Expo 2015. It is therefore useful and urgent listening to the territory, shaping the expectations and collective aspirations and building shared visions of the future for a sustainable city. Project objectives were promoting a **sustainable mobility culture**, building and promoting **a new image of Milan**, facilitating **dialogue** between Comune di Milano and stakeholders. in synthesis, we developed a communication system (CS) according to three main actions: listening, envisioning and promoting.

First of all, the paper will present an overview of the videos and the results. Students were free to choose different techniques and languages to carry our their projects, and they made their films using video, traditional animation and hybrid solutions. Following will be faced the theme of communication to the citizens through the use of storytelling. Or how tales and the "dramatization" of everyday life can lead audience from emotion to awareness, and thus promote the spread of social behaviour and encourage best practices towards sustainable mobility. Finally, we will focus on the relationship between imaginary and scenario, highlighting potentiality and tools of design for envisioning transformation, translating cultural repertoires and producing new visions that are both brand new and shared. In fact, as every project team worked on a specific area and focused on it both the phases of documentation and scenarios visualization. This will make it possible to obtain **a map of the city** of Milan in continuous evolution, which is recorded and made available to the different stages of change. It leads to the activation of a permanent observatory of the transformation of the city.

Introduction

"Imagine Milan" is an educational and research project with a great experimental character for experiencing communication formats capable of promoting social dialogue and innovation, focusing on the theme of sustainable mobility and the city of Milan.

We present the results of an initial exploratory phase, which involved teachers and students of the Faculty of Design (Politecnico di Milano) in the draft strategy and artifacts of audiovisual communication, in collaboration with Comune di Milano (Milan Municipality). The videos are instruments for the common and internal dialogue among decision makers involved in the design of infrastructure and, above all, promoters of a new idea of Milan as a sustainable city. In fact, our city is facing many challenging changes towards the Expo 2015. It is therefore useful and urgent listening to the territory, shaping the expectations and collective aspirations and building shared visions of the future for a sustainable city.

Project objectives:

- Promoting a sustainable mobility culture;
- Building and promoting a new image of Milan;
- Facilitating dialogue between Comune di Milano and stakeholders.

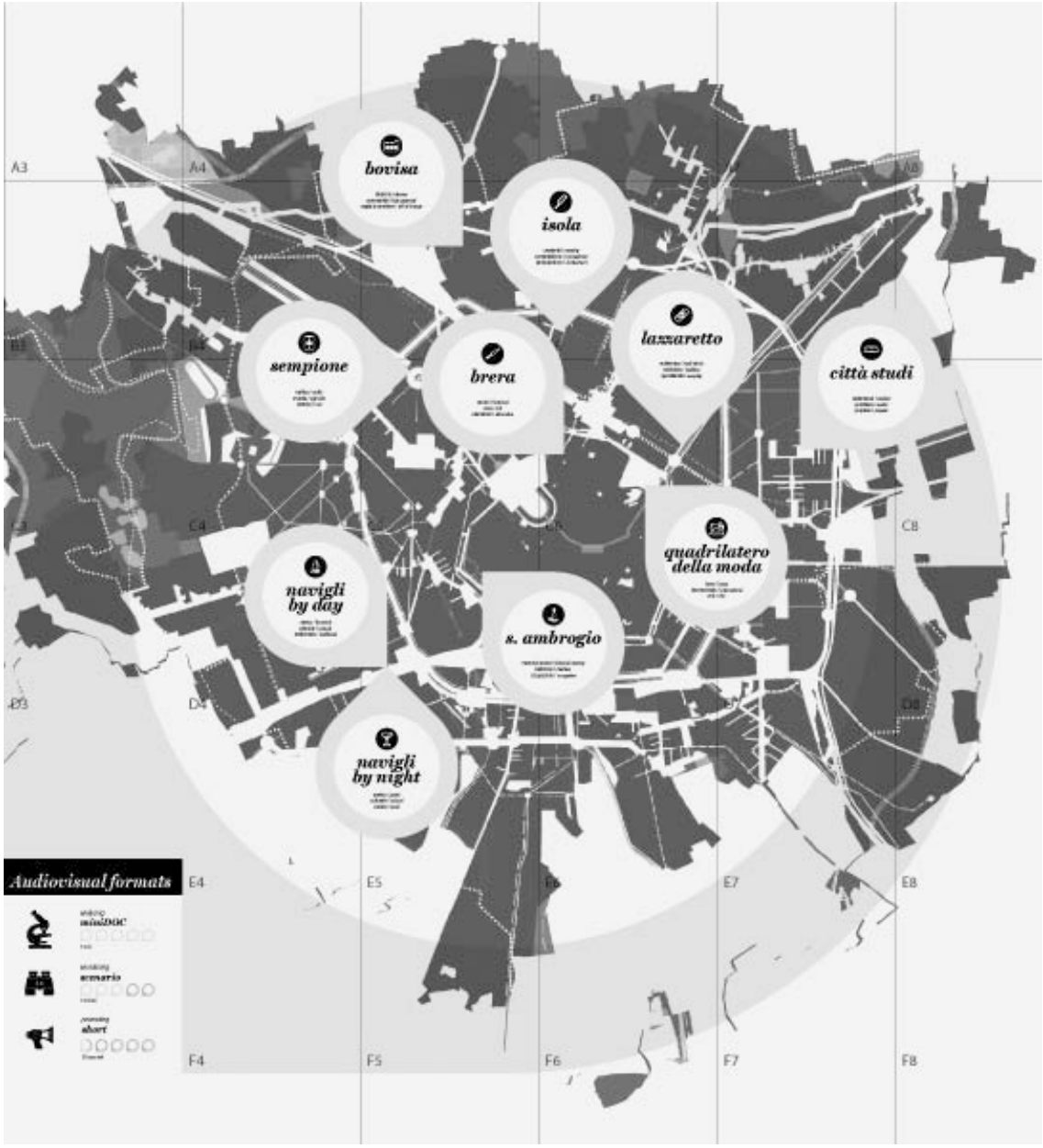
What we did, in synthesis:

Actions		**Audiovisual Communication Formats**	**Themes (sustainable city mobility)**		**Target**
Listening	→	10 *miniDOC* (5 min.)	Walking in Milan	→	Stakeholders and citizens
Envisionining	→	10 *scenarios* (3 min.)	Walking in Milan	→	Stakeholders and citizens
Promoting	→	16 *shorts* (30 sec.)	Walking in Milan	→	Citizens and stakeholders
	→	11 *shorts* (30 sec.)	Cycling in Milan	→	Citizens and stakeholders

What we did, in details:

- Defining **communication strategies and actions** for the promotion of a culture of sustainable mobility in Milan and a new image of the city.
- **Listening** to the territory through the documentation of the transformations in progress and the good practices already active; video interviews with citizens, workers and commuters, associations, craftsmen and companies; the search of footage and iconographic repertoires to reconstruct the memory and consolidate the imagery of places, through the consultation of libraries, archives and the collaboration with Storie Digitali (www.storiedigitali.net).
- **Visualization of scenarios** for sustainable mobility for activating the negotiating-tables and conversations between Comune di Milano, internal stakeholders and actors (technicians and politicians) and the external ones (district councils, associations, merchants and other stakeholders).
- **Promotion** of sustainable mobility values, cycling and walking culture as a mean of socialization and re-appropriation of urban spaces.
- Activation of a permanent observatory of the transformation of some areas of the city of Milan: every project team worked on a specific area, focused on it both the phases of documentation and scenarios visualization. This will make possible obtaining **a map of the city** of Milan in continuous evolution, which could record and make available the different stages of change.

Figure 1: The map of Milan and the 10 areas of interest

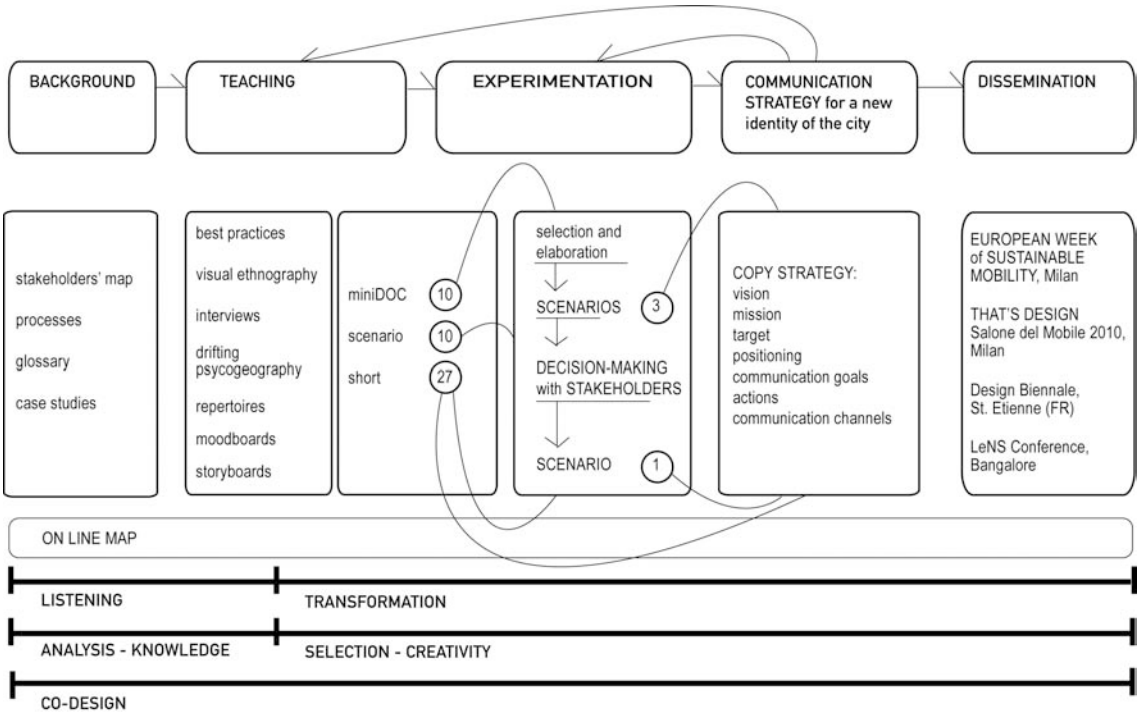


The videos produced are intended for the distribution on urban screens (outdoor; metro and bus), social networks on line, podcasting and broadcasting on local television channels.

The "Imagine Milan" project proposes a collaborative approach between Comune di Milano and the research team, testing activities and practices of co-design for social innovation.

The research process integrates the communication project with the experimentation of innovative tools for collaboration: semifinished artifacts, such as mood-boards communicating the imagery of the area, storyboards and basic visual tools woul be useful during workshops and round-tables. It is based on the critique of a possible future, allowing needs to emerge and stakeholders to share a common path of growth. The adoption of such an approach allows the construction of a new imaginary of reference towards sustainable mobility and a series of concrete actions that accompany Milan to the important appointment with the Expo 2015.

Table 1: Co-design process



An overview

The research and analysis phases became the basis to build the audiovisual projects, from the narrative and aestetic point of view: listening to and exploring the territory were a source of inspiration and suggested patterns to develop the videos.

The first audio-visual format that we focused on was the miniDOC (fig. 2). The video's purpose was to tell in a short length of time (5 minutes maximum) the most important aspects emerged from the previous work of exploration, research and analysis in the area of reference, as well as the critical issues related to sustainable mobility and public spaces.

The direction followed by the most part of designers' teams was making interviews: just edited together, or combined with shots from the area and archive material such as photos and historical films. During the research, in fact, all groups found not only contemporary iconographic repertoires, but also historical archival matherials. Some groups used these materials, often worked out again, to enrich the miniDOC. In one case (*Lazzaretto*) antique prints have been scanned, cropped, placed on different layers and animated as puppets. In others (*Navigli by day*) archival photos were divided into several layers through a post-production process, in order to introduce a sense of depth and movement.

Almost all the works reflect and record multiple points of view, communicated by split screen (*Navigli by night*), by a quick editing (*Navigli by day*, *Lazzaretto*) or by sound editing, superimposing several voices. The miniDOC about *Brera*, for instance, begins and ends without pictures, but only with the voices from many people, communicating the heated debate about the social and urban transformation of such an ancient quarter of the city, famous for its special artistic and cultural identity.

Only one group proposes a different solution, creating a video which is closer to the aesthetics of art than documentary. The miniDOC about *S. Ambrogio* area offers a second level of processing. Interviews, data, photos, became elements to build a script: S. Ambrogio himself, with his "ancient" voice, in a monologue, tells his story, followed by noctural blurred images from the area.

Figure 2: miniDOC

The second format was the scenario (fig. 3), a three minutes video dedicated to the same area, previously viewed, analyzed, documented through miniDOC. Its difficulty was due to the fact that there were no urban or architectural projects to communicate, but the values linked to the sustainable mobility. The aim was not to tell data or real projects, but abstract concepts, and to find ways to visualize them. Here the solutions change radically compared to miniDOC. In fact, if in miniDOC the most important part was given to words and testimony, in almost all scenarios it is given to images and visions. Almost all works don't use dialogues, but just music and sounds. *Brera* becomes a neighborhood without barriers, where children can play in the streets and students of Fine Arts Academy can use the streets to draw and show their work. We can find the same logic in the scenarios dedicated to *S. Ambrogio*, *Lazzaretto*, and *Quadrilatero della Moda*.

How the quality of life can raise, by the introduction of sustainable mobility, is often communicated using a countered relation between subjects and background: actors shooted in green back are shown in drawn landscapes (*Brera*), silhouettes are moving into photos (*Quadrilatero della Moda*), or actors are shooted in green back and worked out again in posproduction to become almost black silhouettes able to act into photographed and redesigned landscapes (*Navigli by night*). In many cases, we notice the use of the silhouettes: a reference to the maquettes of architectural projects, but also to a long tradition in illustration and film animation.

Other scenarios use different logics: *Bovisa*'s scenario, for example, in continuity with its miniDOC, uses the mockumentary style, with fake interviews to residents, in a hypothetical 2020, in wich the area is free from cars. Another scenario (*Navigli by day*) underlines the values related to the sustainable mobility. In this case, words become the film structure: actors are walking and moving in the area, interacting with typographic elements that reinforce the script. In another scenario (*Sempione*), an old man's voice from the future, tells us about an episode happened in his youth when mysterious balloons tied to the cars freed Sempione's area from traffic. Visually, the photos from Sempione's area are shown together with handmade drawings. Insead, the *Isola* scenario, uses a traditional animation technique (stop motion), animating a pop-up book. Each page is a place, which is transformed into what it would be if there were no more cars, but green and public spaces.

Figure 3: Scenario

Finally, each team worked on a very short advertising format (30 seconds) (fig. 4). In this case, the project was not related to a specific area of Milan. The goal was to promote sustainable city mobility and its values and benefits. In this case, the styles and the solutions were very different: from playing with the clichés of cars advertising to micro-tales about love stories born walking. From highly complex digital animation to simple video where small cardboards are used as props and narrative objects. In any case, the action of walking or biking, feet, legs, body, are the thread that runs through all the commercials.

Storytelling for social conversation

Narration is an integral part of human culture. According to the renewed statement by Roland Barthes (1966) “narrative comes along with the history of humanity. There is no people anywhere without narration”. Likewise, the American screenplayer David Mamet (1998) notes that each of us tends to dramatize the story of his personal experiences to create an empathic relationship with the audience. The narrative represents a so natural and deep-rooted need that we can define the human being as “homo narrans” (Fisher, 1984).

Recently the importance of storytelling has been revived with success by various sectors of social life: from business to policy, from marketing to professional training, so as to include project activities in general and design in particular. In other words, it was rediscovered that narration doesn’t identifies just the ability to build more or less attractive stories but it represents, above all, an organizational thinking, a fundamental tool for understanding the entire society and its changes. In fact, according to the theoretical contribution by Brunner (1985) there are two different but complementary cognitive processes. The first is the paradigmatic one, which is based on a logical-scientific and linear thinking, admitting a unique form of representation. The second is the narrative one, which focuses on human actions and events through a series of plural and contemporary performances based on myths, symbols, analogies and metaphors.

Figure 4: Short

If the paradigmatic thought is based on the opposition true/false and places the observed phenomena within a general law (where the connections between one element and the other is rigid and causal), on the contrary narrative thinking includes real and imaginary data, using a variety of perspectives, constructs open causal relationships, and mainly adopts subjective points of view or a vision of reality filtered through the consciousness of the characters. On one hand we have scientific objectivity, which divides and classifies; on the other the subjectivity of the narrative blends reality and imagination to provide a representation which is not scientifically accurate but authentic (and therefore likely plausible) of reality as we perceive it. Authenticity, in this case is measured on the ability to view, play, and conceptualize the human experience.

As a system of organization of thoughts and knowledge, narrative therefore plays a series of fundamental functions for both communities and individuals, that we can condense briefly in a few keywords:

- *Frame*: all stories provide a "frame of reference" that includes the narrated events and in which the spectator can place its own life experiences and make comparison. This function is even more strengthened in cinema and audiovisual tales, in which the concept of "frame" (related to the idea of "a window on reality") takes a real "phisical" identity that isolates and highlights the value of images (Elsaesser e Hagener, 2007).
- *Memory and identity*: tales represent storages of collective, individual and autobiographical memories through voices, words, images, gestures, languages. Those shared memories are going to become a collective identity.
- *Conversation*: storytelling as a tool for sharing and dialogue between individuals and organizations, that facilitates and guides social behavior in terms of responsibility, integration, best practices, sharing of knowledge and values towards change.
- *Imagery*: storytelling practice makes society able to review its past, codify and frame the present and represent its future espectations.

Storytelling enables all these functions from an essential element: dramatization. Each story is actually a representation of a conflict. Characters are individuals in a perpetual struggle with their fate and the environment around them, suffering and struggling to achieve a specific goal. Drama is the real drive of

any narrative, the element of the discourse that creates the bond with the audience allowing him to portray himself and his own experience in the history that is listening to. The mechanism of the drama not only applies to the narrative genres of fiction or entertainment (film, tv series, reality show), but it's also functional in the context of social communication and management referring to citizens and stakeholders. Representing the transformations taking place, promoting innovative services or spreading new behaviors means first of all clashing with the resistance, fears and prejudices that the public opinion shows against any process of change. Nowadays communication cannot simply reassure the audience or enhance the performance of objects and services. Storytelling, in fact, has to tell this emotional conflict and then solve it, triggering a process of identification that turn the viewer into an active subject (storylistener) whithin the communication process.

The Imagine Milan project tried to test and verify the potentialities of audiovisual narrative within social communication. In particular miniDOC and scenarios clearly show that the identity of an area is built right from the representation of personal and collective histories of its inhabitants, a set of polyphonic images, faces, voices, gestures and characters in a continuous comparison (sometimes, indeed, stressful and conflictual) between the historical memory, the complexity of the present and the future expectations.

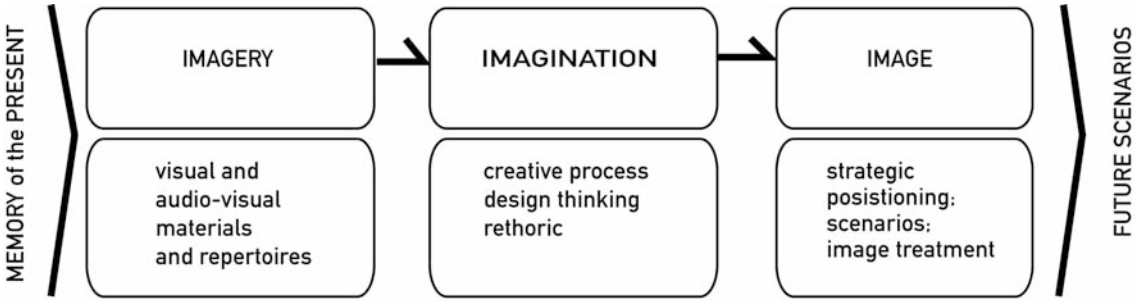
Imagery and scenario

The experience so far conducted represents an experiment of the contribution that communication design can give to the dialogue about possible worlds and sustainable innovation. In particular, audiovisual formats are proving to be complex artifacts both as expressive languages and from the production processes poin of view, as far as they can trigger networks of expertises and knowledge towards representation and mediation. As sustainability is "a social learning process" (Manzini, 2003) design as a social process can equip itself with forms of visualization, simulation and storytelling such as mise-en-scène and framing to facilitate the design conversation, support the learning process and negotiate controversies between the stakeholders. Tales and visualizations are therefore conceived for idea generation on one hand and for prototyping on the other, bringing tangibility to ideas in order to catalyze the process even further and also informing and shaping the project itself. Such images have to be designed: ideas as mind images and images as concrete ideas to be discussed. We can call it design audiovisual conversation: a process between imagery and scenarios where videos represent tools for activating relations and memory processes, but also the imagination process for the configuration of possible worlds.

Johansson et al. (2007) proposed a model of documentation in design practice, distinguishing between discourses about the past (retrospective) and discourses about the future (progressive), that may be more related to the product or the process; to the form or the content. Generally speaking, this kind of model let us mapping our work as practice-oriented or theoretically directed; towards documentation or solution; as realistic, photographic, abstract, geometric or diagrammatic according to the expression axis.

Similarly, the communicative effectiveness of the videos designed and produced for Imagine Milan work on the synergy between different formats and genres, each of them is consistent with specific strategic goals. In fact, assuming audiovisual storytelling as design practice, the three main actions Listening, Envisioning and Promoting correspond to the brief communication formats called miniDOC, video scenario and short, respectively producing Imagery, Imagination and Image.

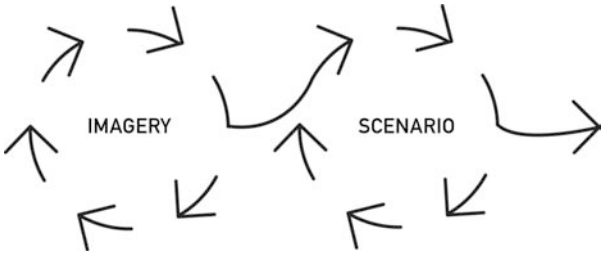
Table 2: Imagery, Imagination, Image



Design contributes to the definition of expectations and needs, acquiring, looting and re-creating a catalogue of images, promises and life styles capable of orienting the individual choices. Looking at the imagery as a cultural and trans-cultural archive of themes, figures and common habits is a fundamental approach to the configuration of possible scenarios for the transformation of everyday life into a sustainable one. It's like looking for and collecting "minimal everyday mythologies" and defining both basic tools and systems for design for observing (just think about visual ethnography or ethnographic cinema), envisioning and telling stories. The realistic and fantastic registers of representation refer to the "archaic universe of doubles" (Morin, 1982) and are based on audiovisual genres that contribute to the registration or the fictional construction of the world, according to an epistemological model of sense making, which has its own technical, aesthetic and linguistic tools for translating and making knowledge explicit.

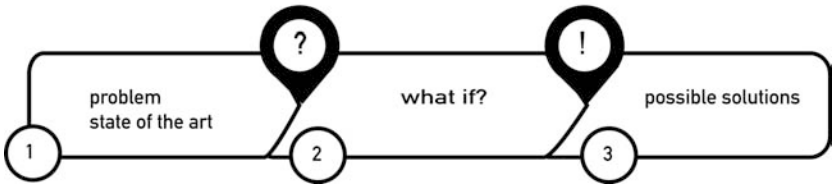
Imagery and scenario are thus strictly related and are intended to regenerate each other (Piredda, 2008) according to a dynamic co-evolution path.

Figure 5: imagery and scenario



In particular, during the Imagine Milan project we experimented a specific format for video scenarios, based on a three minutes duration and a three-acts narrative structure: the first part introduces or defines the problem or the state of the art; the second part or, better say, the turning point asks "what if…?", the typical design question for future scenarios; the third and last part proposes, explains or "metaphorizes" possible solutions.

Figure 6: video scenario's narrative structure



The experience so far conducted has started a process of exploring tools and audiovisual expressive forms to integrate the cultural humus and the personal experiences into the interpretation processes, thus leaving behind the willingness to universalism typical of modern communication and rather addressing to restricted and close communities of users (Lupton, 2008). Communication design can hence provide an epistemological and aesthetic contribution to envisioning our future. To do this we are seeking semifinished artifacts and systemic formats for translating complex visions and tales, towards an "audiovisual design thinking".

Movie design for sustainable mobility: from promotion to a map of the transformation of the city

Since the Faculty of Design of Politecnico di Milano introduced multimedia and visual communication into its teaching programmes, new responsibilities and also the application of different skills have been introduced to increase the already widespread world of communication. Visual design has increased its perspective: multimedia, interface design, web design, virtual project, photography, video. It has also

been fed by the economy of communication: marketing, strategies of communication, market analysis and all that is related to the meaning of communication and company. The company communication is therefore broadening out its horizons. Today companies (publics and privates) possess complex and organised systems for communication. All the aspects of communication – advertising, direct marketing, public relations, commercial television, web, multimedia, events, media planning – aim to create the corporate image, to strengthen its notoriety and its credibility towards its target of consumer. They also aim to create new margins of profit, giving to the companies the chance to become more and more competitive on the global market. This process, which requires many skills, large investments, development strategies with many economical variables, is the first step for the creation of the brand. This process applies the mass market but also the more complex fields that concern the city marketing and new strategies in the green economy.

In the brand there are many plus related to each other: reliability, originality, credibility, elements connected both to the product/service and the company. Those elements produce a positive perception in the user. At the same time people appreciate the emotional involvement that a brand can stimulate, looking for new experiences. In the complex architecture of communication, then, image-movement represents the meeting point of the advertising and the research of new languages of representation and visual design. The situation is the same either if it is an advertising short, an institutional video, a set design for big events or a flash animation for the web. Significant examples are the fair's booths, the big promotional events, the fashion catwalks, the theatre but also the point of sale, the setting in particular occasions, exhibition's opening, shops and other, all placed where the techno-communicative dimension has an important role as attraction and sign of innovation.

We are aware that, today, communication design has to use new forms of experimentation in order to bring new lifeblood to the converation between stakeholders in the market field, which is sometimes flattened by the standardisation of the communication products, towards social innovation. The so-called movie design area holds multilevel requests and uses transverse instruments. The concept of Movie Design implies the union of technologies and strategies for the development of their contents. In this perspective the concept of multimedia, closer to a techno-centric vision, combines with a multimodal concept. This is a word that defines a more cultural approach to the digital world, in which all the channels and communication's instruments are used in a renewed relationship man-machine, generating different and more complex communicative modalities.

In order to face the project of dynamic communication artefacts we have to get complex skills structured in 4 levels, which are connected each other:

- technical skills: the "tools bag", a metaphor, but also a real instrument to face an audiovisual and multimedia communication project;
- linguistic skills: the grammar elements that make sense and allow the interpretation of image-movement and the objective of the communication project;
- aesthetic skills: knowledge and sensitiveness coming from the art and the fields of linguistic and technical experimentation;
- strategic and creative skills: we can find those skills in the field of design of course, but also whithin the economic world, in particular management, marketing and corporate communication which are strongly and historically related to the promotional activities, providing additional tools for design practices.

In the field of company communication the strategic skills and the one related to the multimedia production are usually developed in different places, by different teams: in some cases they are applied directly by the companies, in other cases the advertising agency project the entire communication campaign, from strategy to creativity. Newly, a different approach to the project has been developed, due to the improvement of digital technologies, which make production more flexible. In this case, just one team has the responsibility to coordinate all the four areas: the technical, the linguistic, the aesthetic and the strategic and creative one. This idea of unity is the fundament of the Movie Design practices, in particular whithin the educational experiences.

The Imagine Milan project, we propose here, is part of the Movie Design field. In fact, the communication system proposed and implemented in collaboration with the Municipality of Milan (documentary, scenarios, adv shorts), used all the elements that characterize this new area. In particular:

- the company was represented by the Municipality of Milan;
- the market analysis was focused on finding international best practices;

- the goal was to build communication tools for dialogue and social conversation and raise awareness about the need for virtuous behavior in relation to sustainable mobility;
- the communication products were oriented to a conversation between stakeholders and to a wider audience (a community of interests) through the web channel.

The result of this action-research – a map that can be updated and can therefore represent a vision of the changing city – has shown that communication is a powerful tool for building dialogue and envisioning scenarios. The images illustrate and inspire storytelling and behaviors that may change the relationship that users have towards the city, towards a more sustainable urban living.

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Embracing sustainability in design formation

The experience of Universidade de Brasília – UnB/Brazil

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This paper presents the work carried out by the Design Course at the *Universidade de Brasília*, regarding the inclusion of sustainability issues in the analysis and design practice. Information based on the pillars – research, training and practice – that supply constant feedback to the debate of sustainability in design activity, will be provided. In 2008, a laboratory of socio-environmental design was created in the course to enhance research and extension complementarily to teaching activities. The optimization of existing administrative academic resources was used in order to streamline processes and to work with a reality of several difficulties. The most valuable contribution of this experiment is the search for significant "system discontinuities" in the awareness and in the work with materiality, stimulating the use of whatever is at hand, in a slow and deep way. This process has been an effective means of incorporation of sustainability issues by design.

1. Introduction

In order to contribute to knowledge exchange about initiatives and experiences in the integration of sustainability thinking and design practice, this article presents the work that has been carried out by the Design Course at the University of Brasilia, regarding the inclusion of sustainability issues in the analysis and design practice. For this purpose, we shall discuss important information for understanding the context in which this process takes place, such as characteristics of the Brazilian public higher education, public policies development, local labour market, relevant cultural aspects and a brief history of this process. More specifically, we will provide information based on the pillars --research, training and practice -- that provide constant feedback in the debate of sustainability in design activity.

The most important cause of the origin and development of climate changes, with negative and irreversible impacts on environment was, undoubtedly, caused by man. For several reasons, depending on time and culture, man has behaved as if his actions did not have any consequences, in spite of all his knowledge about natural history, zoology, botanic and others such areas, acquired through scientific advances. The relation between social and environmental problems is quite close when one knows that the determining factors of human being sustenance are: environmental resources, artificial environment construction and the reciprocity in the social area (FRY, 2009: 24). If one of these factors does not occur, an unbalance in the means of survival and in society as a whole is produced. The search for the reversion of this situation, in which *unsustainability* rules, requires a strong will on the part of political, social, cultural and economic forces.

In this context, how to update, monitor and contribute to this process through a professional activity such as design, the considerable impact on socio-technical systems?

The focus in Design Course at the Universidade de Brasília in keeping with its surroundings as an object of study, due to the fact that "the forms of knowledge are always and inevitably places, inseparable from their instruments and their wrappers" (GEERTZ, 1997: 11). The design process is not thought differently. According to Manzini, before occurring at a macro scale, in sociotechnical systems in which design is guided, systemic changes or discontinuities occur only as "discontinuities, ie, radical changes at the local level" (MANZINI, 2008: 19).

The design suffers an adjective – sustainable design – the process of assimilation of the environmental issue in professional activity. Sustainable design would be one of the blocks, which Papanek refers to when he says that the division of institutional knowledge that designer should trigger inhibits innovation and efficiency solutions. Graduates leave the course with some know-how, a lot of skills and a significant aesthetic sensibility, but with almost no methodological resource for insights. Our role is to offer ways to break these blocks (PAPANEK, 1984: 172). The factors involved should not be treated in isolation and the first stance to take is to provide resources to stimulate and motivate creativity.

The environmental issue is structured and configured as social and ecological problems of global reach, operating in all spheres of the social organization and the State (LEFF, 2006:282). A reorientation of knowledge about an environmental issue is now based on three levels:

- Conducting research and application of scientific and technical knowledge based on social demand;
- -Integration of various processes and a set of existing knowledge around an object of study and common problems;
- Questioning the theoretical paradigms of different sciences, elaborating concepts, creating new themes and building new interdisciplinary objects of study. (LEFF, 2006:283).

In addition to considering these three levels of reorientation and restructuring of knowledge, the first questions about what to do and how to include social and environmental issue in the daily academic design, we sought, first, to raise the existing conditions and use regulations at the administrative and teaching levels available within the university.

One of the articles of the Brazilian Constitution reads that universities have an obligation to work on the principle of indivisibility of teaching, research and extension. The University of Brasilia, as well as other public universities in Brazil bring together three important actions to accomplish the training in different areas that meets: teaching, research and extension. It is understood here that the balance between these actions promotes a more complete and effective training, because it allows the student to combine the content learned in courses, research and knowledge production at the local, national and global realities.

Under graduation in Brazil is associated with higher vocational training and allows students upon completion to exercise a profession or continue their studies at postgraduate (masters and doctorate levels). Brazilian education is structured in large areas, which are subdivided into disciplines, creating an artificial division of knowledge and this fact has negative consequences on student training by the difficulty to synthesize such knowledge into an organic whole (COUTO, 2008: 27). This break-up, apart from being antagonistic to the interdisciplinarity of design isolates the context of their professional training of social problems, resulting in a course closed on itself.

The research is presented to undergraduate students through what we call, in Brazil, *scientific initiation*. Contact with the development of research allows students to enjoy either a professional's or critical and reflective researcher's life, committed to ethical principles, renovation and social justice. However, the reference base necessary to instrument students in their academic careers or professional lives focuses not only on this type of activity, but also on lectures and practices, participation in experimental projects and research, monitoring, preparation of monographs, individual studies and group participation in scientific events which are activities that must be articulated in everyday academic.

The university extension, in turn, is the academic resource, which promotes the interaction between the university, and the community in which it operates. It is a means of exchange, by which the academy serves the community through knowledge and assistance, and it receives information about their expectations and needs, learning with the knowledge of these communities by a process of feedback. The extension represents the consolidation of the practice in the students training to complete the cycle of understanding professional performance through its applications.

Thus, the cycle is systematized by the complementarities and interdependence between these three major cases where improved and research produced knowledge are disseminated through education and extension. One of the major obstacles to the implementation of socio-environmental issues in shaping design was the dislocation, in academic daily practice, between these three types of activities – teaching, research and extension. The creation of a laboratory to joint all these actions was the means found for the implementation of a social and environmental oriented design training.

Faced with this situation in full swing, in which the compromise of design is broad and deep, the implementation of the laboratory sought to gather and organize, first, a framework of knowledge on the basis of socio-environmental issues that a more reflective, critical and aware teaching of design. Besides

seeking to respond to market demands, the proposal of this project aimed to meet a demand for more social conscious attitude with new principles, values and habits. The intent was to make the participants of the training in design – students, teachers, along with members of the academic community and local society, assimilate a wide range of possibilities for addressing, identifying and recognizing where and how to act with the knowledge acquired in the course. The aim is also that this initiative has influences on the basic curriculum, through the pedagogical principles that govern the course and, more importantly, in developing such activities in daily training in design at UnB.

2. Methodology

Based primarily on the precepts of open science and the undeniable need for a process of "systemic discontinuity", in early 2008, a laboratory of social and environmental design was created in the course to enhance research and extension (set of activities done with and for local communities), complementary to the projects developed in disciplines.

The production of more effective knowledge includes not only the general precepts produced in each area of knowledge, but also how each individual in the proper context works with these precepts, getting to understand the effects of one's actions beyond those provided by the planned objectives. Adopting the practice of researching not only the object of study but also the methodology used to develop it, in order to have a significant familiarity with the medium on which the research is directed is what governs reflexive ethnography.[1] "Reflexive ethnography aims at explaining both the object of research and the approach employed during the research, from this hypothesis: both are not only linked but the knowledge of one of them also allows a better understanding of the other." (COULON, 1995: 88).

In the initial phase of the laboratory activities, we opted for action research as a methodological procedure to include, in addition to participation, planned social, educational and technical actions (THIOLLENT, 1998: 7). In questioning the best means to achieve effective results, we took into consideration the short period of time that students have to get involved in projects in the lab. Because they have to comply with other mandatory activities within the flow chart of the course, undergraduate students with research projects and extension program within laboratories are involved for the average duration of one year.

Based on the methodological lines mentioned above, more specific actions are being taken in the laboratory, namely:

- Identification of areas of operation in which the design can operate in the development of projects of great potential for solving social and environmental issues, such as: life cycle of products, specification of raw materials, clean energy expenditure in production, workforce, location, transportation etc;
- Proposal and implementation of environmental education in the fundamentals of academic didactic procedures;
- Survey and analysis of contemporary habits through the ethnographic study of local society (Brasilia and surroundings), taking as its starting point the campuses of the university to propose design procedures in design from these data;
- Survey of local production from small productive groups to large corporations, in relation to their resources, processes and contexts, to enable the implementation of a teaching grounded in the development of joint projects between researchers (students and teachers) and local producers;
- Delineation of the profiles of undergraduate students and the egress of the course, based on contributions proposed by the laboratory for continuous evaluation of the work offered by the course to society.

[1] This observation was made by Steve Woolgar and Bruno Latour when observing life in a lab.

2.1. The creation of LADES

Laboratório de Design Socioambiental – LADES (Social and environmental design laboratory), was launched at the Department of Industrial Design (*UnB*), in march of 2008, due to the recognition of a research group registered at *Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq* (National Counsel of Technological and Scientific Development).

The conjunction between theory and practice is the main motivating factor and scientific principle in the conception of this laboratory. An academic system, which aims at making up designers through research and social/environmental projects – with broad contextualization concerning ethics, culture, environment, technology, aesthetics and society.

As shown above, the division of the course in disciplines is insufficient because it does not help students in the process forming the professional, such as questionings, ramifications, speculations, conclusions and positioning. Research, fundamentally, allows the integration between practice and theory, in a relationship of complementarities and renovation. Conscientization, here understood as the conjunction of rational, logical, understandable, intuitive and sensible aspects of cognition, in a balance characterized by their interdependence, is what makes the research an act of reflection, analysis and action. The proposal of these laboratory has been based on more dynamism and opening in dealing with knowledge, aiming at promoting reflections and proposals of bettering for social and environmental issues during the whole life cycle of products and services, through design, complying with the request of communities both internal and external to the university, preferentially in partnership with other areas of knowledge.

The mission of *LaDeS*, with the array of activities it is developing, is to favour as well the formation of students and professionals involved, as the social inclusion of the communities served, in accordance with their claims for the promotion of citizenship, the well-being of society and their relation with the environment. In the beginning, research guidelines were organized as followed on table 1.

Table 1: Research guidelines and goals of *LaDeS*

Source: Siqueira, 2008

Research guidelines	Goals
. Professional formation for social and environmental issues	The main goal of this group of research is to provide the students with reflection and experience in social and environmental issues so that they can design in a more conscious way and thus act according to the necessities and realities of society.
. Study on the methodological proceedings, technologies and materials for specification in project and its production.	This guideline aims at learning the proceedings, technologies and clean materials, developed within design and in other areas, for the correct specification/utilization of such in product design and in graphic design. With this knowledge, it will be possible to teach productive groups.
. Study on utilization of solid waste	The study on domestic and industrial discharges contemplates the use of solid waste generated in the development of product projects realized by incubated groups, or even large-scale production, aiming to contribute in reducing the content of dumps and landfills and in generating income to people not included in the labour market.
. Research and development of inclusion projects	Research and development projects in visual programming and product design to meet the needs of people who go through social exclusion, due to limitations and disabilities (mental, physical, visual and auditory).
. Identity and design management – the relationship between Product and Graphic Design	Study and development of identity in small groups facing the antagonism of market logic. Management of brand identity through its symbols and products, to understand its logic outside the market environment. Creation of tools for design management in small communities.

Currently – based on recent research lines: collective intelligence, design movements (product service system, design thinking, co design etc.) and (new) habits – in the laboratory we work in search of awareness and practice together with students, academic and local communities, through partnerships between

areas, both on the basis of proposals for reuse or adaptation of existing practices, and proposals for new products and services to instil new, more sustainable, habits.

2.2. Disciplines of the course supported by *LaDeS*

Integrating social and environmental issues in the course occurred in a more systematic discipline in **Product Design 3**, which is one of the five project stages that the student develops during the course, including the **Course Work Completion**. However, one of the problems faced in the implementation of sustainability in training design was the short period of time involved – four to five months – from teachers and students with the issues addressed. Although presenting this problem, the discipline has had its importance as a means of initiating the contact of the student with the subject, in his academic journey. From this stage the projects are initiated and taken forward continuing activities within the laboratory.

Another opportunity to include the theme in the course was found in **Directed Studies in Design**, elective discipline (not compulsory) in which teachers can show the students content subjects of research that they develop. Prior to the creation of the laboratory, in the second half of 2007, this course was taught by the author of this article with the theme "design for sustainability", with the aim of detecting those interested in researching the subject. These students and some teachers took part in the formation of the first research group, and therefore of the lab.

In projects developed in the discipline **Course Work Completion**, under the responsibility of the author, since the implementation of the laboratory, only those who have significant approach toward sustainability have been accepted for guidance. Most of them were projects for the reuse of discarded material and products made of recycled material.

3. Some experiences

The realization of these experiments was only possible because of the partnerships that *LaDeS* different areas of expertise realised within the university. The first partnership was with the Social Incubator, a program of *Centro de Apoio ao Desenvolvimento Tecnológico – CDT* (Centre for Technological Development Support) linked to the rectory of the Universidade de Brasília (UnB). The goal of this centre is to promote and support the relationship between university, government, business and society, seeking to strengthen economic and social development in the region, through increased entrepreneurship and technological development. The Social Incubator deals specifically with the development of entrepreneurial skills and professional community groups of artisans and local farmers, based on concepts of sustainability and valuing human life. The associative and cooperative movements are the means of integration of these groups in economic life and are based on the principles of self-management, solidarity and democracy. The partnership with this program has been crucial for enabling the contact of students with real demands.

We tried, also, to perform another type of partnership activities in the lab – which brings together different areas of knowledge within the university. So far *LaDeS* has already used knowledge of courses such as chemistry, transport, mechanics and mechatronics engineering, architecture and others.

Inevitably, the service design principles, even in their infancy, were seen as more than adequate for use in projects with social and environmental focus. The effectiveness of the contribution of design in this issue can only be achieved in its multiple aspects: design working with other areas of knowledge, systems and integrated products against specific actions and isolated consideration of the local and global levels to meet the improvements and changes as a whole. Thus, service design only came to crown the methodological bases of the work being done in the laboratory.

The cases shown below exemplify the principles used in *LaDeS*, such as action research, reflective ethnography, real demands, working partnerships and service design.

In March, one of the **Product Design 3** projects was continued within *LaDeS*, meeting a demand of the Social Incubator for one of their incubated groups *CENTCOOP* (garbage collectors cooperative). Currently, the work of this cooperative is the collection, selection and sale of solid waste without any beneficiation. Some recycling is done in a disorderly and inefficient manner for internal use. This project was presented to and approved by the *Ministério da Educação* (Ministry of Education) as a proposal to integrate the actions of *LaDeS* and *LabModa* (Laboratory of Fashion), both laboratories of Design Course. These actions occur through the offering of entrepreneurial training in productive and commercial activi-

ties to be undertaken by beneficiaries – cooperative / incubated. The proposal aims to offer other options to the activities already realized: garbage collection, carpentry and seamstress services, enabling them to a systematic intervention in the lives of their own communities, from the acquisition of new skills that will enhance and expand their productive practices, their work space and housing and their skills in managing their own activities through the creation of partnerships. The project will be conducted involving groups incubated by the Social Incubator, which perform sewing activities and the cooperatives of scavengers of *cidade Estrutural*, the work of selective collection of wood and cardboard, along with the disposal of scraps of fabric from clothing of the *Distrito Federal*, for the manufacture of furniture primarily to meet the needs of their own homes and later for commercialization.

In the first half of 2010, in **Product Design 4**, offered by the author, students had to develop projects based on real demands; the introduction of service design for UnB demands on its four campuses and for the demands of local society, developed in partnership with other areas within the university. Some projects will be continued within *LaDeS* and as **Course Work Completion** for students that are developing, for example, the mobility system within the campus where the Design Course is located and between the four campuses of UnB; an exchange system of scholarly information between different areas of expertise of the university; system of social integration through the daily activities of a condominium of kitchenettes in *Brasília*.

4. Conclusion

The experience reported here is the quest to develop a work with what you have, optimizing the system tools available for education and using, with their needs and knowledge, the problems of the university and local society.

Despite the establishment of the laboratory, the discussions on this subject are incipient at the curriculum level. More general aspects of national culture such as the disengagement from the social reality are still barriers. Sustainability still carries the character of a fashion, as well as design itself, in Brazil. These factors cause the trivialization of this issue, which are regarded here as one of the first challenges of this endeavour.

The process began with mechanisms to combat the mismatch between actions and areas of knowledge within the university, and over the insufficient involvement of students with the proposed project within the course and has being spreading slowly because it is a process of awareness of the responsibilities of the professional activity.

The integration of sustainability in the formation of a designer goes through in-depth measures of many kinds. Beyond the lab, one must run changes in broader areas such as in the actual teaching project of the course, improving the curriculum to enable the students to have the conditions of reflection, knowledge acquisition and action within their own social, cultural, economic and political reality, to implement the necessary changes through design, as well.

At each step covered in this process of integration of socio-environmental issues in design, this study confirms the hypothesis that the foundation work should be done in the social sphere. The essence of the question here is based on reflections on the sociological and environmental performances of design projects, as a means for behaviour changes in relations: man – man and man – environment.

The initiatives taken worldwide in order to embed sustainability as a basic requirement in design carries special features in different contexts. This diversity shows the uniqueness of each of these experiences. Another factor to be highlighted about the experience reported here is to optimize the use of existing administrative academic resources in order to streamline processes and work with the reality of difficulties of every sort. The valuable contribution of this experiment is the search for “systemic discontinuities” in significant awareness and in dealing with materiality, working with what has been so gradual and profound. Thus, we find that this has been an effective means of assimilation of sustainability in the formation of a professional activity, in this case design.

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Design Systems and Service: an inter-disciplinary, experiential, design studio

An Australian perspective on teaching systems and service design at undergraduate level at the Faculty of Design, Swinburne University of Technology

Mark Strachan
Swinburne University, Australia

In 2006 the Faculty of Design, Swinburne University, started planning the creation of a suite of 'core' subjects that all undergraduate students from Communication Design, Industrial Design, Interior Design and Multimedia would undertake during their thre years of study. I was given the opportunity to create, and lead, a 3rd year studio called Design Systems and Services that was conceived as a way to formally introduce students to systems/design thinking, user-centred design approaches and service design methodologies.

Students are challenged to envision new futures that address the primary context of sustainability. The studio also participates directly with the Victorian Eco Innovation Lab (VEIL) to establish particular themes that ground projects within specific social contexts, physical terrains and to deal with topics that are challenging to Australian society.

The studio is inter-disciplinary and team-based which in itself creates interesting dynamics. Many of the concepts and methodologies employed are new to the students and observing their engagement in these experiential process is very revealing. This paper presents findings from the studio that will provide insights to the pedagogy of systems and service design drawing evidence from project developments and outcomes, including critical reflections completed by the students.

A Systems and Services Opportunity

Major changes in curriculum provide great opportunities to advance teaching and learning and, in this particular case, enabled us to seize the chance to promote sustainable systems thinking in design education. In 2006, the Faculty of Design, Swinburne University, undertook a program to create a suite of 'core' subjects that all undergraduate students from Communication Design, Industrial Design, Interior Design and Multimedia Design would take together. The subjects were developed to provide aims, learning objectives and content that would be relevant to all disciplines and to be delivered in multi-disciplinary studios. Amonge others, for example, these subjects included studios titled: 20th Century Design, Methods of Investigation, Managing Design and, more pertinently, a subject called Design Systems and Services which was assigned to me.

Having been involved in Product Systems and Services design and practice for over 25 years I was immediately aware that an inter-disciplinary approach would be very beneficial for the teaching of systems and service design and that it would allow students to be brought together in such a way that traditional discipline specific structures routinely prevented. Consequently, I could see the potential to adopt a

team-based approach that could take advantage of their respective discipline backgrounds – an opportunity to learn about each others skills and approaches but, more importantly, to collaborate and engage productively.

> "The fact that our group had members from different disciplines also helped, not only with our visuals but in terms of thinking differently. We each were able to offer varied ideas, opinions and solutions which I think made our project a lot stronger."
>
> 3rd year Interior Design student, 2010

This new Design Systems and Services studio was also intentionally positioned to cater for a maturing cohort and targeted 3rd year students, many of which were in the final year of their studies. This was important because of two key factors: Firstly, the potential enormity and formidable nature of systems and service design itself – especially for the uninitiated – and, secondly the demanding delivery format that comprised of a one hour lecture and a two hour studio per week over a total of a 12 week semester. The latter representing 25 per cent of a typical semester workload for the students. These factors, gave rise to some interesting pedagogical challenges. Owing to the diversity of the student backgrounds and the enrolment points into the university, you couldn't readily assume that the students had any common prior learning or, indeed, exposure to any of the approaches or methodologies employed in systems and service design. The short duration of the studio sessions, coupled with approximately 360 participants per year, also meant we had to carefully consider how the experiential and immersive engagements and dialogues commonly used in systems and service design could be applied without compromising the ambitions we had for the studio.

Context of Sustainability

> "We are all caught in an inescapable network of mutuality, tied in a single garment of destiny. Whatever affects one directly, affects all indirectly"
>
> Martin Luther King Jr. 16th April 1963

During the initial development of the studio, we could have been very pragmatic and readily adopt a narrow scope with a focus on commercial themes to drive the delivery and outcomes. Nevertheless, at Swinburne University, we have gone to considerable lengths in recent years to integrate and embed sustainability into much of our curriculum and I could see that this studio would be an excellent vehicle to engage students in a broader definition of sustainability and encourage a broader appreciation of the context in which design operates. The intent was to extend the definition of sustainability that may be common within their specific disciplines, for example, for Industrial Designers to be drawn beyond the more direct material reduction and Life Cycle Assessment considerations and into much more holistic considerations. To this end, Anna Tredwell's Four Pillars of Wisdom (See Box 1 for an adaptation to sustainability) was selected as a reading to provide a more comprehensive model for the students.

> "I was shocked, like everyone else, as to how I've taken my life for granted. I mean sure, we've all done LCAs (Life Cycle Analysis) whilst designing various products in my field of Industrial Design, but this class opened my eyes to a much broader examination of the impact any design idea may have on our community, both locally and globally."
>
> 3rd year Industrial Design student, 2009

Box 1: Four Pillars of Sustainability

Source: Acknowledging Tredwell, 2004

Economic sustainability aiming to achieve economic viability that also incorporates and supports the social, cultural and environmental pillars.

Social Sustainability referring to the capacity of a society to provide for the well being of all its citizens and in a fair and equitable manner.

> **Cultural Sustainability** referring to a society that sustains and values cultural diversity and cultural heritage.
>
> **Environmental Sustainability** focusing on enabling all ecosystems to maintain themselves indefinitely.

Once the studio had been established and run for the first time at the beginning of 2007, the sustainability theme also had the unintentional benefit of the subject being adopted as a university-wide sustainability elective. This has since provided an even greater diversity of students taking the subject and adding a further diversity to the make-up of the teams and to reinforce the inter-disciplinary nature if the studio.

In our considerations for the new studio, we could have also created purely theoretical constraints and contexts for the brief but, by fortunate coincidence, under the leadership of Professor Chris Ryan, with whom we had previously collaborated with on an international pilot project called Eco-Sense, launched a new initiative called the Victorian Eco-Innovation Lab (VEIL). This new organisation brought about through the Australian Centre for Science, Innovation and Society (ACSIS) at the University of Melbourne was supported by the Victorian Sustainability Fund, which was established by the Victorian government in Australia. VEIL's remit was to take a new and innovative approach to shaping producers' and consumers' expectations about sustainable futures, and to stimulate innovation for sustainability in Victoria. One of the key functions of VEIL has been to bring together design and architecture staff and students from a network of Victorian universities. The partners include: Melbourne University, Faculty of Architecture, Building and Planning and the School of Land and Environment; Monash University, School of Design; RMIT University, School of Architecture and Design, and; Swinburne University Faculty of Design.

VEIL organised a series of research and scenario 'Hubs' which provided the framework for collaboration and to address particular social contexts, physical terrains and topics that are challenging to Australian society. The overall goal being to identify new eco-innovation opportunities by opening-up the space for innovative thinking about sustainable futures. This was achieved by setting a date 25 years into the future and to initially imagine that we were already present there in 2032 and looking back retrospectively to envision the type of design interventions and initiatives that had taken place to bring about significant positive changes to what were now sustainable lifestyles. This provided an interesting perspective for engaging in design projects and also provided a rich resource of information and, eventually, a repository of project outcomes. We worked closely with Ms Dianne Moy, the VEIL project coordinator, to develop and integrate the VEIL themes into the Design Systems and Services project briefs. This brought the benefit of a strong and real context for the students and often provided opportunities for the exhibition and publication of their work.

For more information on VEIL, see: http://www.ecoinnovationlab.com/

Establishing the Studio

The primary aim of the Design Systems and Services studio is to introduce students to the principles of systems and service design. A number of strategies were considered in terms of the content and learning objectives for the studio and in determining the scope of the studio. We established that we wanted to convey to the students how systems and services actually exist all around us and pervade all aspects of our everyday lives – something that isn't necessarily too apparent unless you have previously explored, let alone questioned, the many social constructions that often dictate our lives. We also wanted the students to think about what role has design played in these systems and services and, more importantly, what role has design, design thinking and innovative approaches have to play in making better systems and services.

The following Learning Objectives (see Box 2) were established:

Box 2: Learning Objectives

Source: Strachan, 2007

- Identify the scope of system and service design in relation to business and the design industry;
- Apply mapping techniques and methods to visualise the system or service;
- Articulate the role design and designers play in the design of systems and services;
- Articulate how the principles of system and service design broadens the opportunities for designers to apply their creative capabilities over a broader spectrum of business and commerce;
- Engage in critical research/investigation and analysis of user(s), their context(s) and the processes relating to the design and development of systems and services;
- Undertake work in collaborative inter-disciplinary teams in the definition and development of systems/services design projects;
- Apply user-centred design principles, scenario-based development techniques and iterative design processes;
- Develop well-considered, expressive and visionary design systems and/or service outcomes.

We resolved that we must challenge conventional thinking and approaches by adopting a process of creating future scenarios where new system and service innovations could be designed and envisioned, and ones that specifically looked to improve ecological performance and support sustainable practices. We decided the most effective way to engage the students would be through user-centred techniques and to adopt a series of creative, often simple, methods that could be employed at different stages of the studio. This gave rise to the following content (see Box 3):

Box 3: Studio Content

Source: Strachan, 2007

- Analysis of user need and demographic context of user(s), client/business, community;
- Modelling and analysis of individual users, organisations, services and systems;
- User-centred design;
- Scenario-based development techniques;
- Sustainable practices;
- Iterative design (design – prototype/build – test/evaluate).

We also included research and investigation phases and an emphasis on critical analysis procedures throughout the project to aid in the their understanding of the themes and to ensure that their developments were robust and coherent. We also stipulated self and peer reviews to ensure that both the individual and the teams were functioning appropriately. The other vital ingredient was to include opportunities for reflective practice which culminated in the submission of written critical reflections from each individual team member. It is the insights from these reflections that have proven to be very valuable for the development of the subject and have been used throughout this paper to illustrate how the students have responded to the subject.

> "Prior to undertaking this unit of study, 'Systems and Services Design' had been an unknown territory to me I had never really considered it or its role within our society (being from a communication design background). At some stage during the initial studio I recall reading on the white board an overwhelming statistic that has since remained with me – '80 per cent of environmental impacts of systems and services are determined at the design stage'. The statistic shocked and amazed me, making me self examine my role as a designer, reflecting on the highly influential role that we (designers) play within society and more importantly our critical role in its evolution. It made me question how we can design more efficient processes and procedures right from the beginning for improved ecological performance and sustainable practice."
>
> 3rd Year Communication Design student, 2009.

Project Briefings & Themes

We determined that the intent of the studio was to provide insight into design's emerging role in the development of systems and services, and to prepare the students for a challenging, yet exciting future where their creative capacity as a designer can provide the leadership to initiate and manage change.

> "The relationship with VEIL made the subject seem more important as I could see how students research is being seriously considered in plans for Melbourne 2032."
>
> 3rd Year Interior Design student, 2009.

In collaboration with VEIL the major themes and contexts were established. Some dealt with quite specific topics such as water with the 'Water Sensitive Cities' theme and others, like the 'EBD: Ecological Business District' which looked at creating a high density, low-carbon urban community located in the heart of Melbourne adjacent to both the existing CBD (Central Business District) and Docklands area. The EBD theme provided a great context: an opportunity to envision the creation of a sustainable mini-city. It was determined that the site would start to be developed in 2014 and to look ahead to 2032 when the EBD development is occupied and all the facilities fully established. The challenge of the studio was to propose new, innovative and sustainable systems and services that support the EBD development and its everyday living activities.

This particular project culminated in a substantial exhibition of the 'Eco City' project outcomes from all the Hub partners in February 2009. The Victorian Minster for Roads, Ports and Major Projects, Tim Pallas, who opened the exhibition said: "….What could be done with this new land? This is where projects such as Eco City have great value. All good strategic planning begins with a discussion and I, for one, believe this dialogue is always improved by the number of intelligent voices involved. In this case we have the brains trust of students and academics from four leading universities, as well as local and international experts generating some very exciting ideas…..[VEIL's] ideas will have a real influence on the site's future."

More recently the studio has enabled us to engage with VEIL in another 'real world' context and specifically addressing how existing communities could create more sustainable neighbourhoods. Broadmeadows, in the City of Hulme, is a place of rich cultural diversity and presents many unique opportunities for innovative design thinking. The briefing we developed (see Box 4) consisted of the following introduction:

Box 4: Broadmeadows Brief

Source: Strachan, 2010

> The City of Hume is a rapidly developing centre north of Melbourne, caught up in many of the problems of burgeoning suburban sprawl, population growth, climate change, stressed infrastructure and impending broad-brush state planning initiatives. VEIL is engaged in the creative task of projecting ways that existing local resources can be connected and revisioned as part of a vibrant, desirable and sustainable future community. Working with Hume City Council and a team of researchers and designers, VEIL has identified a number of key potential areas within the Broadmeadows with the intention to explore and visualise a series of distributed and connected experimental visions for the future development of the region that can unfold towards a resilient, low-carbon future.
>
> This is a unique opportunity for design to contribute to the future thinking and visioning of Broadmeadows. These visions of a transformed future, toward 2032, can build desirable, optimistic expectations, but sites and forms of intervention have to be found today that can shift the dynamics that have shaped past development and release new community energy for change.
>
> Based on one of the topics listed below, your team is expected to explore what systems and service design solutions could potentially evolve within the realms of the everyday activities, environments, organisations and communities of Broadmeadows.

An exhibition showcasing the design work from the hub partners based on design research by VEIL in collaboration with the Hume City council is taking place in July 2010, as part of the State of Design Festival an annual design event promoted and supported by the Victorian Government Design Victoria Strategy.

> "It has been demonstrated throughout the semester how the design skill-set can be used to benefit communities. Through a User-Centered Design philosophy extensive attention was given to the end-user, in the case of the Broadmeadows 2032 project, those who live in the suburb. Design tools such

> as user journeys and maps allowed the designers to appreciate, understand and experience the audience, purpose and context meaningfully. In hand with Eco-sustainability, the two principles together enabled groups to develop design approaches that proved to offer viable solutions to enhance both the community and the environment."
>
> 3rd year Industrial Designer, 2010.

Most of the project briefings we have generated with VEIL challenge the students to look ahead to 2032. This is a time where our lives are conducted and organised in a significantly different way to give scope to create innovative outcomes that would otherwise be restricted by linear thinking, prevailing attitudes and legislation. This approach is intended to free the students from a 'business-as-usual' mindset and to wrestle them away from linear thinking strategies and artefact-based outcomes. For as designers, we often concentrate our professional capabilities on the creation of artefacts and specific deliverables, such as: websites, food branding and packaging, domestic white goods or commercial interiors. Yet these outcomes rarely, if at all, exist on their own either through the stages of their conception, production or use. They are invariably part of a larger, often more complex systems that need to be acknowledged, appreciated and understood but, nevertheless challenged in the pursuit of creating better design outcomes. What systems and service design approaches allow you to do is engage in these more complex contexts, take a wider perspective and generate design solutions that tackle those broader issues of everyday living, working and playing.

One of the important points we emphasise is identifying sustainability as a creative process of change. Something that can be embraced in an imaginative and rewarding manner and, through System and Service innovation, it can become a catalyst to stimulate social change that can influence and encourage more sustainable lifestyles, and patterns of production and consumption.

> "Environmental degradation is due to patterns of production and consumption"
> ("Climate Change is real" – CSIRO report, 26/01/06).

The studio formalises a lot of content through the lecture series and through readings. This includes a series of definitive lectures on the overall subject of systems and service design and the methodologies and techniques employed. They are then supplemented with other special lectures, for example, with representatives from VEIL to introduce themselves and the project theme. Other lecturers have included: service entrepreneurs, behavioural scientists, social constructivists. To support the studio, since the inception of the studio we have used some key readings, including: 'Enabling solutions, social innovation, creative communities and strategic design' (Manzini, 2005) which has served as the first reading to amply illustrate how design is much broader and that it has a significant role to play. Other readings have varied depending on the theme of the studio

> "Before undertaking this subject I had never thought in depth about designing systems and services. I realised how we take these things for granted and by analysing and mapping them we can recognise the weaknesses which may be addressed through design. The focus on sustainability is highly relevant in todays design culture and while we often think about things like using recycled paper stocks vegetable inks, Design Systems and Services – especially the Manzini readings – highlighted how whole systems can be designed for a sustainable future and there should be a shift away from looking at whether the end product is water or energy efficient."
>
> 3rd year Interior Designer, 2009.

> "At the beginning of the semester, the System and Services class seemed a bit of a blur. I was not too sure what was being expected and I found it a bit difficult to understand the whole notion of the subject. But after a while of reading the assigned essays to read and attended classes and lectures I slowly understood the concept. It was all made up from the systems and services around us that would otherwise go unnoticed unless it was studied. From this, I was able to comprehend what the subject was trying to teach us and fully grasp a better understanding of it all."
>
> 3rd year Communication Designer, 2010.

Studio Delivery

Mapping

The first studio session is spent creating the inter-disciplinary teams and undertaking a hands-on mapping workshop titled “Journeys”. Initially, each team member produces a representation of their own ‘persona’ on a Post-It® note comprising of a sketch of themselves accompanied by a short written description. Using butchers paper, they then map their journey to college. We provide few prompts to begin with but then, at key stages, we encourage them to convey more information to enrich the mapping and make them more informative and meaningful. The rudimentary response may, for example, be a simple line drawn from A to B but we then encourage them to understand how someone else will interpret their information and get them to start adding further detail. This could address the different modes of transport (train, car, bike, walk) and to employ visual means to convey the detail with icons or different tracks, for example, footprints or rail lines etc. This process continues with visually adding and annotating ‘touchpoints’ (physical entities of interactions or nodes of change/transition), for example, railway stations, tram stops, ticket machines, tollbooths, parking facilities etc. At certain stages we get the students to share their work by pinning it up and presenting it so they can all appreciate the techniques being used. As they engage further in the exercise, the students are encouraged to enhance the level of information through, for example, the representation of time, the intensity of activity undertaken, their emotional state etc.; elements that contribute to the understand their experiences and the significance or, indeed, insignificance of their journey.

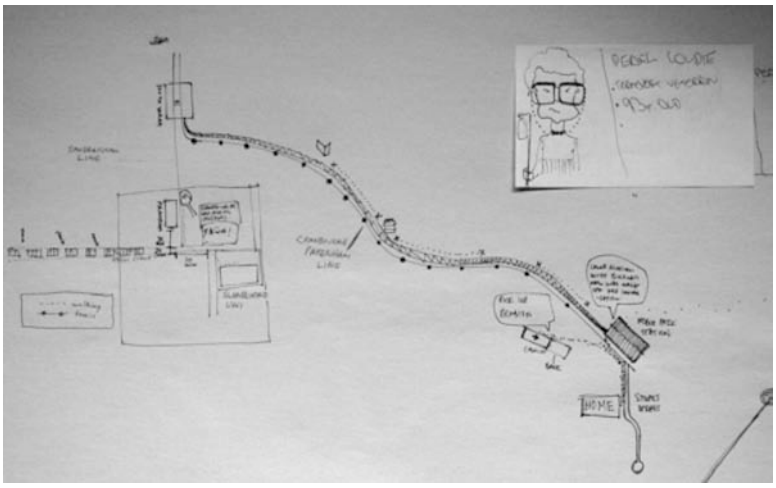
Figure 1: Mapping User Journeys

This mapping process can be extended in many ways. Either by adding a provocation by removing a particular mode of transport, then getting the students to plot their alternative journey, or by requesting them to create a 'narrative' of their journey that introduce elements of character, emotion, motivations, circumstance etc. to augment the overall experience of the journey. The next step in the workshop in-

volves challenging each team to collaborate together to create a fictitious persona or personas and an engaging narrative of their 'everyday' lives and interactions.

By introducing new characters and mapping their 'user journeys' they can have a lot of fun but also begin to recognise how the process becomes less centred on their own personal perspectives and allows them to imagine what it is like to be someone else and see the world through their eyes. This 'empathy' modelling is fundamental to the systems and service studio and a key concept to get across to the students. If time allows, exploring different 'scenarios' and adding complexity or provocations can further enhance the workshop.

Figure 2: User Journeys with new persona



The conclusion to the mapping workshop involves each group presenting their mappings and provides the opportunity to acknowledge the groups that come up with the most engaging, thoughtful meaningful or amusing narratives and user journeys. By getting the students involved in this form of mapping exercise has proven to be a very powerful way in which to immediately engage the students in systems and service design methodologies. This is a direct way in which to introduce common terminology that will be used throughout the studio. The realisation for the student is that they have innately already started to use and apply User Profiles (personas), User Journeys, Mapping, Narration, Touchpoints and Scenario Developments.

> "These activities helped me understand the concept of mapping and touch points and demonstrated how ideas can be translated into images and are not so text-heavy."
>
> 3rd year Interior Design student, 2009.

Research, Analysis and User-centred Development

Depending on circumstances, an initial period exploring everyday systems and services can be very useful and help familiarise the students with what constitutes a system or service. It can also be very instructive to get the students to challenge the assumptions by which we presently engage with them. Interactions with banking machines, using public transport information and ticketing systems and experiences of post office services can often illuminate all the intangible issues that can either frustrate, annoy or delight us. These can be narrated as short stories or mapped and, if useful, documented as case studies.

Where the main theme is concerned, we engage in a process of investigation and analysis as the project teams are expected to produce quantifiable and referenced evidence to support their project developments and deliberations. This often establishes both the enormity of the issues they are addressing and provides legitimacy and justification to the decisions they make. With this as a foundation to their project work they are encouraged to employ a variety of visualisation techniques, broadly termed mappings, to not only represent their analysis and thinking processes but also as an active process of creative development. Multiple representations are encouraged – layer upon layer – to assist in identifying potential points of design interventions and opportunities that could lead to innovative opportunities.

Throughout this process there is an emphasis on the potential users and stakeholders, and of identifying the dynamics and interactions involved. User-centred design principles are employed to provide an understanding and appreciation of what may face the user and to remove the propensity to imagine the world through the eyes of an idealised young student on a perfect day, i.e. that your user may well be aged, infirm, anxious and in a rush and that it may well be raining, with high winds – and not forgetting it is night time and they are in an unfamiliar part of town. The power of persona, character development and lucid narrative is very important and opens-up considerable opportunities for experiential learning.

Scenario-based development techniques

The adoption of the strong narrative that establishes the 'Who? Where? When? Why? What?' is crucial to the user-centred approach and, especially for the purpose of this studio, it is the ability of the student to be taken out of their comfort zone that is of importance and to be able see – and feel – the world from someone else's point-of-view and to gain a greater understanding of their needs, motivations. There are different scenario-based development techniques that can be employed but nevertheless the key is that it must directly involve the student experientially. Techniques such as imagining that you are 'walking in another persons shoes', or of enacting roles and playing out a series of events can be used. Nevertheless, it isn't uncommon to meet with some reluctance – if not outright resistance – to participate, but persistence is essential. Otherwise the powerful revelation of how scenario enactments can provide insights and establish empathy will remain a mystery. If necessary, employing an actor who specialises in improvisation to run a workshop with the students can also bring excellent returns.

Figure 3: Scenario Enactments

> "When designing systems and services, its vital to thoroughly understand who your audience and end user is. Once you understand them and empathise with them, its important to keep them in mind during each step of the design process. Its also inherent in the success of a system or service."
>
> 3rd year Communications student, 2009

When undertaking scenario enactments, it is important to remember that the purpose is not to simply replicate the obvious but to gain in-depth insights, and to identify and expose unexpressed needs. Furthermore, scenario enactments should be used at a variety of stages of the design development process as a means to prototype interactions, identify key moments and to explore different circumstances and experiences. This combines very effectively and naturally with the other systems and service methods such as Personas and user profiling and User Journeys to create richer contexts and more meaningful circumstances. This is also where we encourage the students to contemplate: What if? Indeed a very simple question but one with great potential that unlocks the mind and encourages an openness and creative dialogue – one that is open to new discoveries and possibilities. The intent is to induce a willingness to explore and experiment – a basis for inspiration and pathways to innovation.

Even when dealing with serious topics, elements of humour are also encouraged. This not only fun for all those that are involved but it often exposes the real issues that, handled incisively, can be very poignant and really hit home. This comes to the fore when the empathy that is established with the user is also conveyed to an audience, for example, at a presentation. The ability to engage the emotions of an audience and to make your key points truly palpable is a very valuable asset.

Towards the project outcome

In the latter stages of the studio we introduce the students to iterative design techniques and encourage them to undertake a process of continuous refinement to hone their overall outcome. This cyclical prototype/build – test/evaluate – refine method helps them improve the quality and integrity of their outcomes. In terms of assessment, we are also true to principles of systems and service design methods. We have two formal panel presentations, one midway through the studio and one towards the end. While we provide continuous informal feedback throughout the studios, after the final panel presentation we formalise the feedback and give it to the students so that the teams can respond and revise their work before it is finally submitted. This is in effect the same form of iterative process and it is intentionally inclusive and embracing to give every opportunity for the generation of quality outcomes.

To conclude the project, we expect the teams to convey their vision for the future by providing a clear proposition for their new system and/or service and to employ all the visualisation and systems and service methods at their disposal to make their outcome as clear and believable as possible.

Conclusion

Through the development and implementation of the Design Systems and Services studio, we have provided students at Swinburne University with a timely and challenging design experience. While it is evident that some students found the studio challenging, there have been many benefits evidenced and, at the very least, the students can take a toolkit of methods and techniques that they can employ in their future careers. Over a thousand students have now taken the Design Systems and Services studio in the past four years and it is encouraging to see that many of the students have recognised and acknowledged the significance of sustainable systems and services thinking and design.

> “Design Systems and Services is a highly beneficial study for all young designers to explore. It permits us to learn about, subtracting complications within current systems and in turn improving our problem solving capabilities. This unit definitely opened my eyes to how I can contribute to changing the world’s habits for the better. Before studying this subject, I didn’t think it possible for a designer to have the power to create such positive sustainable results.”
>
> 3rd year Communication Design student, 2009

> “Design Systems and Services as a subject is extremely beneficial to young designers. It allows them to digest problems and implement problem solving methodologies that they will then find extremely useful in their designated future careers. Although this subject can be a bit stressful at times, mostly due to the flexibility of criteria, I find that it has allowed me to grow and develop as a designer.”
>
> 3rd year Communications student, 2009

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the Learning Network on Sustainability

Mobilizing the garden

An adaptable systems approach

Eric Anderson and Kristin Hughes
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Our culture's gradual shift toward urbanization has created an ever-widening separation between the food we produce and the end consumer. In young people, this results in a lack of awareness about the food production processes. This unawareness leads to poor nutritional choices that increasingly manifests into many common, but serious health problems at a young age that can persist throughout life. In the summer of 2008, research at Carnegie Mellon School of Design sought to address this issue. With the focus on 3rd and 4th grade elementary schools students, researchers discovered that the main opportunity was to create a community-supported mobile teaching lab. The findings were then compiled into a design brief for teams of third-year industrial design college students to create conceptual proposals for elementary students to experience hands-on learning as an extension to classroom learning.

> "Given the nature and the dimension of change, we have to see transition towards sustainability (and, in particular, towards sustainable ways of living) as a *wide-reaching social learning process* in which the most diversified forms of knowledge and organisational capabilities must be valorised in the most *open* and *flexible* way. Among these, a particular role will be played by local initiatives that, for some reasons, can be seen as signals of new behaviours and new ways of thinking." Ezio Manzini

Introduction

In the early 19th century, less than 10% of the population of the United States lived in cities. Many of those living outside of the city at that time had a natural connection to their food, as they were either producers themselves or closely aligned with the producers of their food. This relationship allowed families to value their sources of nutrition and pass down their knowledge to successive generations. As cities began to grow, so did processed food products and related marketing. The bond between food knowledge and its origins began to fracture (Vileisis, 2007).

Jump ahead to 2010. By some estimates, over one-half of the world's population, and 80% of the population of the United States lives in urban areas. Quick service restaurants are flourishing and a growing number of people, including kids, are satisfying their diet through processed foods. A 2004 study from the US Department of Agriculture confirms what nutritionists and healthy food experts had been saying for years, that a steady diet of fast food places consumers at a greater risk of being overweight and obese. Childhood obesity is a growing concern. Based on 2003-2006 statistics, 16.3 percent of US children and adolescents have a body mass index (BMI) at or above the 95th percentile (Ogden 2008).

Quick service restaurants are not the only ones being scrutinized for the nutritional value of their food. In the United States, school food service programs have also come under inspection. In 2006, an average of 28 million K-12 students (25% of Americans) were served government subsidized lunches every day. According to The National School Lunch Program Background, Trends, and Issues report, "public concern for the program has focused on whether it is contributing to the growing problem of childhood obesity and on the quality of foods available to schoolchildren" (Economic Research Report Number 61 July 2008).

Reversing the obesity trend and declining health consciousness of children in the United States requires a dramatic shift in our education system from linear assessment driven pedagogy, to integrated learning approaches with health and nutrition as critical core values. In Pennsylvania, for example, school

wellness policies are fraught with vague requirements, and the programs are often superficial, lack nutritional education components and omit parallel family and student engagement. (Probart 2008, N. Moreno, 2004). Doctors, school administrators and community services should work together to provide effective health education to stimulate healthy lifestyles (Slusser 2008, G. Rao, 2008, S. Kumanyika, 2008).

This is not a new argument. In the late 19th and early 20th century America, the accelerated shift to urbanization was an important time for expanding education. It stimulated the creation of several movements to develop new school curriculum. One such movement was the Natural Study Movement in which teachers, parents, scientists and farmers came together with the goal of encouraging kids to use their natural sense of curiosity to learn about the wonders of the natural environment. Its described purpose was to educate the child with respect to the environment to promote a more enriched life (K. Armitage).

Today, high profile personalities are working to rekindle the spirit of early movement models by rethinking the ways we inform children, distribute food to schools, and address health education in the classroom. In the U.S., the First Lady Michelle Obama planted a vegetable garden on the White House lawn and encouraged the nation to do the same, and her efforts have made an impact. The National Gardening Association reported that the number of households planting home gardens in the United States increased by 19 percent in 2009. Popular media is also showcasing the health and nutrition concerns of America's children. Reality shows like Jamie Oliver's Food Revolution, a network television series that aired in March 2010, expressed a goal to save the lives of children by changing the high fat and high calorie breakfast and lunch meal plan typically provided by schools to 50% of students. He worked to achieve this by demonstrating healthy menu alternatives for an elementary school in West Virginia, which has one of the highest numbers of obese people.

Despite the alarming statistics on childhood obesity, urban communities are recognizing the need to re-educate youth about health and nutrition and have begun developing experiential learning curriculums. A notable example is Edible Schoolyard, established in 1995 by Alice Waters in Berkeley, California. Edible Schoolyard is a project based embedded curriculum that teaches students to be inquisitive about their natural world. The students learn how to gather research and shape new learning concepts using classroom and field experiences to create relevant, and ongoing learning. At the end of their projects teachers encourage students to reflect, analyze and assess their activity and its contribution to the environment. The teachers continually emphasize eco-literacy in all levels and facets of the students' experiences. Programs like Edible Schoolyard represent systematic changes in teaching nutrition, sustainability and eco-literacy (M. Crabtree).

A design-based approach

In a project-based approach to learning, students are provided a set of real-world tasks designed to help them discover new information about a given problem, though their teacher is already aware of the solution. A design-based approach to learning, although similar to project-based learning, is distinctly better suited as a catalyst for change in socio-ecological conditions. Design-based learning accepts that there are multiple perspectives to any given situation and thereby invites stakeholders to collectively identify the systemic issues that define the overarching problem. All stakeholders work to develop solutions through discovery, observation, collaboration, planning and execution. This iterative process breaks down assumptions by encouraging risk-taking and failures, so that learning is achieved through experimentation and not by prediction. A design-based approach fosters curiosity, thus enabling students to use critical thinking and problem solving skills and facilitating the expression of many unique solutions. It contradicts rigid education models that require educators to prepare students for standardized assessment tests, rather than providing hands-on learning and synthesis opportunities. Both problem-based learning and design-based learning are invaluable models to engage multi-modes and styles of learning and experiences.

Understanding the design challenge

In college-level design education, emerging issues of global concern, such as sustainability, renewable energy, and education are a growing priority. However, a big challenge for educators at the undergraduate level is determining how to successfully structure class assignments and discussions on complex systems problems within the constraints of student knowledge, sustained interest and an academic schedule.

In the summer of 2008, a team from the School of Design at Carnegie Mellon University conducted research to understand how schoolyard gardens and classroom learning might be connected. The research team, comprised of Eric Anderson from industrial design and Kristin Hughes from communication design, as well as two undergraduate students, Luke Martin and Michael Ricci. The team collaborated with a local non-profit organization called Grow Pittsburgh.

Grow Pittsburgh's vision is to "see the day when growing and eating healthy, local food is commonplace." Their mission is to help various community groups demonstrate, teach, and promote responsible urban food production (www.growpittsburgh.org). The organization helps community members in need with fresh local food, provides affordable healthy food to distressed urban areas in Pittsburgh, works with other community organizations to develop collaborative learning opportunities, and works effortlessly to teach children the value of nutrition and involve them in the production of healthy food.

Grow Pittsburgh, inspired by the work of Alice Waters, established a relationship with several public Pittsburgh elementary schools to build Edible Schoolyard as a way to expose children to the seed to table process (Figure 2). The partnership allows schools to guide students toward healthier lifestyles and choices by teaching them where their food comes from, how it is prepared and the personal benefits to eating healthy. Additionally, it uses real world contexts to support teachers in building classroom activities. Their goal is for elementary students to use the garden to experiment, apply theoretical knowledge and gain an understanding about the seed to table process.

Figure 1: Example of typical Edible School Gardens

After a full year establishing working gardens in three select schools, Grow Pittsburgh created an event called the "fall harvest celebration," in which community volunteers, students and teachers came together to harvest, prepare, cook and eat produce grown on school grounds. A renowned chef and parent, who has children in the school, volunteers to help prepare and run the event. While the event was well received, it identified a weakness in the school food system; the elementary schools were ill equipped to facilitate fresh food preparation of any kind. The school cafeteria and kitchens were essentially designed only to hold and heat processed, packaged, lunches (Figure 2). Grow Pittsburgh believed that in order to properly engage and facilitate activities with students during the harvesting event, they needed a table design that supported food preparation, food tasting and delivery. At this point, they made a connection with the School of Design.

Figure 2: Example of cafeteria lunch offering

The Carnegie Mellon research team responded to Grow Pittsburgh by creating a series of structured activities to identify a broader set of key questions and concerns. The goal was to understand if a new table was truly the answer to increased preparation, teaching, and food distribution, or whether a different education model needed to be discovered. Researchers learned that in addition to the schools inability to support fresh food preparation, three other important factors were at the core of the problem: the school curriculum did not support or reinforce learning opportunities in the garden; inconsistent and poor communications between stakeholders prevented meaningful and sustained relationships; and youth are alarmingly disconnected from their food and do not appreciate the value of making healthy choices.

The team employed many tools used in design research—interviews, direct observation, artifact creation and analysis. These tools were particularly helpful in understanding stakeholder roles and concerns. The team learned how the education, garden and community support systems functioned by shadowing stakeholder representatives. These activities reinforced the need for a solution that considered the voices of the school (administration), people (students, parents, and teacher) and community (volunteers, Grow Pittsburgh, local farmers).

Through scenario development, the team explored several alternative futures, including a yearlong educational support piece, so that the harvest celebration would not become disconnected from the larger system needs. This work also provided researchers with a clearer understanding of the enormous scope and complexity of the systemic issues that the harvest celebration represented.

Eight steps were identified in support of the seed to table learning objectives at the fall harvest celebration: 1) harvesting the crops 2) transporting crops 3) washing the crops 4) preparing the crops for cooking 5) cooking the food 6) eating the food 7) composting the waste 8) reclaiming the seeds. Each task represented an opportunity for designed artifacts to support learning, whether in the form of physical products, or communication pieces such as video or and live demonstrations. Along with these eight steps four high-level goals were established to measure the success of the design solution:

- Create an environment that intrigues kids with hands on activities about the seed to table process and reinforces school curriculum
- Connect the school, garden, and community
- Create a culture that becomes increasingly environmentally aware
- Be a valuable contribution to teachers and administrators

Our research explores the creation of a mobile, modular learning system solution. This additional criterion was included in the project brief that would later direct the work of design students.

Task analysis and scenario based tool

Methodologies such as task analysis and scenario building have become commonplace in many design activities. Task analysis seeks to understand how the user performs defined activities in real context. This is achieved through interviews, observation (direct and/or image recording), and outcome assessment. Understanding the academic timeline for the fall harvest celebration through a task analysis of multiple stakeholders informed the team's ideas about how the event stages could be structured and timed to accommodate multiple classes and two grade levels through a series of learning activities. Scenario building

in design is a textual, and increasingly visual, description or narrative of a use episode (J. Carroll). The scenario is described from the user point of view and may include social background, resource constraints (e.g. space, staff, volunteers, technology, etc.) and background information. Together, task analysis and scenario design tools help mine understanding about how and why users do what they do.

The final stages of research activity included three scenarios for the design brief. Each provided a detailed narrative to frame the desired student experience and those of other stakeholders. One illustrated the desired yearlong learning experience, another focused on classroom support throughout the year, and the third focused specifically on the harvest celebration. Each was created to guide and inspire the performance of the design students to whom the project was given.

Introducing the design challenge to students

The challenge: Design a mobile learning lab that engages 3rd and 4th grade students in hands on learning and physical exercise to support school curriculum goals and promote the values of heath and fitness. In addition to other considerations, the lab would travel to different schools throughout the school year and therefore must comply with highway regulations. This design challenge was given to 3rd year undergraduate students majoring in industrial design. It represented their first experience dealing with a large complex problem. Anderson and Hughes led the project and understood that finding ways to inspire dialogue and engage students in complex system thinking, design and concept development in a seven-week project experience would be a challenge. For this reason, the class was provided with significant upfront research.

Twenty-five students comprised the 3rd year class. To initiate engagement, faculty had students self-select project teams, resulting in a total of seven teams. In teams, students had to work to reconcile the many competing design influences inherent in designing a modular mobile learning environment. These included:

- Digesting and interpreting the research documents provided, as well as generating new investigation based on their selected direction.
- Developing and resolving a mobile learning environment that had a clear theme and unified individual concepts of team members.
- Providing details of conceptual development and clearly communicating the key aspects of the environment in support of the desired experience, as well as including individual component concepts.
- Accomplishing individual product conceptualization that involves a broad exploration of possibilities for addressing the obvious problem and seeking to discover the unexpected, in an effort towards a well-resolved individual solution that fits into the overall environment scheme.

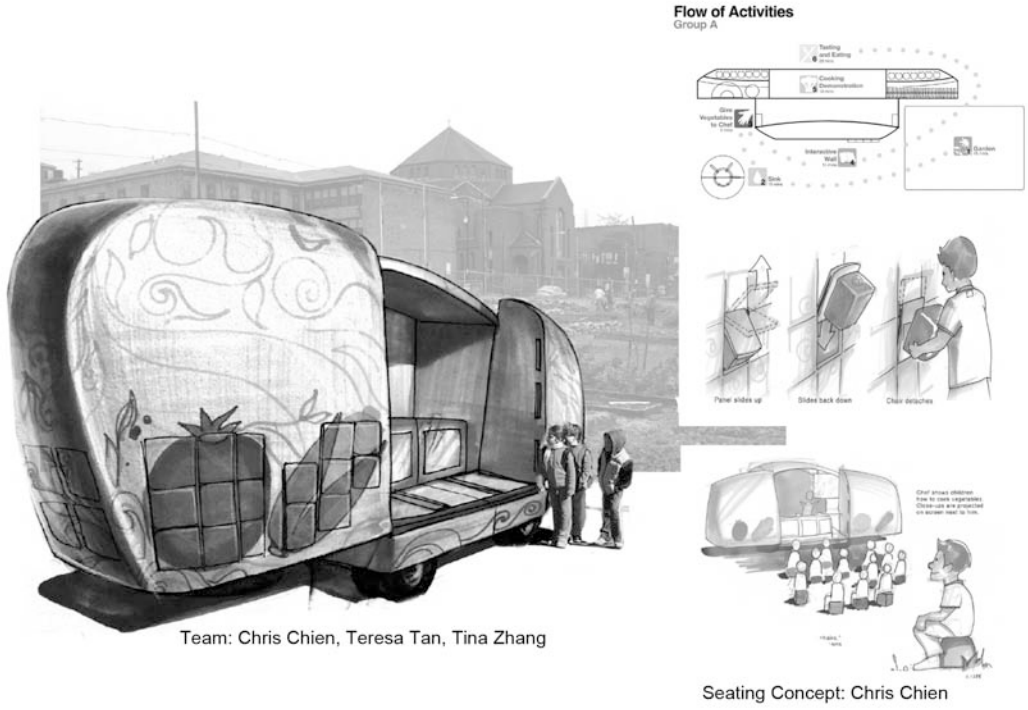
The project was contextualized as a “real world” design opportunity involving a client that was extremely interested in the possible development of the outcomes. Two main objectives were established for the project: to address the physical and informational opportunities for the fall harvest celebration event, and to support physical exercise in the learning lab as part of a holistic approach to good health. For example, as part of the physical exercise design requirement, one possible outcome might consist of a modified bicycle with a blender attachment that would allow children to blend harvested carrots and create carrot juice.

Consistent with the mission of the School of Design, steps were taken to humanize the issues by having students visit school yards to see the garden work, conduct interviews with school and community representatives – such as members of Grow Pittsburgh – and become informed about the health issues associated with poor nutrition. The knowledge that their work could lead to potential solutions and influence future discussions helped motivate the students.

The students’ final work represented an impressive response to the fall harvest event. Each team produced unique offerings that highlighted new opportunities for fun engagement and learning. Several introduced concepts that embraced natural materials to create service products and others used water or human power as a source of energy to power activities.

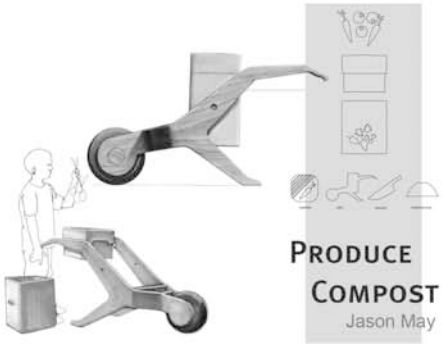
Figure 3: Example of final student work

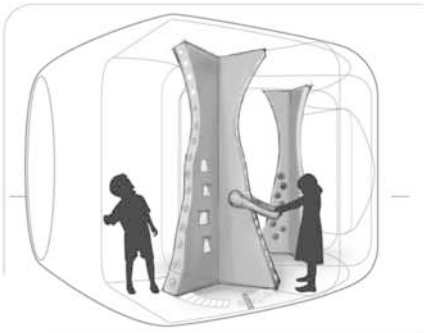
The work here highlights a few examples of how the student teams conceived the mobile teaching lab and the supporting activities. Each concept expanded the idea of a trailer through modular components that leveraged the school landscape to create unique and dynamic environments.



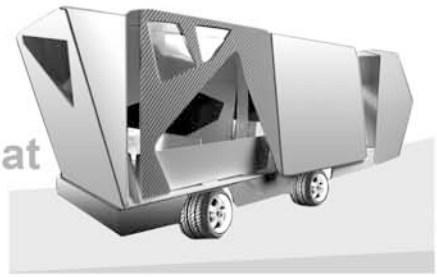
Team: Chris Chien, Teresa Tan, Tina Zhang

Seating Concept: Chris Chien



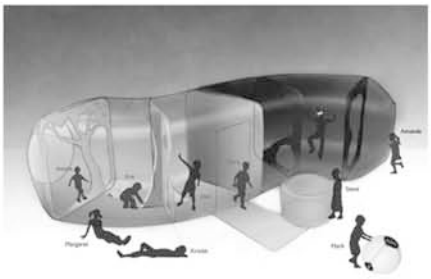


Pump, Plug and Play Luther Young
Growing Plants



Austin Robert Bales • Margaret Anne Gerhart • Annie Ha eun Lee

Squeeze Box
Josh Finkle, Jeremy Wolf, Luther Young



Rolling Washing Ball
Jeremey Wolf

Aligning with the "Living Principles Framework"

Recently, the American Institute of Graphic Arts (AIGA) put forth a framework to help guide designers and educators in key decision-making processes when dealing with issues surrounding sustainability. When designers were surveyed by the AIGA, 87% said that sustainability was a "top-priority," but felt that they lacked the knowledge and understanding to apply principles of sustainability to both their practice and client-driven problems. Most felt they lacked reliable knowledge and tools, and more importantly, lacked the confidence. As AIGA states, "the decentralized nature of resources, the complexities of the issues and the lack of filtering for how they relate to design appear to be the main barriers for turning motivation into action. Everyone wants to do the right thing, but no one relishes attacking this knowledge hairball."

AIGA broke sustainability down into several parts called the "Living Principles Framework." The framework helps designers make process-driven choices actionable in regards to the following four areas: environmental protection, social equity, economic health, and cultural vitality. In their words,

> Design is a powerful conduit for change. As the messages, artifacts and experiences we create pass through the hands, minds, and hearts of people, we have an opportunity to weave sustainability into the broader fabric of culture and to shift consumption and lifestyle aspirations to a more sustainable basis for living. In order for individuals, societies, economies and the planet to flourish, we must support environmental responsibility, social equity, economic health, and cultural vitality and recognize that they are inextricably linked. The confluence of these four streams is the key to sustainable design.

The Living Principles Framework set a precedent for deeper, more meaningful thinking about sustainability in design and design education. Design educators face many of the same challenges that surround the principles of sustainability. How do we bring these large, complex issues into the classroom? Can both the student and teacher learn complex systems thinking in the context of eco-literacy and sustainability without having learned it in early childhood? Is design education suited as a discipline to identify and address larger sustainable and systemic environmental issues? And, if so, how will we balance disciple-specific competencies (drawing, form-giving, etc.) while shouldering the responsibilities of environmental protection, social equity, economic health, and cultural vitality?

Conclusion

Today's designers may serve as catalysts for progressive systemic change, as they possess the potential to identify systemic failures and create sustainable and desirable solutions collectively. As complex problems spanning disciplines and communities continue to emerge, preparing design students to engage in these conversations becomes increasingly challenging within the limits of traditional design education models.

Design briefs, also called project briefs, are statements of work typically used in the industry, and simplified for use in the studio in design programs. A design brief is by no means a new tool. However, work at Carnegie Mellon suggests that an enhanced design brief that reflects a rich series of documentation from multiple sources can support learning and relieve time pressures within an already stressed academic schedule.

The mobile teaching lab project is an example of a complex systems problem. Through a design-based approach, multiple stakeholders (design students, teachers, school and community organization administrators, and others) were connected through structured conversations and exchanges. As a result, information regarding specific areas of concern, such as the state of kitchen facilities to support fresh food preparation, curriculum challenges to integrate new learning, and barriers preventing outside partners from supporting education was acknowledged for its relevancy, thus allowing the design students to conceive of holistic solutions.

In this study, researchers approached the problem of educating youth about the origins of food holistically by listening to multiple stakeholders and exploring how design methodologies can inspire new ways of learning in established curriculums. Increasingly, design is used to distinguish problems from symptoms. Subsequently, there will be ongoing opportunities to gain insight from industry and education, and address global complex problems. Issues within cities have become microcosms of larger world problems

therefore evolving models that prove successful in small communities may be expanded to address larger and similar problems.

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http://www.livingprinciples.org/about/mission/: The Living Principles community site was conceived by Tomorrow Partners, a strategic creative agency in Berkeley California, and built in collaboration with development partner Futurescape. Special thanks to the following team members, who went above and beyond to bring this vision to life.

http://www.aiga.org

http://www.letsmove.org

http://www.jamieoliver.com/campaigns/jamies-food-revolution

http://www.edibleschoolyard.org/

http://www.ecoliteracy.org/

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Education experiences and proposals on social innovation for low-income contexts

the Learning Network on Sustainability

The Lost Skills Project

Rediscovery of 'lost' or undervalued Haptic design skills fostered through encounters and events staged in empty retail spaces in Wrexham town centre by students of design at Glyndwr University

Desdemona McCannon
Glyndwr University

An initiative utilising empty retail space in town centre Wrexham has enabled students studying Design Communication and Design Materials at undergraduate and post-graduate level creatively to rethink public space and re-invent its purpose. The project is intended to create links between the design school and the local community through a variety of events and encounters. The space is being utilised to generate a skill-sharing forum for the students to observe and learn about 'lost' skills. By lost skills we mean skills associated with making, mending, growing, adapting. These skills are often based in domesticity, and have traditionally been passed down through each generation. Because of the low status of domestic and decorative arts within the art curriculum at school and university level, these skills are not taught formally. There is a need to re-evaluate what design teaching prepares students for, with more emphasis on a sustainable approach to design problem solving.

Haptic Skills and Craft within Higher Education: the rationale for the project

The project's primary aim was to re-evaluate the use of haptic skills in design education. By haptic we mean tacit skills associated with touch and handling materials that are passed down through demonstration and practice. These skills are taught through experiential learning techniques such as workshops and individual experimentation with media and materials, and are not easily quantifiable. By design we mean the conscious ordering of materials for a particular purpose, intended to communicate an idea or function and be of use or benefit to the recipient. The haptic dimension to approaching design problems can often be overlooked by design educators, in the emphasis on gathering research, conceptualising and working ideas out on paper. The ability to communicate ideas using paper and pencil has been privileged within design education at the expense of the experimental and playful processes associated with haptic, three-dimensional exploration of materials and ideas. Thinking through making is not, it seems, given equal validity within design education. Recent research indicates that:

> Haptic perception plays a significant role in many art and design processes and seems fundamental to many aspects of human activity including dextrous craft skill development, and as a source of pleasure and intrinsic motivation in arts activities in general (Prytherch 2008).

Without the haptic sensibility, design problem-solving becomes an exercise in style and aesthetics. By understanding materials through touch and experiencing what they can do, the designer can further their ideas, taking on a much more human-centred approach. Ergonomics and issues surrounding designing a 'universal' user experience all start with the physical exploration and testing of materials. Without the inherent understanding that handling and shaping materials gives the designer, design literally becomes a 'paper exercise'. The experiential aspect of gathering information in this way means that haptic learning sits uneasily within an academic framework, as it is learned empirically, guided by practical experience

rather than theory. What is learned becomes a muscle memory in the hands, bypassing 'conscious' decision-making entirely.

The advantages of practice-based learning are recognised as encouraging creative thinking (Houghton), enabling a 'playful' approach to materials and problem-solving, and improved dexterity in craft and making abilities. Haptic learning, and the association with 'craft'-based subjects within the curriculum have suffered within the university context from a perception that they are lacking in academic rigour and conceptual content. However, this is far from the case, as experiential learning has been shown demonstrably to 'integrate haptic, visual and conceptual knowledge' (Houghton 2005).

Benefits to the Learner of 21st Century Crafts

- Craft teaches unique kinds of haptic knowledge and thinking skills
- Develops hand eye coordination and parts of the brain other subject elements don't
- Critical thinking, problem solving and creativity are needed in many sectors of the economy
- Research shows these are the skills employers value most
- Many jobs need practical skills
- Craft helps nurture a culture of lifelong learning
- Through craft pupils learn moral and social responsibility
- To develop social skills and team work
- To become more confident, self reliant, self disciplined and build up self worth ; and
- Craft encourages habits of hard work, effective collaboration and social interaction
- Craft provides a link between school, home and work
- Links generations and communities

Extracts from Report to QCA prepared by Dr Nicholas Houghton in association with the Crafts Council UK, October 2005

Without an academic rationale, haptic, experiential and 'craft'-based approach to design has been overlooked in favour of a learning and teaching method that is predominantly centred around drawing, the 'visualisation' of ideas, gathering visual and text-based information, and writing reflective journals. 'Craft has always battled for economic and cultural space' (Greenlees,2009). 'has been largely underrepresented in government research (ibid). The low status of craft within educational hierarchies can also be attributed to its association with domestic and decorative skills, which are often gendered activities. Needle skills, such as tapestry, embroidery, needlepoint, and textile-based skills such as knitting, crochet, lace-making etc., are generally not taught in schools. The recent instigation by the crafts council to encourage schools to set up after-school 'craft clubs' is in response to a recognition that craft-based activity in schools is lacking in the UK. If these skills are not being taught in schools, and without the traditional passing down of these skills within the domestic sphere, these skills will die out. There is currently a re-evaluation of craft taking place within the arts sector, with 'indie crafts' and films such as Faythe Levine's documentary of grassroots craft activism *Handmade Nation* creating a debate around the subject. 'Intelligent making applies and creates different forms of knowledge, both tacit and propositional' (Press, 1998). The educational benefits of recognising divergent 'learning styles' and a re-evaluation of the dominance of text in an image-saturated media is still an emerging field. Craft and domestic arts remain a neglected area of academic study. Habits of making and mending in the home have been replaced by an ideology of passive consumerism, and an acceptance of product obsolescence.

Research commissioned by the Crafts Council looking at the status of crafts-based subjects in education points to a severe decline in the status and visibility of crafts in the curriculum at school level, and raises the concern that 'if children are not learning skills during their school years they will not be able to enhance them in later life' (Glaister, 2008).

Research undertaken at Sheffield Hallam University (Press, Cusworth, 1998) has also shown that 'craft education appears to impart new styles of thinking, acting and problem solving to its students, which may be more appropriate than traditional learning systems, in our changing culture.'

Heritage Skills

The Heritage Crafts Association provides strategic leadership for a range of traditional and heritage crafts 'to ensure that these skills are not lost in the next generation' (Heritage Craft Association 2008). Its remit is to measure the status of heritage crafts in the UK and identify those in danger of becoming lost, and addressing issues to ensure their survival. It also advocates and communicates the importance of heritage skills to the Government and key agencies and organisations. It raises the awareness of heritage skills through showcase events and public relations. It also works with key agencies in education and learning to ensure that the highest standard of heritage skills are passed from one generation to the next.

Research undertaken to study the importance of heritage skills as cultural inheritance states that 'cultural heritage plays a central role in shaping our national identity, supporting the development and sustainability of local and national economies and providing a source of inspiration and creativity' (Glaister, 2008).

The Cultural Heritage Blueprint states:

> Cultural heritage helps us to understand how society has evolve and contributes to shaping the future. It stretched beyond the tangible to languages, customs, practices. The sector supports the development of cohesive communities and contributes to shaping the cultural identity of specific places. It is the biggest driver of the UK's tourism industry (estimated to be worth £85.6billion in 2006).

The cultural heritage sector

- Collects, preserves and interprets the past
- Develops and shares knowledge and ideas
- Provides opportunities for learning and engagement
- Enriches people's lives and creates a sense of place and identity
- Provides creativity, inspiration and enjoyment

Crafts Council UK Cultural Heritage Blueprint, 2008

Heritage skills are isolated within the craft's sector as an area of potential concern, the 'key to its future is sustainability, in its broadest sense. We need to protect cultural heritage from environmental threats and any resulting erosion or destruction.' This refers not only to the fabric of buildings and artefacts, but the erosion of habits and customs.

The Heritage Lottery Fund has created significant investment in the heritage tourism industry. This was set up in 1993 to distribute proceeds from the National Lottery to projects relating to the UK's traditional skills and 'heritage'. Research commissioned by the HLF in 1999 revealed that:

> Despite the flow of substantial funds from the HLF and many others … the skills base has not grown to meet demand. Poor investment in training, few new apprentices and an undervaluing of traditional skills are putting the heritage at risk. Many of our traditional skills are in danger of dying out.
>
> Sustaining our Living Heritage (Heritage Lottery Fund, 2000)

It is within this context that the pedagogical argument for the 'Lost Skills Project' exists. It is a response primarily to the lack of physical and mental dexterity and initiative that many students of design show in approaching design problem-solving, and an appreciation of the potential richness of haptic and experiential learning styles. It is also a response to the cultural issue of traditional skills 'dying out' in the UK, suffering along with the low status that 'craft' has in cultural and educational institutions.

Re-Purposing Commercial space

> 'Craft as a distinct body of knowledge and as an activity, also has a clear place in community development, the new ethical enterprise culture, creative consumerism and new structures of everyday life (Press, Cusworth, 1998)

The Lost Skills Project was set up as an experimental exercise in taking learning out of the art school studio setting and into a more public, neutral space. The objectives of the project are as follows:

- To create a stimulating environment for learning to take place
- To engage passers-by and members of the community from without the art school, and to encourage the general public to share 'lost' skills that they hold
- By offering their work to scrutiny by many different audiences and demographic groups, students can understand the importance of context, diverse audiences, and the possibility of miscommunication.
- To re-purpose commercial space as a place where non-commercial activity takes place. The use of the empty retail unit in this way becomes a critique of the purpose of the high street, and commercial space, replacing the idea of capital with that of social value.
- The networks that are open to the students are open-ended and unpredictable, fostering social skills and the ability to act on opportunities when they arise.
- The creation of a supportive, self-sustaining and exponentially growing network that is capable of reacting quickly to opportunities and drawing upon a committed core team.
- The instigation of grassroots problem-solving allows students to identify needs within the observable community, facilitating a shift towards a more 'human-centred' and less 'client-centred' attitude towards the design process.

Description of the project

The group was set up via social networking sites, e-learning platform at the university, and word of mouth amongst postgraduate ad undergraduate students of Design at Glyndwr University within the Creative Industries Programmes. Meetings were arranged at the art school to discuss the aims and objectives, to brainstorm possible ideas and projects we could devise for the empty spaces, and also to suggest trips and visits to local practitioners and makers that the students felt would be beneficial

Once the premise of the project was described to the students – that it would only exist as a network if they helped create it – and its purpose was to source and learn 'lost skills', the students showed a great understanding and immediate enthusiasm for the task.

The first question we asked was 'what traditional skills do you wish you could learn?' and the answers were immediate and heartfelt. Many of the skills put forward were to do with the students' immediate needs – to make their own clothes, to be able to grow vegetables, to be able to mend things, to learn how to build shelters or construct things using traditional methods and materials. This indicated that there was an awareness of the students' lack of agency in the fabric of their everyday lives, and a desire to become more empowered. The skills they pointed to were those that would free them from the need relentlessly to buy and replace consumer goods.

Another aspect of the project is that of community. The willingness students showed to perform informal 'skills audits' among friends and acquaintances bore fruit in the responding willingness of people to offer to come and teach their skills. A rich vein of skills resides within the older generation, with many women in particular coming forward to offer to demonstrate and teach needle and textile related skills.

Many personal contacts and networks were offered and suggested by the students, which were all fed into a central social networking site which all could access and add to, and which acted as a virtual notice-board and discussion forum. The project did not have a name for several weeks, which reflected its non-hierarchical organisational structure. The students used the page to indicate the skills that students they would like to learn, and these were then matched to possible collaborators or organisations from the pool of contacts that could approach to provide the experiences we were looking for.

Wrexham Council generously offered us the use of the historic Grade 2 listed Butcher's Market at no cost to the project. In terms of partnership, the council were pleased to see events happening there that created interest in the market to the general public, and could potentially increase footfall in the market. The market was built in 1853 and retains many of its traditional features. Most of the stall-holders are not butchers today, with only three of the 24 stalls offering meat products for sale. Many businesses in the market are struggling or failing, with more than ten units lying empty. We visited the market and documented the stalls that were empty, agreeing on the use of one by the main entrance as a base for the pro-

ject, but negotiating the flexible use of other spaces in the market for different types of project. We decided to stage events there over two hours, which would be open to all to engage with.

LOST
SKILLS
WORKSHOPS
IN THE MARKET

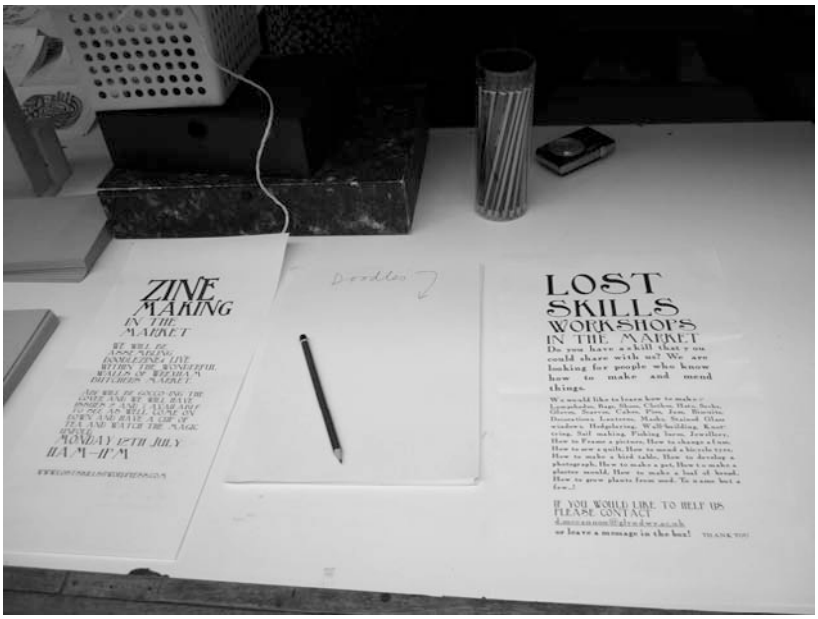
Do you have a skill that you could share with us? We are looking for people who know how to make and mend things.

We would like to learn how to make :-
Lampshades, Bags, Shoes, Clothes, Hats, Socks, Gloves, Scarves, Cakes, Pies, Jam, Biscuits, Decorations, Lanterns, Masks, Stained Glass windows, Hedgelaying, Wall-building, Knot-tying, Sail making, Fishing lures, Jewellery, How to Frame a picture, How to change a fuse, How to sew a quilt, How to mend a bicycle tyre, How to make a bird table, How to develop a photograph, How to make a pot, How to make a plaster mould, How to make a loaf of bread, How to grow plants from seed. To name but a few...!

IF YOU WOULD LIKE TO HELP US PLEASE CONTACT
d.mccannon@glyndwr.ac.uk
or leave a message in the box! THANK YOU

Over two weeks, we organised four events in the market and two trips to locate skills in the surrounding area.

Figure 1: Zine making in the market



We used one of the smaller island units for this event, and asked people to participate in the making of a zine. By being actively involved in the creation and seeing the process that a small publication undergoes in terms of collating pages, hand-stamping the cover (using a rubber stamp that had been cut by hand), folding, cutting, trimming and binding the pages together, each participant could experience both the mechanical nature of the tasks and also the problem-solving, the logistics of creating a workable 'production line' in which every element contributed to the end product. Feedback from students during the event varied from how 'relaxing' it was to focus on mechanical and repetitive tasks, to an inquisitiveness about where the paper was sourced, how to liaise with printers and the practicalities and cost implications of producing a zine. Several of the students talked about their intention to both design and produce a publication of their own.

The shift from perceiving themselves as 'for hire' as designers to becoming editors and content-generators themselves is a radical one. Although many students perceive that their career will necessitate a subjugation of their beliefs or ethics to the wishes of the client, this model offers them an entrepreneurial option, albeit not economically attractive, but a way of making individual voices heard within the media sphere. The maxim that 'Freedom of the press is guaranteed only to those that own one' is a radical one, and encourages a DIY attitude to publishing that would enable grassroots opinions to be heard.

The use of computer technology within design education, although purporting to empower the student through ease and flexibility of process, can actually disempower them by limiting choice and offering 'default' options when designing. To go back to the principle of making something by hand offers the student the opportunity to handle paper, experiment with folding, and understand the layout composition of the book as a three-dimensional entity, unfolding in time by the user. These are experiences that the screen cannot offer.

The use of the island stall meant we could lay out the process of making the zine in a way that could be seen in gestalt fashion, that is 'all at once'.

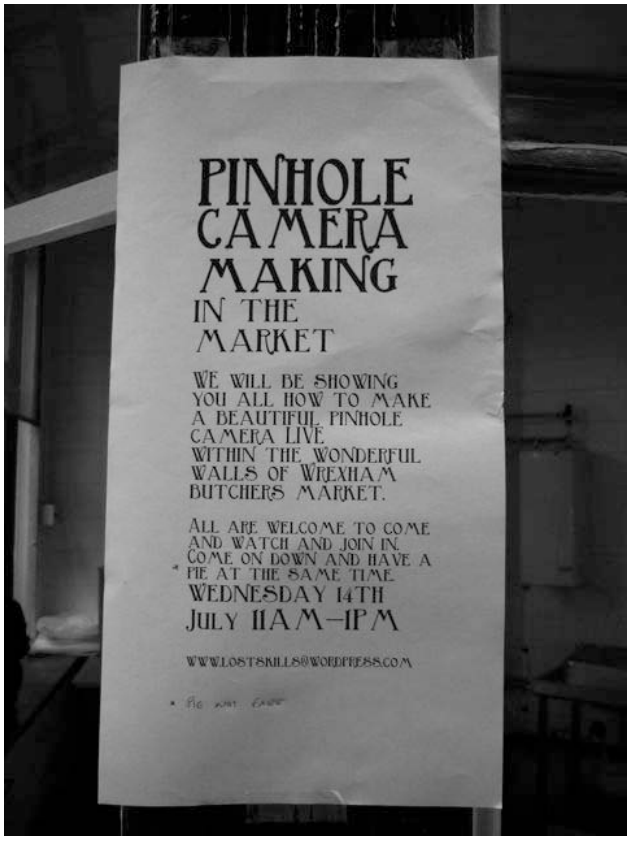
The event was documented photographically by several students, and the pictures were shared on the social networking page. These were commented upon by participants and other members of the group over several days, and a sense of excitement in the project, and belonging was engendered through its visibility on the site. More people began to join the group.

Pinhole Camera Making in the market

The second of the events based in the market was held in a more open shop-style space near the front entrance to the market.

The flier for the event was posted throughout the market a few days beforehand, alerting stallholders and frequenters of the market of the event. The event was publicised through the social networking site and through word of mouth among the student community. It was also publicised through art and design blogs artinliverpool.com and *Creative Boom*, Wrexham a listings website.

The workshop facilitators were two staff members from the art school with an interest in analogue photography. They provided a short lecture which was projected upon the white tiles at the back of the stall, and offered to show participants how to assemble a simple camera from materials which they provided. They had also made a digital pinhole camera which they used to demonstrate the principle, and were able to capture images immediately.


PINHOLE
CAMERA
MAKING
IN THE
MARKET
WE WILL BE SHOWING
YOU ALL HOW TO MAKE
A BEAUTIFUL PINHOLE
CAMERA LIVE
WITHIN THE WONDERFUL
WALLS OF WREXHAM
BUTCHERS MARKET.
ALL ARE WELCOME TO COME
AND WATCH AND JOIN IN.
COME ON DOWN AND HAVE A
PIE AT THE SAME TIME.
WEDNESDAY 14TH
JULY 11AM-1PM
WWW.LOSTSKILLS@WORDPRESS.COM


PINHOLE
CAMERA
MAKING

Passers-by stayed to watch for a few minutes at a time, and the stall-holders in the market were supportive and interested in the event.

The physical task of making a camera from a box and black tape de-mystified how a camera works for the students, and was an effective way of demonstrating the physics of how a camera works. The element of chance and of 'happy accidents' in the analogue process also offered a different way of thinking about photography to those who had only experienced it as a digital medium.

National Waterways Museum, Ellesmere Port

A visit was arranged to go as a group to the National Waterways Museum at Ellesmere Port, about 20 miles from Wrexham. As a recipient of Lottery Heritage Skills Funding, the museum hosts traditional skills sessions in its café one morning a week. Several of the students had already taken part in these lessons, and were contributing crochet filigree work and blankets to the restoration of traditional canal barges that the museum holds.

Members of the group sat with members of the skills workshop and asked them about the types of skills that they knew. We found many women were very willing to show us beadwork, patchwork, needlework, knitting and crochet, were highly skilled in these crafts and had been taught by their mothers and grandmothers how to do them.

We also had the opportunity to speak with the museum's resident sign-writer and boat painter, John Coombe, who had been taught the traditional methods of hand-painted typography and boat decoration.

His enthusiasm and wealth of knowledge about the history of canal boat decoration, and the individual artists' work that the museum held in its collections was inspirational. He also offered to help the project at no charge. The generosity of people in relation to the skills they could offer signals an interesting lack of assumption about the 'worth' of these entities in terms of traditional capitalist exchange, but points to a more sustainable attitude that the skills potentially belong to everyone, are democratic and the worth of the skills is seen as being intrinsic to the act of making, rather than residing in the often ephemeral or workaday artefacts produced.

The sense of community in the crochet workshop was noticeable, with the process of making engendering a comfortable companionship amongst the participants. Much banter and laughter was evident and the atmosphere was one of benign good humour. People's individual prowess was lauded and the group were supportive of each other. The LS group came away with a strong sense of the benefits to the individual of working within a group situation when making. The benefit of social networks, the skills and goodwill that are created when people engage in purposeful activity, were aptly described by Hanifan in 1916 as 'social capital':

> I do not refer to real estate, or to personal property or to cold cash, but rather to that in life which tends to make these tangible substances count for most in the daily lives of people, namely, goodwill, fellowship, mutual sympathy and social intercourse among a group of individuals and families who make up a social unit… If he may come into contact with his neighbour, and they with other neighbours, there will be an accumulation of social capital, which may immediately satisfy his social needs and which may bear a social potentiality sufficient to the substantial improvement of living conditions in the whole community. The community as a whole will benefit by the cooperation of all its parts, while the individual will find in his associations the advantages of the help, the sympathy, and the fellowship of his neighbours.
> Hanifan quoted in Portes (1998)

A commonly cited theme within sociology and cultural studies has been that of the alienating effect of modernity and capitalist systems on the individual (Simmel, 1907; Tönnies, 1957) with many relationships in modern urban society based upon the exchange of money, and the loss of primary relationships such as familial bonds in favour of goal-oriented 'secondary' relationships. Marx's Theory of Alienation is based upon his observation that in emerging industrial production under capitalism, workers inevitably lose control of their lives and selves, in not having any control of their work. Workers never become autonomous, self-realized human beings in any significant sense, except the way the bourgeois want the worker to be realized. Alienation in capitalist societies occurs because in work each contributes to the common wealth, but can only express this fundamentally social aspect of individuality through a production system that is not publicly social, but privately owned, for which each individual functions as an instrument, not as a social being.

The opposite of alienation is 'self-actualisation', achieved through useful work and bonding with a supportive community, such as evidenced by the museum workshops and the emerging 'Lost Skills Project' community network.

> I am not interested in dry economic socialism. We are fighting against misery, but we are also fighting against alienation. One of the fundamental objectives of Marxism is to remove interest, the factor of individual interest, and gain, from people's psychological motivations.
> Che Guevara quoted inHollander (1983)

A visit to the Bluecoat Display centre

This was arranged for students to meet the curators and discuss the status of 'studio crafts' within the remit of the project. Although many of the students involved in the project are engaged in making within an 'applied arts' context, the artefacts made for a gallery setting, which have a high commercial value, were felt to be at odds with the DIY, grassroots, philanthropic nature of the project itself. The Bluecoat Craft Display Centre is an important regional venue for makers, and is internationally recognised for promoting and exhibiting excellence in the crafts. It too is currently running 'hands on' workshop sessions for the general public, but is charging a considerable fee for each event. It was felt by the group that the context of the Display Centre, within a newly refurbished contemporary art gallery complex, was offering a different kind of experience to that of the open, free, democratic workshops within the market

space in Wrexham. Although the work on display was exquisite, it was presented in a way that removes it from the fabric of everyday life, and the ceramics and textiles on show on plinths and in glass cases would not be robust enough for everyday use, nor would they be repairable if they were damaged. The trip was useful as a way of positioning the project ideologically, for although the Craft Display Centre is a charity and has a remit to encourage and engage with the education of craft skills, as evidenced by a visit from the director of the charity and Display Centre to the art school in Wrexham earlier in the year, the philosophy behind the sorts of 'craft' on display is essentially elitist and beyond the means of all but the relatively wealthy and middle-class patrons of the centre. The skills workshops being offered at the centre were not necessarily to do with empowering the individual to make and mend their own clothes and surroundings, but a more 'genteel' hobbyist approach to book-binding or model-making. The use of empty space within the Bluecoat to offer a creative and haptic alternative experience to the passive consumerist shopping experience surrounding the centre is comparable to the Lost Skills Project's use of the Wrexham Butcher's Market; however, the comparison ends there, as the LSP is catering for an entirely different demographic group within the community, and its aims are more democratic.

Future Events for the project

The project has attracted a lot of interest from the local and national media, as well as gathering momentum in terms of people coming forward to offer to run a workshop in the market space. Future events are in the pipeline and can be disseminated at the conference in September. A 'Community Quilt' is being set up, which will enable people to share both their skills and their memories of living in Wrexham, allowing a diverse personalised democratic history of the town to be represented, containing many voices.

A workshop session on 'make do and mend' session, is planned, to embellish and re-purpose old clothing; sessions on book-binding, drawing, knitting and toy-making are also in the pipeline. The generosity of the council in allowing us to use the space on a very flexible basis requiring very little notice has allowed us to react quickly to suggestions and offers of help, and to set things up with an immediacy that captures participants' enthusiasm. Essentially the project has created a self-sustaining network of committed and enthusiastic skill-sharers who have found a forum to disseminate and celebrate the skills that have passed under the radar of conventional academic scrutiny and do not presently have a place in the HE curriculum. By engaging in these skills we hope to observe the long-term effects on the students' design

practice. It is the aim of the project to observe, document and attempt to quantify how the haptic skill sets improve the students' mental and physical dexterity in approaching studio-based design tasks. We will also observe how the transferable skill sets engendered by the problem-seeking and team-working ethos that the project has fostered, manifest themselves within the student body involved in the project.

> I don't want art for a few, any more than education for a few or freedom for a few. What business have we with art unless we can all share it?
> William Morris (1883)

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Heritage Crafts Association www.heritagecrafts.org.uk

the Learning Network on Sustainability

Design cooperation between students from Botswana and Norway with a focus on sustainability

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In March 2010, 14 students from the Norwegian University of Science and Technology were hosted by 21 students and their teachers from the Industrial Design & Technology Department at the University of Botswana for a week-long cooperation in two local projects. The goal was to address a number of sustainable design challenges in a cross-cultural collaborative setting and provide students with the opportunity to learn about each other's design approaches. Based on a questionnaire survey and teachers' observations, the paper discusses how this type of collaborative project could achieve the goals, but also identifies a number of improvements for future similar projects.

Introduction

Cross-cultural design experiences are increasingly considered essential for students. Many of them normally engage in a professional life in a global world. Students may benefit from cross-cultural experiences by acquiring *substantive knowledge* of other cultures, world issues and global dynamics; open-minded and empathetic *perceptual understanding* of people of other cultures without stereotypes; *personal growth* in areas such as self-confidence and independence; and the propensity to make *interpersonal connections* with people of other cultures, both in the host country and after returning home (Willard-Holt, 2001). For product design and industrial design engineering students, cross-cultural experiences may even be more relevant, as many will end up working for multinational companies manufacturing and selling their products on a global market. Whereas understanding global customers may to some extent be a text book exercise that can be learned through regular forms education, gaining experiences with cross-cultural design aspects in a local context may be less straightforward for design schools to provide. Hobson and Rodgers (2005) have stressed the importance of exploring cultural differences amongst a group of product design students, showing that, although hard to measure, their cultural roots influence their final design outcomes. It is then only a small step further to assume that exposure to other cultures will make design students able address or even adopt unfamiliar cultural aspects in their design work.

Sustainable design

Cross-cultural design has a certain overlap with sustainable design, as addressing cultural issues in an international context can be considered as an element of the social component of sustainable design. This has to be done in a responsible way; globalisation as a contemporary issue has been criticised because of its possibly negative socio-cultural effects on local and regional communities. Hence, finding suitable approaches for moderating globalization in regional contexts is considered a major issue in areas such as sociology and management, and design as well.

Addressing sustainable design challenges in non-western contexts has been a topic of increasing interest as of late. Crul and Diehl (2008) point out that, whilst there is considerable experience with sustainable product innovation in industrialised countries, much of this is not directly applicable to emerging economies. Innovation climates in developing countries are, by nature, problematic, and may be characterized by poor business and governance conditions, low educational levels, and mediocre infrastructure, challenging the promotion of innovation in these contexts. Most of the current available sustainable design manuals and tools are based upon European experiences. However, in emerging economies needs are different and more immediate. Also the characteristics of local users, local companies and product innovation approaches differ because of specific local social, economical and industrial development aspects. Often micro, small and medium enterprises companies dominate both economy and labour market. A structured product development process often is lacking.

These insights have led to the development of Design for Sustainability manual specifically targeted at developing economies (Crul and Diehl, 2006), which was an adaption of the United Nations Environment Program (UNEP) Ecodesign manual (Brezet and Van Hemel, 1997), which was mainly based upon experiences in Europe and the United States. In a nutshell, the new manual is adapted to the context of developing economies in terms of an increased focus on internal drivers, higher priority to cost savings, educating in elementary product development principles and the inclusion of simple to understand tools that do not require extensive knowledge on underlying sustainability principles.

Over the years, designers have played active roles in so-called poverty-alleviation and Base-of-the-Pyramid projects, supporting these and other strategies. Designers are experts in understanding needs, communicate between professions and combine these findings in product and service solutions. As cultural differences, affordability issues, scarce access to resources and in some cases unstable political systems are challenging factors when addressing product, system, or service-oriented solutions, the creative thinking and innovative experimentation embedded in designers' work methods have been found to support project goals considerably (Moe and Boks, 2010).

Background of the project

In March 2010, 14 students from the Department of Product Design at the Norwegian University of Science and Technology were hosted by 21 students and their teachers from the Industrial Design & Technology Department (IDT) at the University of Botswana (UB) for a week-long cooperation in two local projects, address sustainable design challenges in a cross-cultural collaborative setting. This event followed a tradition, present at both universities, of cooperation in international design projects where students obtain cross-cultural experiences in the context of sustainable product design (Boks et al., 2008). The cross-cultural interaction involved site visits, local research and design studio activities in which all students were involved.

This paper aims to share experiences with setting up and carrying out such international design projects, using documentation on processes, presentations and reflections, and interviews with the participating stakeholders, as well as the outcomes of a survey among the participating students addressing their experiences.

Background from Norwegian perspective

Since a number of years, 3rd year students from the Department of Product Design (IPD) of the Norwegian University of Science and Technology (NTNU) have the opportunity to organise a study trip as part of their sixth semester. Destinations for these trips are increasingly non-European countries. The IPD department believes that such experiences greatly contribute to the development of industrial design students, by interacting and cooperating with foreign students, and by gaining perspectives of what industrial design means in a non-familiar context. After all, as said, designers, as many professions, are increasingly part of a global community, both professionally and socially. Earlier experiences with study trips to China and Central America were documented in a previous publication (Boks et al., 2008) evaluating perceived benefits of such study trips that require considerable funding and organisation efforts. In the small amount of scientific literature on cross-cultural exchanges in higher education, limited reflection can be found, especially within the context of design education, and relatively large student groups. Based on a survey, the previous publication concluded that past study trips have proven to be meaningful investments

in both increasing the cross-cultural perspective of the participating students and strengthening contacts with involved institutions abroad.

The cooperation with the UB-IDT, which was part of the NTNU study trip in 2010 in addition to a stay in Uganda, differed from previous study trips. Previously, collaborative projects focused on stand-alone workshop joining students from different backgrounds; this time a more substantial and active collaboration was sought with a local company from Botswana, as further explained in section 4.

Background from Botswana perspective

For the IDT Department at UB, the visit by NTNU students provided a worth wile opportunity of working with students from a different cultural background and experience. This visit was in-line with the IDT department's aspirations of having its students exposed to an international design context.

Previous related activities included projects with Nokia (Cultural Context Design) which ended with to IDT students attending the Nokia Student Conference in Finland. There has also been a tradition of study trips to South Africa for final year students, where design companies and schools are visited to share cultural experiences and inspiration. Memoranda of agreements have been signed with several universities around the world including Rice University in Houston and Delft University of Technology in the Netherlands. Also, several UB staff members have obtained master and PhD degrees at academic design institutes abroad in the Americas, Europe, Australia and Asia.

With Botswana having a small population; design students need to have a feel of designing for a global market. Thus, more contact with other cultures is essential for Batswana students to prepare them for the competitive global market, hence the UB-NTNU project.

How different are Botswana and Norway really?

From a Norwegian perspective, searching for cross-cultural experiences for students to participate in during study trips is an exciting challenge. Previous experiences in China learned that both differences in culture and ways to communicate make collaboration with Chinese universities probably one of the most challenging and interesting experiences from that perspective. Experiences in Central America proved that collaboration with design departments at universities in emerging economies not necessarily implies a culture shock as one might be after. It is therefore a justified question whether embarking on project collaboration between students from Botswana and Norway would really offers the intended cross-cultural experience. After all, Botswana is one of the fastest growing economies of the world, with a dynamic culture characterised by the quest for novelty and consumption patterns not much different from those of the industrialised world (Molokwane et al., 2009). Nevertheless, some differences can be pointed out that also have their effect on the study programmes at NTNU and UB, justifying the "cross-cultural experience" signature. Owing to the generally small to medium size profile of the national industry, most industries in Botswana may be single commodity producing companies, requiring multi-faceted trained designers rather than variegated professionals for different sectors (Molokwane et al., 2009). Even though this may be the case in Norway as well to some extent, the NTNU curriculum intends to prepare students for professional careers at multinational design departments as well. Given its relative proximity to many such firms, Norwegian students obviously have more resources and staff experience at their disposal allowing for such preparation. Since the manufacturing industry in Botswana is still at it infancy there are few places where UB students can be exposed to the application of design in industry.

That being said, it is pointed out that many similarities exist between both curricula in terms of design subjects and course set-up.

Projects

About two months before the project, two cases had been selected by the UB teachers. The first case involved a local company, WildFoods, which collects, processes, and sells products made from fruits which are obtain for a fair price from local communities (Figure 1). Community involvement and fair pricing were among the reasons why this company was selected. The company is currently small, with little money and expertise to invest in design, but is ambitious to enter international markets. The students

were to provide design assistance ranging from developing sustainable packaging, in-store display and logo alternatives for various market segments to further product portfolio development. This project presented a real problem and an involved client; the company was very active in participating in the project, by providing a guided tour of the production facilities, explanation of current marketing strategies, and by acting as discussion and brainstorm partner both mid-project and during the final presentation session.

Figure 1: WildFoods Product Range

The second project placed students within a context, in this case Gaborone Bus Rank, challenging them to identify design opportunity spaces. The Bus Rank was selected because of a lot of activities and personalities co-existing in a small space, providing several sustainability challenges, including both environmental and social aspects.

Design activities

After having been grouped in seven groups of mixed background (UB-NTNU), the 35 students were free to choose any of the two above themes to work with. One of the first icebreaker activities was that each group was to design a 'company logo and mission', resulting in a number of creative attempts (Figure 2).

All students attended the briefings of both projects prior to selecting a project that may suit their liking. Visits to WildFoods Company and the Gaborone Bus Rank allowed notes and pictures (observations) that more familiarised students with the projects. The assumption was that, by allowing students to select a project to work-on they will be more motivated and therefore produce better results. The students were briefed to focus on sustainability and affordability of solutions in designing solutions.

Figure 2: Example of group logo (left)

Figure 3: Impression of the design process (right)

The students used various information collection and design methods. A number of groups investigated for example local super markets to observe how WildFoods products were currently displayed, interviewing shop owners about customer feedback. All groups made extensive use of brainstorming

techniques, sketching, mock-ups and computer modelling (Figure 3). Co-operation amongst groups involved per project was essential in realising a variety of solutions for both projects, such as business class packaging (Figure 4), logos (Figure 5), and a bus shack designed for improved social interaction (Figure 6).

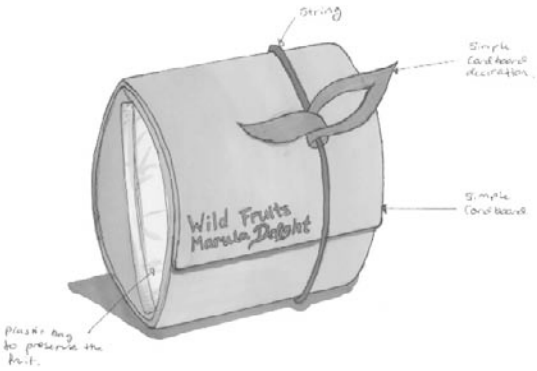

Figure 4: New packaging proposal

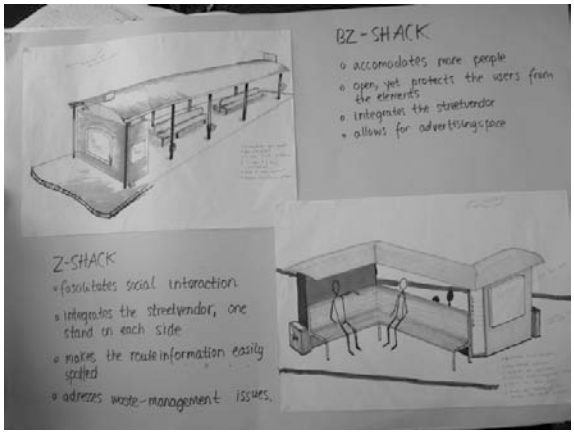

Figure 6: Bus shack design for social interaction

Figure 5: New company logo proposal

Survey

In order to evaluate the experience, an anonymous survey was held by means of a questionnaire. Immediately after the last joint session on the last afternoon, all 35 participating students answered questions addressing mutual understanding of design, use of design methods, (inter-cultural) communication, set-up of the project and overall evaluation. Specific attention was given to the different aspects of sustainability, and to investigating how much the students had learned from each other.

The questions were answered on a 5 grade scale (strongly disagree-disagree-indifferent-agree-strongly agree). Evaluating the answers, each question received an average numerical score, by translating the used qualitative scale into a quantitative one (-2,-1,0,1,2).

This section presents the results from the survey, and discusses differences in answers between the two students groups, with the overall intention of structurally mapping the benefits and pitfalls of this type of design project.

Understanding of design, use of design methods

A number of interesting results appeared when asked about the mutual understanding of what it means to be a designer in another country. Much more than vice versa, the Batswana students felt that the Norwegian students had a similar understanding of industrial product design (0,68 versus -0,3). They also indicated that they shared a universal design language, whereas the Norwegian students were rather indifferent about this (0,07 versus 1,18). Considering the use of tools and methods, more differences become apparent, which cannot be explained by different perceptions on whether both groups are used to the same tools and methods; the respective answers to that question points out that this is quite similar (0,57 versus 0,79). But in general, Norwegian students are of the opinion that they are used to different ways of carrying out a design project whereas Batswana students think that these ways are quite similar. For example, Norwegian students ‘disagree’ (-1) that both groups have a similar way of brainstorming and ide-

ation, whereas Batswana students agree (0,89). Similarly, Norwegian students leaned towards disagreement regarding the statement that the Batswana students have a similar way of prioritizing activities (-0,6), whereas Batswana students leaned towards agreement (0,58).

The results indicated that one prior aim of the project was well achieved: both students group agreed (Norwegians, 1.07) or even strongly agreed (Batswana, 1,89) that, through the project, they got a good impression of how students 'from the other country' work.

Table 1: Questions on Understanding of design, use of design methods

	NTNU students	UB students
The students from the 'other country' had a similar understanding of industrial product design as we do	-0,3	0,68
The study trip made me realize that we shared a universal design language with the design students abroad	0,07	1,18
The students from the 'other country' used similar tools and methods for design like the ones we learn	0,57	0,79
The students from the 'other country' have a similar way of brainstorming and ideation	-1	0,89
The students from the 'other country' have a similar way of conceptualization	0,14	0,95
The students from the 'other country' prioritized the same activities during our project	-0,6	0,58
Through the project, I got a good impression of how students 'from the other country' work	1,07	1,89

Communication

The issue of communication between the two groups of students was investigated as well. Both student groups agree that they took the opportunity to talk with each other about being a design student in a different country, about cultural differences related to product design, and about life in general. On average, the Batswana agreed a bit more than the Norwegians, but the responses point in the same direction. There is a difference however when answering the question whether there was enough room for social interaction. The Batswana students were clearly pleased with this (1,26), though the students from Norway would perhaps liked to have more interaction (0,14). This difference can probably be explained by the fact that the Norwegian students were totally focused on this project, whereas for the majority of the students from Botswana, the project came on top of other educational or social obligations, making that they were probably neither wanting nor expecting more room for social interaction.

Table 2: Questions on communication between the students

	NTNU students	UB students
During the project, I took the opportunity to talk about comparing how it is to be a design student in a different country	0,57	1,17
During the project, I took the opportunity to talk about cultural differences related to product design	0,71	1,11
During the project, I took the opportunity to talk about cultural differences related to life in general	0,93	1,16
During the project, there was enough room for social interaction with 'the other students'.	0,14	1,26

Project set-up

The activities were not graded nor an official part of any course, but to some extent obligatory for the participating students once they had committed themselves to the project. Nevertheless, teachers at both sides had considered the possibility of grading the outcomes of the group work. The motivation to do so could lie in pressing the students to deliver their best performance, but the motivation to reject the idea of grading was that it would probably undermine the main aims of the project, i.e. to create a social exchange process, understanding what it means to be a design student in a different cultural context.

Strikingly, strong differences in attitude between the two students group can be observed when asked about grading. Clearly the Batswana students were of the opinion that the project results should have been graded (1,53) whereas the NTNU students disagree (-1,3). A similar difference in opinion is revealed when asked about the possible effects of grading, though not that strong: though it might have contributed to the quality of the results, it would have had an (even) less positive effect on cooperation and interaction – confirming the teachers' opinion on this matter beforehand.

Table 3: Questions on grading and guidance

	NTNU students	UB students
The project results should have been graded and have been an official part of a course	-1,3	1,53
If the project results would have been graded, that would have had a positive effect on their quality	-0,3	0,82
If the project results would have been graded, that would have had a positive effect on our cooperation and interaction	-0,8	0,56
During the project, there was enough guidance from the teachers	1	1

Overall evaluation

As the project was to explicitly focus on sustainability aspects, students were asked if they thought they had succeeded in addressing these. A clear difference can be observed between the Batswana and the Norwegian students. The Batswana were very positive as to the groups' achievements, with social aspects scoring highest (1,44), leading for environmental aspects (1,37) and economic boundary conditions (1,17). Norwegian students were much less satisfied according to their scores (0,85, 0,64 and 0,21 in the same order) – even though also these scores indicate some degree of satisfaction. This difference may be explained by the fact that Norwegian students may have had a higher expectation of their achievements, or are more critical as to what constitutes success.

On the question whether the two groups of students had learned from each other about environmental and social aspects of sustainability a similar pattern can be observed. The Norwegian students indicated a positive contribution, but smaller than the Batswana students, but were overall quite positive towards having learned about social sustainability aspects (0,86). Both groups also indicated that became more interested in design for other cultures (1,07 and 1,12). Overall, students were quite satisfied about their end results, both where it concerned the final concepts developed (0,64 and 1,42) and the understanding of how the other students worked (0,93 and 1,42).

Table 4: Questions on overall evaluation

	NTNU students	UB students
We succeeded in addressing 'environmental aspects' in our project	0,64	1,37
We succeeded in addressing 'social sustainability aspects' in our project	0,85	1,44
We succeeded in addressing economic boundary conditions in our project	0,21	1,17
We have learned about environmental aspects in design from students from 'the other country'	0,29	1,42
We have learned about social aspects in design from students from 'the other country'	0,86	1,44
I was happy with the end result of our project in terms of the final concept we developed	0,64	1,42
I was happy with the end result of our project in terms of the understanding I got of how 'the other students' work	0,93	1,42
Because of the study trip I got more interested in design for other cultures	1,07	1,12
I expect this experience will have an impact on my professional life	0,57	1,53
The short deadline made me more creative in comparison with more usual design projects	1,07	1,37

Discussion and delimitations

The participant selection was by default for University of Botswana students; a class was picked to work with the visiting NTNU students. This may have affected student approach and motivation towards the project. Though the Norwegian students did not have prior preparation for the project either, they knew months before that they would be joining this trip and can therefore be assumed to have, on average, a higher level of motivation. Batswana students had no choice but to participate in the project and judging from their responses to the questionnaire they would not have openly opted out of the project. This possible difference in attitude may have influenced answers to the questionnaires even though they were completely anonymous.

In addition to the 28 scaled questions in the survey, two open questions were included as well, asking students what they liked and didn't like about the project. Interpreting their answers, the Norwegian students particularly liked working with real clients, the nature of the tasks given, and the observation how others work through collaboration. The Batswana students indicated similar answers, but stressed more the collaborative aspect and less the reality aspect.

For UB students, most cross-cultural experiences are through others visiting, which limits them to studying how others work only within the Botswana context, and not in the visitor's one. This experience is less comprehensive, compared to that of visiting students. The survey taken reflects this, UB students highly rated "observing how others work" which was all they could do. UB students may benefit more if they were to also have these cross-cultural experiences within a different geographical or cultural context. Students involved in such projects gain confidence in their skills as designers, which is also reflected by their better grades. Design is still a young field with an ambitious goal of solving complex problems; processes to solve and ways to teach design is in constant evolution. Therefore projects like these present an opportunity to experiment on how to best teach design and contribute towards greater design knowledge. It was felt that Norwegian students were more independent in their thinking as compared to Batswana

students that usually require some guidance; this goes with the cultural differences, where Norwegians are more used to air their views, not being afraid to disagree, whereas Batswana students felt perhaps compelled to agree with questionnaire statements formulated by teachers, well over 90% of responses agreed or strongly agreed with the given statements.

Conclusions

Based upon the survey and experiences from the authors, the project was generally successful. It is felt that exposure to and collaboration with students from another cultural/geographic context extends creativity and the solution space within design for (social) sustainability, even though this is hard to measure. The cooperation with a real company adds meaning and sincerity to the projects (something NTNU did not have before and which was much appreciated by the students).

Another point worth noting is that although preparations for the project took considerable time, there is no guarantee that social interaction between students automatically occurs, as it is very depending on host students' personal agendas. To make them 'free' from other obligations seems to be a crucial requirement for the cross-cultural interaction to optimally succeed, although difficult to accomplish in practice.

Another impression is that the 3rd year NTNU students experienced the exposure to a real company and a new culture as a relief; it appeared as if the UB students were already much more acquainted with the 'real' world outside university perimeters.

The design concepts themselves showed that students understood that WildFoods had limited funds; by producing simple innovative solutions that were within company capabilities. The Bus Rank solutions involved the use of recyclable materials (mild steel for bus shelter) and devising ways to make social interaction more orderly and less confusion (Bus Rank Signs).

For the Industrial Design and Technology Department at UB) it was the first time for hosting such a project, but the project went generally successful. A lot has been learned from this project, such as the need for more time to prepare, having student participation voluntary and planning more social time for the students. The experience from this project certainly provides a platform for even better projects in the future.

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the Learning Network on Sustainability

Education for sustainability

An interdisciplinary and multimedia project focused on the Belém River (Curitiba, Brazil)

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This paper is related to the research and development of a multimedia project about the Hydrographical Basin of the Belém River, which is located in Curitiba City, Brazil. This project, addressed to children from 8 to 12 years old, and to be delivered to educational institutions, aims at giving a contribution to Education for Sustainability, taking into account that it is a very important way for promoting knowledge and conscience about the value and the co-responsibility of taking care of the environment in all its dimensions. Furthermore, that it is important for promoting co-operative actions in order to improve the present and future conditions of the environment, based on systemic and interdisciplinary approaches, considering the inter-relation and interdependence of knowledge and all dimensions of environment and life.

Environmental Education is a very important way for promoting knowledge and conscience about the value and the co-responsibility of taking care of the environment in all its dimensions. Furthermore, it is important for promoting co-operative actions in order to improve the present and future conditions of the environment, based on systemic and interdisciplinary approaches, considering the inter-relation and interdependence of knowledge and all dimensions of the environment and life.

This paper is related to an interdisciplinary and multimedia project that aims at giving a contribution to Education for Sustainability. The project has been developed at the Interactive Media Design Centre (Núcleo de Design de Mídias Interativas) of the Post-graduation Program in Technology / Federal University of Technology – Paraná (UTFPR), in Curitiba city, Brazil, by an interdisciplinary team[1].

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How to extend the understanding of environmental reality?

The intention of understanding reality, as well as of developing diverse forms of interference in environment, searching for satisfaction of needs and yearnings, has characterized the human evolution process, both in biological and cultural dimensions. In the last decades, a process of acceleration in interactions between natural and social systems has been verified, revealed by the sprouting of global ecologic problems, such as climatic changes, destruction of the ozone layer and loss of biodiversity, which affect the well-being and the conviviality of human societies.

The challenge of promoting a better understanding of the local reality articulated with the global reality – due to the perception of complementary, dependence and interdependence principles between different dimensions of the human conviviality-, has stimulated a frequent use of the term "sustainable", as an adjective for distinct human activities, such as development model, way of life, pedagogical chain, technician-scientific innovation, amongst others, as a way to explicit the search for conciliating development and conservation. This proposal implies a clear understanding of the term sustainability, including educational actions.

Morin et al (2003) emphasize that "the task of education for the planetary period is to reinforce the conditions for the emergence of a world-society composed by protagonist citizens, conscientiously and critically committed with the construction of a planetary civilization" (2003 : 98), with solidarity, identity and belonging feelings to the Earth as a native land and home for all human beings.

This perspective estimates the reinforcement and participation of people, individually and collectively, in decision making and in the development of strategies for environmental management, which affects the social practices in everyday life and the conservation of the biosphere.[2].

In this context, the Environmental Education was recommended by the United Nations Conference about the Human Environment, in 1972, structured at the Belgrade Meeting, in 1975, and configured as an international program at the Tbilisi Conference (URSS) in 1977, including principles, objectives and practical orientations aiming at the understanding of the environmental problems by people and collectivity. This program re-guided and articulated biological, physical, social, economic, cultural and political factors, in order to stimulate the control and handling of the local environment, and, as a consequence, of the global one.

These propositions were reaffirmed in subsequent international conferences and meetings. It is worth mentioning chapter 36 of the 21st Agenda, which presents general propositions for the Promotion of Education, Consciousness and Training (BRASIL, 1992), as well as the Environment and Society Conference: Education and Public Consciousness for Sustainability, promoted by United Nations for Education, Science and Culture (UNESCO), held in Greece, in 1977. This conference emphasized the fundamental role of Education in order to promote conscientious actions of people. Moreover, other movements that emerged for implementing these orientations also have originated other initiatives, such as the ONU's declaration that inferred the period between 2005 and 2015 as the Decade of Education for the Sustainable Development, as well as the inclusion of environment as one of the ONU's millennium objectives. (PNUD, 2010).

In Brazil, Federal Law no. 6938/1981 –Environmental National Politics (BRASIL, 2010), the Federal Constitution of 1988, and Federal Law no. 9795/1999 –Environmental Education National Politics (BRASIL, 2010) are legislations that establish the Environmental Education as one of the principles "for the social and economic development, national safety and protection of human life dignity, aiming at the preservation, improvement and recovering of the environmental quality that is proper to life".

Furthermore, the National Curriculum Parameters (PCN's), which guide education in Brazil, integrate contents about environment in the curriculum, as a transversal theme in all educational practices. Besides, the Environmental Education National Program (PRONEA) establishes guidelines for the development of Environmental Education as a dialogic practice that aims at developing in the Brazilian society a critical and sensitive consciousness about the environmental questions, based on an approach that relates social, ecological, economic, political, cultural, scientific, technological and ethical factors, in order to promote the development of autonomy, freedom and individual and collective responsibility in the processes of choices, decisions and participations in daily life actions.

[2] Biosphere or Ecosphere is the fine layer that is formed by the web of all existent ecosystems in the Earth. (KORMONDY; BROWN, 2002).

Environmental education, playfulness, and cultural diversity

The multidimensional complexity of the present reality has motivated the revival of some ethic-philosophical questions related to the sustainability of life in the Earth, and to the quality of the social conviviality, by means of a deeper understanding about the multifaceted human activities, which includes education.

It is observed a continuous process of creation and innovation of educational methods and technological resources, such as the digital ones, which belong to the history of Education, as they are related to learning theories.

According to Morin, "thinking in a complex way becomes pertinent as we face (almost always) the need to articulate, relate, contextualize" (2003 : 38). This is convergent with the transversal approach proposed by the PCN's concern for three themes related to the environment: cyclic nature of nature, society and environment, and environmental handling and conservation, in order to allow an integrated vision of local and global reality, affective involvement, and participative conduct.

In this sense, promoting individual and collective participation through educational processes, considering the natural and cultural diversity, demands such pluralism and diversity of educational environments and methods, in order to effectively communicate and improve people's knowledge about environment, taking into account people's experiences and practices, as recommended by the Tbilisi Conference (DIAS, 1994), and reaffirmed by the PCN's and by the Treated of Environmental Education for Sustainable Societies and Global Responsibility (BRASIL, 1992).

The development of pleasant and playful activities is very important in educational processes for people from all ages, as they promote the development of expression, organization and critical analysis of ideas and information, which in turn give a contribution to a better understanding of reality, by means of the improvement of knowledge, both in formal and non formal scopes. (see e.g. BARRA et al, 1996; DIETZ; TAMAIO, 2000).

Furthermore, according to Geertz (1989), culture is a web of meanings woven by people along life, based on which each one develops values, conducts, and analyzes their own existence. Culture is dynamic and varies for each one, going beyond economical, political and territorial frontiers. Therefore, environmental education should not follow a universal approach. It is necessary to cater for some particular requirements of the target beneficiaries, taking into account their symbolic, technical and practical needs and yearnings, amongst others.

Developing an interdisciplinary and multimedia design for environmental education

Methodologies and didactic resources for environmental education have faced diverse challenges, such as, for instance: integration of the systemic approach, adequacy to the beneficiary group, easy access, diffusion and handling, incorporation of technological innovations, amongst others.

In this sense, the development of digital multimedia for environmental education, which might be available in digital supports such as the internet, digital television, CD-Rom and DVD-Rom, amongst others, combining different medias (e.g. animation, illustration, photography, text, video, etc.), might be helpful in environmental education, promoting an easy access to information and experiences from local contexts and real life.

The conceptual approach of the *multimedia project for environmental education* is based on the respect for the cultural diversity, which is also part of the environment, aiming at the conservation of biodiversity, as well as on social co-responsibility. This instructional material is intended to give a contribution to Environmental Education by affording the diffusion of information, in order to develop in people a deeper perception of the environment, involvement and commitment with it, as well as motivation to get involved in actions addressed to environmental care and protection.

The Hydrographical Basin of the Belém River

Currently, the project is focused on the Hydrographical Basin of the Belém River, because of its historical importance for the development process of the city of Curitiba, capital of Paraná State, Brazil, as a superficial water source for diverse uses (see BOLLMANN; EDWIGES, 2008), as well as due to the need to develop actions addressed to recover its water resources, based on the Brazilian Law n. 9433, from 1977, which established the National Politics for Managing Water Resources, and the hydrographical basin as a territorial unit for managing water resources, involving public government, users and communities (BRASIL, 2010).

The Belém River is entirely located in Curitiba, and its hydrographical area, which integrates the right margin of the Iguaçu River's basin, reaches 35 neighbourhoods, and the river crosses 15 of them. These present different environmental, economic, social and cultural conditions, including some very critical in terms of environment degradation (see e.g. BOLLMANN; EDWIGES, 2008).

The Belém River springs in the Cachoeira neighbourhood (in the Northern region of Curitiba), and it falls into the Iguaçu River, in the Boqueirão neighbourhood, after covering 17.3 km within the city. There are important public spaces along its trajectory, such as: São Lourenço Park, Pope Forest, Public Stroll, Gutierrez Forest, Botanical Garden, Wired Opera, Paulo Leminski Quarry, Zaninelli Forest, and German Forest. Furthermore, the Rio Belém crosses the political centre of Curitiba (so-called Civic Centre), which usually has intense traffic of people and vehicles.

Although the notable environmental and symbolic relevance of the Belém River's Hydrographical Basin for Curitiba related to its geographic, economic, social, cultural dimensions, amongst others, the quality of its water has been degraded, due to the precariousness of the sanitary sewer infrastructure, irregular occupations of its margins, as well as to accumulation of sand, amongst other environmental problems. According to Bollmann and Edwiges (2008), the pollution and contamination of the Belém River's Hydrographical Basin is primarily caused by domestic effluents and solid residues; approximately 90% of its water pollution is originated from domestic effluents.

Concept and methodological approach

The concept and methodological approach of the project that is reported in this paper is based on the understanding that "to achieve the effective development of environment education, full advantage must be taken of all public and private facilities available to society for the education of the population: the formal education system, different forms of non-formal education, and the mass media" (TBILISI DECLARATION, 1977). Furthermore, it is understood that "environmental education should bring about a closer link between educational processes and real life, building its activities around the environmental problems that are faced by particular communities and focusing analysis on these by means of an interdisciplinary, comprehensive approach", in a way to promote "a proper understanding of environmental problems", as well as to "help to develop a sense of responsibility and solidarity" in a broader local and international dimension, in order to provide knowledge and skills to effectively develop actions addressed to the conservation and improvement of the environment.

Taking this perspective into account, the guidelines of the project are based on present, past and future perspectives from people who have relevant experiences related to the Belém River, such as environmental researchers, people who work, live or lived nearby the Belém River, as well as on its historical contextualization and present observation.

The project is addressed to children from 8 to 12 years old, who are often able to use computers and interact with digital multimedia, as well as to understand and critically analyse basic concepts, as inferred by Jacques Gonnet (2004).

It is also intended to be accessible to the general public from all ages and socio-professional groups, who might be interested in the subject, as well as people who might have an effective influence on the formal and non formal education, such as parents, teachers, and professors, amongst others.

Multimedia resources include video documentaries, audio, illustrations, animations, photos, textual contents, accessibility features, amongst others.

The research follows an interdisciplinary and qualitative methodological approach of an interpretive nature (MOREIRA; CALEFFE, 2006), which does not aims at establishing an absolute truth, nor general conclusions and homogeneity in categories. Instead, it aims at analyzing complex and dynamic conditions (OLIVEIRA, 2002).

One emphasizes here the importance of adopting an interdisciplinary and a "transdisciplinary" approach in research and development, which promotes, besides interactions and reciprocities between disciplines, permeability and crossing borders (KLEIN, 1999; NICOLESCU, 2002), taking into account that the relationships between society and technology emerge and are manifested in contexts of complexity and cultural diversity, influencing and being influenced by people's views of the world, their historical and symbolic references, knowledge, values, practices and ways of living.

Furthermore, it is here understood that "there are instances that allow to control [- in a certain way -] knowledge; each one is necessary, and each one is insufficient" (MORIN; LE MOIGNE, 2000 : 62). Moreover, "[…] what allows knowledge is simultaneously what limits it" (MORIN; LE MOIGNE, 2000 : 64). Thus, there is always some uncertainty, which demands a non determinist and non reductionist perspective in the organization of systems.

The methodological procedures include semi-structured interviews (with a sample of citizens, who live, lived, and/or work nearby the Belém River, professionals and researchers who have been focused on environmental education and sustainability), observation, photography and audiovisual research, websites analysis, amongst others.

The content of the project is focused on the inter-relationships between systems related to the Hydrographical Basin of the Belém River and users´ experiences, in order to establish deeper connections with their lives and local contexts. This approach might also be helpful to promote co-responsibility and initiatives of actions addressed to environmental protection.

The development of the digital media is based on principles of interaction design (see e.g. PREECE et al, 2005; BADRE, 2002; amongst others), as well as on social and cultural contexts (see e.g. GEERTZ, 1989; BADRE, 2002; LÖWGREN; STOLTERMAN, 2005; ONO, 2006; amongst others). Interaction design principles are related to: visibility; feed-back; physical, logical and cultural factors and restrictions, mapping, consistence, affordance, amongst others (see e.g. PREECE et al, 2005).

It is worth mentioning the relevance of considering user in a broader sense of its meaning – not as a passive actor, but rather as a participative one in the development process of communication and information, not only receiving information and using artifacts (see e.g. MURRAY, 1997). In this sense, a sample of the target group from 8 to 12 years old has been asked to participate in the representation of memories, and present and future perspectives about the Belém River, as well as in the evaluation of the multimedia project.

Multimedia design for environmental education

The analysis of some Brazilian websites about environmental education and ecology addressed to children (e.g. Criança Ecológica, Recicla Kids, Caminho das Águas, Caderno Águas do WWF, Chuchuchuá, Meu Planetinha), as well as of some international projects related to environmental education and sustainable development, such as Lola Project and YouthXchange, for instance, has also given an important contribution to the concept and development of the multimedia design.

The textual and image contents were chosen taking into account the beneficiary group with age from 8 to 12 years old, as well as the objectives and digital media of the project.

Too long texts were avoided, and image contents (e.g. illustrations, audiovisuals, pictures, animations) were prioritized in order to let the digital media more attractive, dynamic, pleasant and stimulating to interact with.

In this sense, the educational media has been developed, in a continuous process, also searching for a contextualization with the local reality, but without losing the connection with the global community and the environment as a whole.

14 neighborhoods – Cachoeira, Abranches, Barreirinha, São Lourenço, Ahú, Centro Cívico, Centro, Rebouças, Jardim Botânico, Prado Velho, Guabirotuba, Hauer, Uberaba, Boqueirão) -, which are crossed by the Belém River, are represented in the digital multimedia, emphasizing the extension and importance of each one in the urban scenery.

The trajectory of the Belém River begins in the Cachoeira neighborhood, where its spring is located (Figure 1). Then, it crosses other neighborhoods (Figures 2 and 3) until reaching the Boqueirão neighborhood (Figure 4), where its estuary with the Iguaçu River is located.

Figure 1: Scenery of the Belém River in the Cachoeira neighborhood

Source: Research and development team of the Interactive Media Design Centre / Post-graduation Program in Technology / Federal University of Technology – Paraná

Figure 2: Scenery of the Belém River in the São Lourenço neighborhood

Source: Research and development team of the Interactive Media Design Centre / Post-graduation Program in Technology / Federal University of Technology – Paraná

Figure 3: Scenery of the Belém River in the Prado Velho neighborhood

Source: Research and development team of the Interactive Media Design Centre / Post-graduation Program in Technology / Federal University of Technology – Paraná

Figure 4: Scenery of the Belém River in the Boqueirão neighborhood

Source: Research and development team of the Interactive Media Design Centre / Post-graduation Program in Technology / Federal University of Technology – Paraná

Working with the neighborhoods that are more closely related to the Belém River, the media might express the idea of familiarity of the local contexts to users (immersive readers), thus making easier to understand the composition of the ecosystem of the city, taking into account the dynamics of the economic, social, cultural, energetic sustainability of human relationships, as well as of natural and built environment (SIRKIS, 2005).

Furthermore, the media offers some top views of the Hydrographical Basin of the Belém River, which might help users to have a better understanding about the relationship between urban elements and the environmental system.

A mapping of the media (see Figure 5) was developed, in order to achieve a more efficient organization of the communication system and its architecture, also considering the relationship between elements of the graphic interface, e.g. icons, command buttons, links, textual contents, pictures, illustrations, videos, animations, etc.

The first pages of the multimedia aims at giving spatial references for the user related to the Hydrographical Basin of the Belém River. Five maps allow the user to have a macro and micro perspective of the Hydrographical Basin of the Belém River within the continent (America), the country (Brazil), the State (Paraná), the city (Curitiba), and also in relation with other hydrographical basins of the city (Figure 6). According to Thierry Kazazian (2009), different scales, as a matter of fact, show solidarity, by means that each element exists in relation with other elements.

The main menu bar of the graphic interface is vertically placed on the left side of the page, with the option of hiding it for a better visualization of the illustration and other contents of the page. And there is a secondary menu bar, horizontally placed in the bottom of the page, with some general information, such as: about the media, index, glossary, accessibility, help. Both menu bars are composed by analogous colours with a pallet of yellow greens, greens and blues, which result in a harmonic combination with foregrounds and backgrounds of the pages. (see Figure 7)

Typographies of the logotype “Rio Belém” (Belém River), body text, titles and subtitles have sans-serif typefaces, and they are simple and youthful (see Figure 7)

The digital media offers some accessibility resources, in order to reduce restrictions to people with visual and auditory deficiencies, and to deaf persons, e.g. language of signals, color and font size options, sound, subtitles, as well as language options (The media is intended to have the following language options: Portuguese, English and Spanish. Besides these languages, others might be also being accessible, depending on future collaborations).

Figure 5: Mapping of the digital media for environmental education

Source: Research and development team of the Interactive Media Design Centre / Post-graduation Program in Technology / Federal University of Technology – Paraná

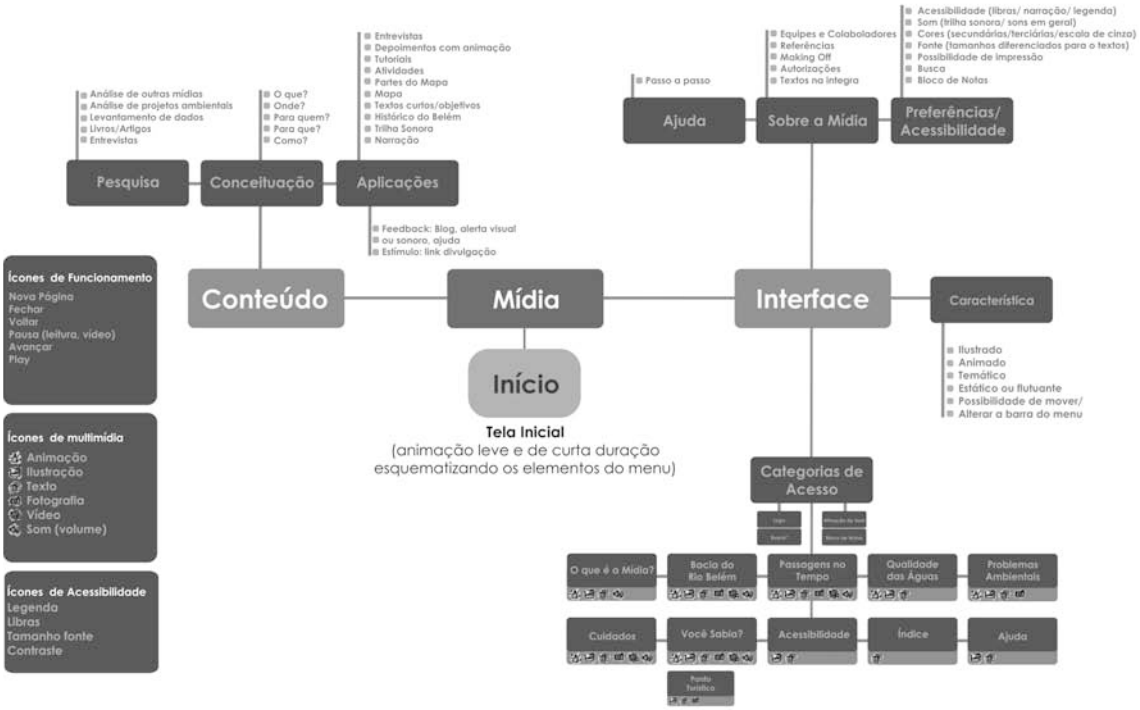


Figure 6: Macro and micro perspective of the Hydrographical Basin of the Belém River

Source: Research and development team of the Interactive Media Design Centre / Post-graduation Program in Technology / Federal University of Technology – Paraná

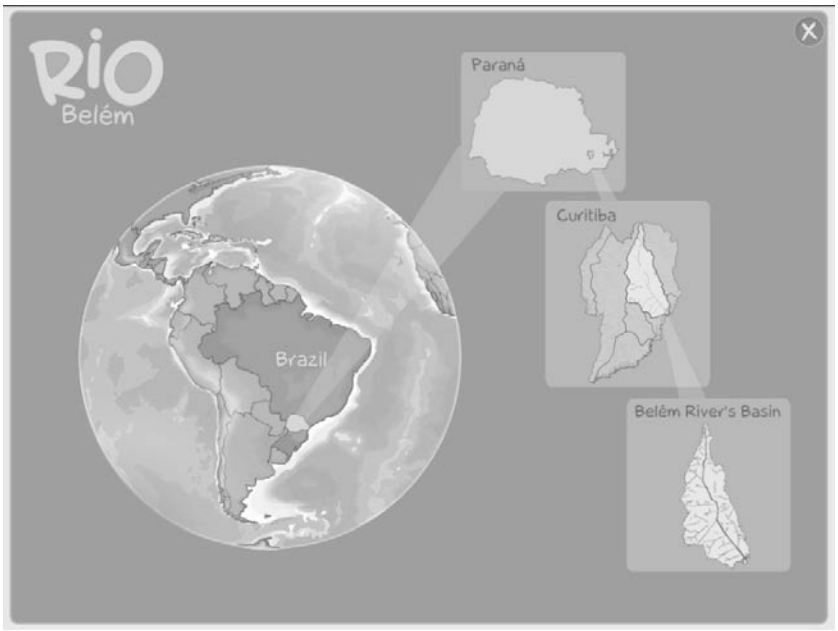
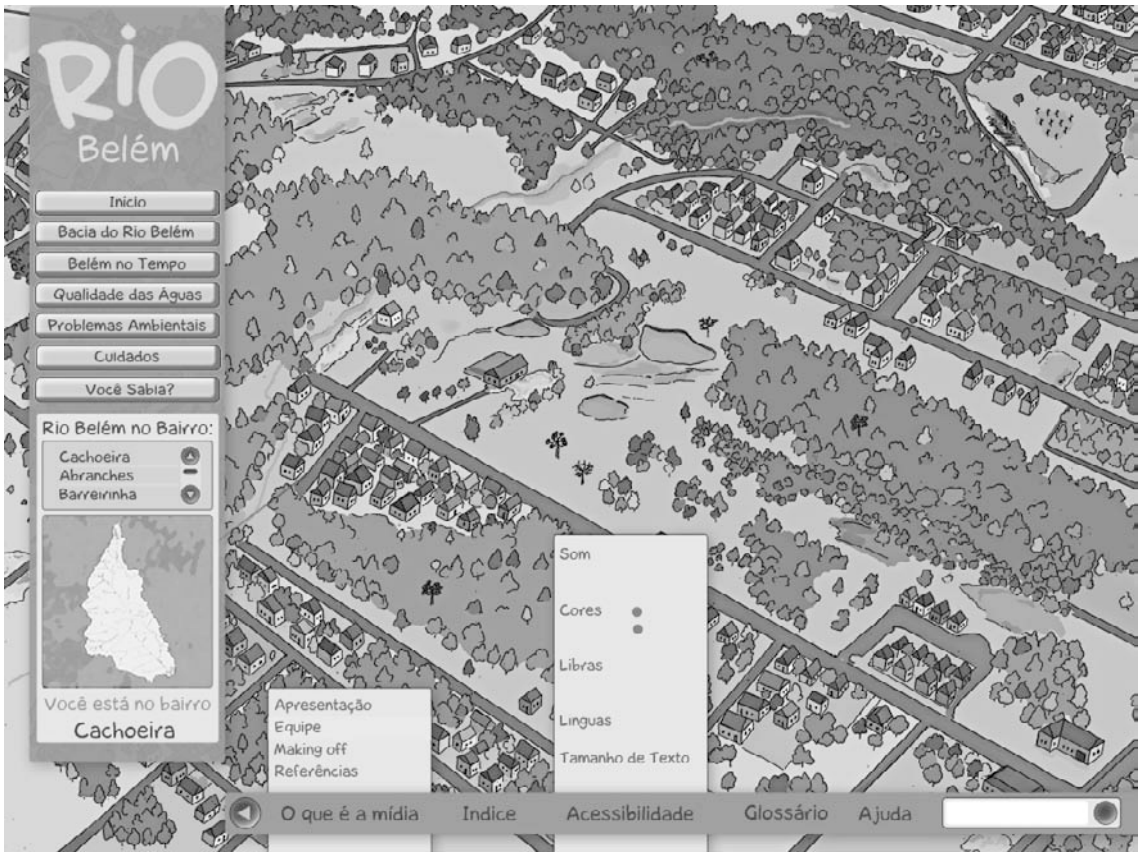


Figure 7: Page of the multimedia graphic interface

Source: Research and development team of the Interactive Media Design Centre / Post-graduation Program in Technology / Federal University of Technology – Paraná



The command buttons of the main menu bar are related to the following subjects (see Box 1):

Box 1: Subjects related to the command buttons of the main menu bar of the multimedia

Source: Research and development team of the Interactive Media Design Centre / Post-graduation Program in Technology / Federal University of Technology – Paraná

The command buttons of the main menu bar are related to the following subjects:

- **Home.**
- **Hydrographical Basin of the Belém River.** Geographic, historical and environmental contextualization.
- **The Belém River along the time.** People's memories, present and future perspectives about the Belém River, registered in videotaped interviews with citizens who work, lived and/or live nearby, as well as represented by drawings and pictures made by .
- **Quality of waters.** Information about the quality of waters of the hydrographical basin of the Belém River, along its trajectory from spring to falls, in different neighbourhoods.
- **Environmental problems.** Examples of environmental problems related to the hydrographical basin, such as: diffuse pollution; inappropriate destination of garbage and sewer; deforestation; amongst others.
- **Cares.** Recommendations for taking care of the hydrographical basin, in order to preserve and improve its natural resources, such as: installation of appropriate sewer system; appropriate destination of garbage; preservation and improvement of vegetation in the margins of the river; appropriate location of buildings within the hydrographical basin; amongst others.
- **Did you know?** Some curiosities related to the local culture, as well as some examples of initiatives and actions aiming at the preservation and improvement of the environment, amongst others.

Audiovisual is one of the resources that are available in the digital media, used to register interviews with people from the community who work, live and/or lived nearby the Belém River, and with professionals and researchers from the environmental area, about their memories, present and future perspectives.

One of the interviewees (INTERVIEWEE A, 2009), for instance, is a retired teacher, whose childhood was closely linked to the Belém River. She and her brothers used to play in the margin of this river, as she reports, and as illustrates some pictures from that time. She tells that, after entering in the faculty, her contact with the river occurred by the neighborhoods and places throughout she used to pass by: "I passed by the, nowadays, so-called Civic Centre, which was called 'Campo do Paraná' at that time. I used to pass by the 'Passeio Público' [Public Stroll] to go to the Faculty of Philosophy, which was located on the side of the Guaíra Theatre at that time", she affirms. Nowadays, she has had less contact with the river and with neighbors, comparing with her childhood and youth period. And she imagines that the river will be totally canalized in the future, what contradicts the current official planning guidelines for Curitiba city.

Taking into account the importance of approaching the children of the reality of the hydrographical basin of the Belém River, the research and development team and two collaborators from the Environmental Secretariat of Curitiba city followed the trajectory of the Belém River, producing pictures and audiovisual material. This illustrates different environmental contexts and conditions, in terms of quality of waters and infrastructure, for instance, which could be explored in the multimedia for environmental education.

Along the trajectory, for example, Leny Mary Góes Toniolo, who works in the Environmental Secretariat of Curitiba city, explains about the systemic perspective of environment, about people's perception of the river, as well as about the need to sensitize them in order to have an effective behavioral change: "We do not learn anymore with the cycles of the nature, and we do not think anymore in terms of processes of cycle, of dynamic flows, and we started to think in a linear way, of cause and effect. '…' I believe that the hydrographical basin is a great challenge to understand a bit such complexity." (TONIOLO, 2010).

Another interview presents experiences of a young man (see Figure 8), who lives in a low income neighborhood since he was born, in a house located in the margin of the Belém River, which had environmental problems such as floods in the past, before its canalization, due to inappropriate housing occupation, destination of garbage and sewer effluents, amongst other factors. Nowadays, there are still environmental problems, such as the lack of safety along the canalization of the river (some people fall down into the river), inappropriate garbage destination (garbage use to be thrown by people into the river), etc.

Figure 8: Scene of the Belém River in the Vila Diana neighborhood, and an inhabitant

Source: Research and development team of the Interactive Media Design Centre

Conclusions

Currently, there are a few digital media about water resources and environmental education addressed to children, which are related to local contexts, also taking into account social and cultural diversity. This emphasizes the contribution and relevance of the multimedia project focused on the Hydrographical

Basin of the Belém River, which, although its important role for the economic, social and cultural development of Curitiba, currently presents the highest level of water pollution in this Brazilian city.

This problem reinforces the relevance of developing environmental education focused on it, in order to promote a better understanding about real and local context, awareness, co-responsibility and commitment of governors and community, as well as effective actions that can lead to conservation and improvement of the environment.

The multimedia for environmental education brings across memories, present and future perspectives that are inter-related in people's daily lives, and that register their cultural references, experiences, imaginary, values, conducts, needs and yearnings, which are relevant and should be considered in environmental education, based on a systemic approach.

It is worth mentioning that the focus on the Hydrographical Basin of the Belém River do not intend to demerit any other hydrographical basin, nor other environmental contexts, taking into account their importance and interdependence for environmental balance.

The project is intended to be a reference for further expansions of contents, aiming at including other hydrographical basins of the metropolitan region of Curitiba, as well as other relevant contexts and themes for environmental education, aiming at strengthening the involvement of different knowledge, research and development systems, in order to improve contents and the quality of environmental education.

The results of the project will be available in digital media, such as Internet, CD-Rom and/or DVD-Rom, in order to make the access to them as easier as possible, and they are intended to be delivered to educational, research and development institutions, which aim at developing environmental education.

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INTERVIEWEE A. Interview conducted by Maristela Mitsuko Ono – at Pilarzinho neighborhood, in Curitiba city, Brazil, on October 15th 2009.

INTERVIEWEE L. Interview conducted by Maristela Mitsuko Ono – at Diana neighborhood, in Curitiba city, Brazil, on March 31st 2010.

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the Learning Network on Sustainability

Will the *social* make design address the marginalized?

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Design in India has a unique character, defined by the nature of society, the colonial past and the academic design culture. Through history, it has been aligned with institutions of power: the government, whether imperial, colonial or post-Independence, and industry as the wielder of technology. With class structure and social hierarchy replicated throughout the profession and its concerns, the goals of design tend to reflect an orientation that is administrative or prescriptive, where the designer plays the expert who has no need to consult the people on their needs and wants. Design thus ends up relying on a notion of society as it ought to become and not as it is or was. A broad research agenda for social design must begin by addressing a number of questions. What role can a designer play in a collaborative process of social intervention? What is currently being done in this regard and what more might be done? How can agencies that fund social welfare projects and research gain a stronger perception of design as a socially responsible activity? What kinds of products meet the needs of vulnerable populations? The paper paints the backdrop to social design in India and explores the potential for it to affect the lives of people. This century is going to see a proliferation of the social through information and communications technology and through a new kind of philanthropy. This will call for people trained in new tools with a deep sympathy for the social and for real people. The shift away from the market focus is bracketed by many challenges — in this instance, with the school, the challenge is being proposed as a curriculum. It is therefore time that we, as design academics, rethink the developmental paradigm along the lines of sustainability and equitability — a goal that can be achieved potentially through social innovation but most certainly by proscribing an elitist practice of the profession. It is this desire for design as an agent of change that defines the School of Design project for the Ambedkar University, a new university in New Delhi. The name ‘Ambedkar’ refers to an ideology of social reform, a commitment, as its charter states, to “Ambedkar’s vision of promoting equity and social justice”. The specific notion of equity here is one of affirmative action; the name ‘Ambedkar’, when associated with an agency, conveys in India a focus on the improvement of the lives of those from the untouchable castes. For such an institution to have in its charter a school of design raises the question of what kind of design school that would be. A design school with a curriculum that can nurture the spirit of Ambedkar and social inclusion can act as a greenhouse for a specific engagement of design with a specific India. The programme could bring students to the forefront of service innovation and design via supervised development training that would combine academic rigour with managerial relevance through working on independent projects with a BoP focus. In this paper, the authors lay out the framework that would define their construction of a design

curriculum founded in the social context and arrived at through a process of negotiation with stakeholders.

Introduction

For us in India, it started a hundred and fifty years ago. At the Great Exhibition of 1851 in Calcutta, an engineer with the East India Company, Col. E. Goodwyn (College, 2001), gave a lecture titled "The Union of Science, Industry and Art". It would provide the impetus, three years later, for the establishment in the city of a school of design called the School of Industrial Art. Forty years later, the school added a specialisation in the Fine Arts under pressure from students' parents — in keeping with their status as members of the Calcutta elite, they wanted their children to be trained as artists copying Greek statues, not as lowly artisan-designers working in factories. The school ultimately became known exclusively for its Fine Arts courses; such is the prescriptive power of the elite that in time the courses in design withered away.

While the story offers an insight into the context that is India, by the end of the colonial period, a century later, design education had achieved greater social acceptability. Its rebirth in India happened in the early 1960s through an import of curricula based on the Ulm model. Its context was extracted from a technological-urban paradigm, initiating the discourse of the object for consumption and exhibition.

There is indeed room for the techno-urban discourse, but it ill serves the vast majority of people in India who could potentially become the focus of design attention. Economic disparities here are both extremely large and ever-increasing, with a sizeable population listed as being below the poverty line. The response — as a developmental archetype, followed by government agencies and corporate India since 1947 — has been consistently inadequate in terms of the distribution of benefits. As for design, which belatedly vowed to focus on the needs of the larger society, it has fallen woefully short of its obligations to deliver social change to those at the Bottom of the Pyramid (BoP) (Bicknell and McQuiston, 1977, Nadkarni, 1977). A shift in the design domain is imperative if it is to address unmet needs in the arena of the marginalised.

It is therefore time that we, as design academics, rethink the developmental paradigm along the lines of sustainability and equitability — a goal that can be achieved potentially through social innovation but most certainly by proscribing an elitist practice of the profession. It is this desire for design as an agent of change that defines the School of Design project for the Ambedkar University, a new university in New Delhi.

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The Backdrop: The Neglect of the Societal

Design in India has a unique character, defined by the nature of society, the colonial past and the academic design culture. Through history, it has been aligned with institutions of power: the government, whether imperial, colonial or post-Independence, and industry as the wielder of technology. With class structure and social hierarchy replicated throughout the profession and its concerns, the goals of design

tend to reflect an orientation that is administrative or prescriptive, where the designer plays the expert who has no need to consult the people on their needs and wants. Design thus ends up relying on a notion of society as it ought to become and not as it is or was.

Three things seem to be happening with the design scene in India. First, it is distinctly aligned with the government whose policies have dictated the way design constructed its priorities. Added to that has been the fact that for years few designs for industrially manufactured products ever made it to production. Second, although there have been notable successes in the craft sector, the approach has been to replicate the colonial view of craft as exotica admirably suited for trade, for sale in a faraway location and perspective. Technological interventions have also been made. Thus, again, society does not constitute a significant factor in design. Third, privileging and status concerns modify and transform design. Design curricula were imported; they subscribed to an idea of design appropriate for a consumer-focused society. The location of design programmes in recent years in institutes of technology removes design even further from the social aspects of solution construction. (Srinivasan and Varadarajan, 2003)

All three constructs are characterised by a focus upon the production and sale of the object, and a neglect of the societal side of design. Significantly, it is the elite, administrators and articulate designers, who take it upon themselves to decide what 'good design' is for the people. While this is how the voice of design was usually constructed in the texts of the last century, it presents a unique problem in India in that such a view becomes isolated and limits design's ambit to a small section of society, reinforcing Sainath's observation: "A profoundly undemocratic streak runs through India's development process." (Sainath, 1992)

Design institutes have proliferated in India in the recent past with a mitotic replication of the core curriculum as design for manufacture. India-specific projects continue to be spoken of as 'design for development' or 'design for the rural', in effect privileging technical innovation as the way for design to engage with the needs of the marginalised. The following critique applies quite precisely to these institutions — we reproduce it at some length to make the case for a new curriculum that includes the social. "Since the Industrial Revolution, the dominant design paradigm has been one of design for the market and alternatives have received little attention. Compared to the 'market model', there has been little theorizing about a model of product design for social need.... Conversely, little thought has been given to the structures, methods, and objectives of social design." (Margolin and Margolin, 2002)

The 'Marginalised'

A significant proportion of the population of India lives in its villages. It also constitutes the majority of India's poor, uneducated and chronically ill. Although they have been the focus of all international aid and of the long-term development goals of both local and multilateral agencies for five decades, their numbers have only grown. Change there has been, but life for these millions continues to be harsh and is imbued with a feeling of powerlessness and social exclusion.

While it is not our desire to categorise this population, as 'the marginalised', we do so to emphasise that this is a segment of people that mainstream design practice has kept to the periphery of its concerns. The socially excluded constitute the focus of much academic inquiry and the construction of this population is an outcome of not only neglect but also potentially of incorrect strategies.

"When one speaks of social exclusion, one does not refer to the exclusion suffered by a particular social group but all social groups that are subjected to exclusion. Moreover, social exclusion does not limit itself to market discrimination but refers to discrimination and denial of access in all aspects of life. Finally, social exclusion addresses the multiple and cumulative aspects of being excluded and the consequences that arise out of it." (Louis, 2007)

In small pockets, projects of non-governmental organisations, such as the Barefoot College and Pradan, have transformed the lives of the populations they have touched. Fuelled by enormous passion and a commitment to live and work in the field, these projects demonstrate the power of local and multidimensional problem-solving. Taken in one sweep, they also look very similar to system-design projects that design students work on, except that they extend the life of the project beyond the drawing board and the folio into intervention and demonstration.

On Change

Relieving the grimness of the context, there are ample signs of hope. In recent years, there have been many shifts both in design school curricula and in the various ways the social has been incorporated. The old focus on technological and product innovation targeted at the rural and the poor continues, but there are robust examples of curricula looking at the sustainable and the social as primary issues of engagement. While interaction design looks at the people side to digital technologies, service design and social innovation too have moved from their core management roots to emerge as design specialisations. Initiatives such as change.org and design-21 are two examples of campaigns and social actions that include design and reinforce a shift in focus from a consumption-oriented practice to one of effecting change especially for those poorly served by infrastructure and state policies. This is all good news and is a sign that design is ready to join a sector dominated by aid agencies and NGOs. Yet more needs to be done.

The Potential

The India project (project of India) began over half a century ago as a proposition for change: after the end of colonial rule, Indians in power would work for the well-being of both collective and individual. An inquiry into its success shows that much was not achieved. In this, India is similar to other parts of the planet: “Of the world’s 6.5 billion people, 90 percent have little or no access to most of the products and services many of us take for granted. In fact, nearly half do not have reliable access to food, clean water, healthcare, education, affordable transportation or shelter.” (Smith, 2007). It therefore becomes a design agenda to focus upon service provision through design.

Service design, as it has emerged in the west, primarily focuses on the notion that the artifact designers come out with is a service. Which means there would be two kinds of projects — the redesign of existing services and the design of new ones. In the BoP context, service design can be seen as being primarily suited to central agencies in creating programmes for social welfare. However, there is room for another kind of strategy, one centred on the individual: social innovation.

Social innovation refers to new strategies that meet social needs — including projects that have a social purpose like microfinance or distance learning — and that extend and strengthen civil society. The concept can also be related to social entrepreneurship, which recognises a social problem and creates, organises and manages a venture to make social change. Whereas a business entrepreneurship typically measures performance in terms of returns and profits, social entrepreneurship assesses success in terms of the impact on society.

It is these two perspectives that offer up the potential to focus design attention upon the BoP and provide an alternative to its material focus.

The Bottlenecks

Given the absence of a focused program, the design profession re-purposed systems thinking to address the large problems that surrounded design in India. Offered as a studio topic, the systems design project would point students to issues of health or waste and, in the process of research, allow the student immersion in the field. While it was quite possible for the outcome of the systems project to be a service, it was only the odd student who ventured there. In the main, the dominant discourse would make the project fold into a technical innovation project, so the field work came in time to be the site for finding problems and the outcome another product or object. Over time, the ever-present brief of these kinds of projects, for the problems never seemed to go away, wore out the collective design community and it was okay to design a composting bin rather than take on the unaddressed problem of pervasive waste.

Still the ground is there, the intentions are there, what is missing are belief and experience in the design of non-material outcomes.

Action is difficult, owing to two factors: the first is design’s training and curricula, which are deficient in tools and ways to work in a non-material project, and the other is the context. Sainath looks at what happens in drought, at the way good schemes end up benefiting agencies and not the populations targeted. Another barrier, ironically, is that business investments in social and infrastructure needs often face the highest regulatory hurdles. Corruption? This is a byproduct of how policymakers and nonprofits often approach the needs of the poor, which are mostly handled within the realm of social or government work.

Meeting the social and infrastructure needs of the poor is complex for design as the arena is charged, with social scientists, development experts and political commentators all proffering solutions. Design as

the aesthetic, technical specialisation feels especially out of place and unsophisticated in this dialogue/ discourse.

But design can engage with the construction of projects and solutions that can enable an individual to live with ease and dignity. Immediately we see that we may not be talking about the profession of design at all in the sense of an aesthetic-material project to make objects better. This is the challenge of design in India — should it keep its engagement with the material, compromise so that it is part material and part service, or take the extreme step of seeing itself as a component of a collective enterprise?

If we take the third option we are confronted with the fact that we may be keeping only the intellectual aspect of design — problem solving — and letting go of all else. Additionally the designer at work would be seen as employed in the field of NGOs and other service organisations, designing and redesigning things which may have no material outcome. Which immediately raises the issue of whether this is design at all. This question has been addressed by the profession of service design, though interaction design is still negotiating its roots in design, where the social science collaboration with design results in a greater role for the individual who is the focus or locus of change. (Sachs, 2008)

The Social in Design

There is an ever-widening gap between longstanding assumptions about design education and where we are going in design practice, between the circumstances of 21st-century life and the worldview from which we devise the content and pedagogy of professional design curricula. (Davis, Sep/Oct. 2008)

Design does not train for sociality — it has always been about mass markets, one-size-fits-all, top down, quality. Most importantly, design trains for discrete projects, not long-term engagement or slow change. The social is a different thing altogether, embracing conversation, narrative, engagement, facilitation.

There are a few trends in the year 2008 that will mean something to how and what we design now and in the future. Two things are going on: one, increasing complexity in the scale of design challenges; two, thinking about the people for whom we design as participants in the design process. This necessitates a new knowledge base that supports new practices. It is necessary to be both bottom up (centered on the individual, the field of social innovation) and top down (emanating from the collective-state-corporate, the arena of service design). In curriculum terms, both are post-graduate specialisations, but when introduced at the undergraduate level comprise social design.

A broad research agenda for social design must begin by addressing a number of questions. What role can a designer play in a collaborative process of social intervention? What is currently being done in this regard and what more might be done? How can agencies that fund social welfare projects and research gain a stronger perception of design as a socially responsible activity? What kinds of products meet the needs of vulnerable populations? (Margolin and Margolin, 2002)

A strategy for a curriculum can be speculated upon here. Let us first discuss service design and social innovation and then talk about a possible undergraduate programme.

Service Design is the activity of planning and organising people, infrastructure, communication and the material components of a service, in order to improve its quality, the interaction between service provider and customers and the customer's experience. The increasing relevance of the service sector, both in terms of people employed and economic importance, requires services to be accurately designed. Service Design is an emerging discipline that lies between the various fields of Design and Management. It is the cusp of both these major disciplines which in India have rarely met or exchanged expertise in an educational setting.

There are, however, several opportunities in Service Design in India. Indian corporates as also MNCs operating in the country have shown great interest in recruiting design architects. Indian public sector enterprises are also open to taking design graduates into their fold. Service Design agencies, such as live|work and IDEO, apply design tools, techniques and thinking to service challenges, either to improve existing services or to create new ones.

The first Service Design education was introduced in 1991 at Köln International School of Design. Several other schools (such as Politecnico di Milano) are now proposing service design as the main subject of master studies or as part of the academic curriculum in Interaction Design or Industrial Design (Carnegie Mellon University, Linköpings Universitet, Domus Academy, Aalborg University). India is still awaiting a proper education system in the field of service design. The active participation of custom-

ers and other actors traditionally considered external to a firm's boundary emphasises the need for design activity that organises the interaction among these actors, thus planning sequences of events, materials and information flows. Furthermore, the involvement of "non technical "actors, such as customers, implies that the activity of service design be analysed not only from a functional perspective (with the aim of optimising flows and resources and reducing time of operations) but also from the emotional perspective (creating meaningful events, motivating customers, communicating the service).

In the last few years, the public sector has expanded, with new investments in hospitals, schools, cultural institutions and security infrastructures. The number of jobs in public services has also grown. Such growth is also associated to a large and rapid social change that is calling for a re-organisation of the welfare state. In this context governments are explicitly considering service design for the re-organisation of public services.

There is a growing tendency among Indian bureaucrats to opt out of service for further education. Service Design is one course that could attract a lot of talent from this pool. In many parts of the world, Human-Computer Interaction (HCI) emerged as an interdisciplinary activity between the fields of Computer Science, Cognitive Psychology and/or Human Factors. In India, however, it emerged as Interaction Design. Designers with an exposure to Human Factors inputs will be very effective in tackling many HCI problems. Freelance designers and small design firms of Indian origin have been consulting in HCI in India and abroad. Companies in e-learning and new media that emerged in the early 90s were the first to hire designers for Information Architecture, Instructional Design, Visual Design and Interaction Design.

As far as social innovation is concerned, India extends huge opportunities with its 1.1 billion population of which about 70% resides in rural areas. Of late, the priority sector has witnessed a lot of interest in India and many national and international organisations have driven into innovation in the fields of green energy, sanitation, water harvesting etc. India has also witnessed significant scientific and technical growth over the last two decades, capabilities which social innovation can easily harness.

Even amidst the recent financial slowdown, India is slated to grow at 6.5% even as some developed economies have plunged into recession. Social innovation opportunities could come from the corporate sector as part of their Corporate Social Responsibility programmes. Other opportunities lie with NGOs both domestic and international. Students could also take up entrepreneurship as a new career option.

Porter's five force analysis suggests that Post Graduate Diploma courses could be a very attractive industry to be in. Ambedkar University will have a first-mover advantage as no other institute in India offers a similar one-year program. This is a corporate social opportunity for Indian industry and the design community. We have here the foundation of a cooperative movement that could conceivably create health, wealth and the freedom to choose. Not just for a fortunate few, but for the vast majority across our nation.

There are already numerous social entrepreneurial initiatives that are based on innovative business models that create wealth and opportunity even for the poorest. Design studios already work with disparate segments assisting in augmenting the quality of their user's lives, but this opportunity is for more than just the design industry.

Social design is the creation of social reality, the design of the social world. It refers to design in its traditional sense, meaning the shaping of products and services. Social design thinking within the design world joins developing human and social capital with new products and processes that are profitable. Profitability and ownership of the processes are the cornerstones of sustainability that underpins human well-being. In this view social design is an activity that should not be framed with connotations of charity, aid donations, help etc. It is not voluntary work but should be seen as professional contribution that plays a part in local economic development or livelihood. Social design is the art and science of setting rules in social systems. It is the link between Facility Design, Organisation Design, and Corporate Strategy.

Conclusion

The paper paints the backdrop to social design in India and explores the potential for it to affect the lives of people. This century is going to see a proliferation of the social through information and communications technology and through a new kind of philanthropy. This will call for people trained in new tools with a deep sympathy for the social and for real people. The shift away from the market focus is brack-

eted by many challenges — in this instance, with the school, the challenge is being proposed as a curriculum.

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the Learning Network on Sustainability

Ilha Design

The project, its development and its accomplishments

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Ilha Design is an initiative from Design students of The Federal University of Rio de Janeiro (Universidade Federal do Rio de Janeiro – UFRJ) which main objective is to introduce Design as a way of social and cultural inclusion, which is essential for a better quality of life. It also promotes the Social and Eco Design segments as well as the importance of these areas for the economy. It started in 2007 and each year more than two thousand people (children, young adults and adults) take part in it. It takes place in an island (Ilha Grande – Rio de Janeiro, Brazil) which is a biological reserve. The community in this island has a low income, very little investment from the government, little access to information and other resources.

Design, originally born from the union between Classical Arts and Applied Arts, provides its students the knowledge of technical and creative process, covering the practice and the execution in a functional way. This ability provides its professionals easiness of relationship with other fields of Arts among its duties and strength the tools for the didactic and pedagogic fields along with Art education.

Ilha Design uses the principles of Universal Design, the design that integrates, the "design for all". It aims at product, graphic and environmental design so that all its projects can be used by most people, despite the age, sex or physical, psychological or economical situation.

Ilha Design focuses on education – not merely instructing or orientating children, young and adults, but stimulating critical thinking among cultural, social, political, environmental and economical issues. Education is provided specially through integration, contact and exchange of knowledge.

> "Educate the children and there will be no need to punish men"
> (Pythagoras)

This paper explains Ilha Design project, shows its development, objectives, results and its relation with Sustainability.

Justification

Ilha Design takes place in an island, Ilha Grande, which is a Biological Reserve. The community in this island has a low income, very little investment from the government, little access to information and other resources. Ilha Design provides amazing opportunities, using Design to supply people's needs in a sustainable way.

Design and Arts at Ilha Grande are alternative paths, ways of expanding horizons, stimulating creativity, valuing natural resources available and creating solutions to everyday problems, showing that it is possible to seek a greater professional qualification for a better quality of life.

Ilha Design is an unique experience that joins the knowledge acquired in big institutions, such as UFRJ, with the needs of the school of a community, integrating every person involved. It promotes not only the University, but specially the school to a new and promising horizon.

Figure 1: panoramic view of Ilha Grande

Photo: Andréa Cebukin

Objectives

- Emphasize the importance of Design and Arts as social and cultural integration in the community.
- Identify and present the values of different areas of Art and Design, showing to the students new professional possibilities.
- Stimulate the interest in Design and Art in people of all ages through visual perception and critical thinking.
- Make volunteers aware of the social issue, the Sustainability and the social-cultural problems.
- Promote Design, showing that it is accessible to everybody and integrate parents in the school.
- Raise the number of students that look for academic studies.
- Encourage the social-cultural development among Ilha Grande's inhabitants.

Methodology and Expected results

Having Design and Arts as central axis, Ilha Design offers workshops to students of the involved school. There are also lectures, expositions, video exhibition and the "open spaces". The event receives every single person from the community.

Volunteers must register online on the Project website during a certain period. Students from every course or University are allowed to taka part, as long as the activity is within the project ideals. Every activity must have a practical and a theoretical side, showing clearly the importance of its use.

Workshops

Given by two volunteers, workshops must have a theoretical part, showing the importance of the activity, how it can be used in everyday life and its relation with Sustainability, and a practical part where each student develop a project based on what was learned. It has a determinate schedule, lasting 2, 3 or 4 hours, and only pre-enrolled students can participate. The products of the workshops are shown to public in the exposition or in a performance. Afterwards they are given back to the students.

Figure 2: cardboard furniture workshop

Photo: Andréa Cebukin

Open Spaces

Open spaces are alternatives spaces given by a group of 4 volunteers, where anyone who is interested can join in. These activities try to integrate different study fields from Design and Arts. They must be quick activities to contemplate different ages and kind of students, not being necessary to enrol.

Figure 3: volunteers and students at the hand windmill Open Space

Photo: Andréa Cebukin

Videos Exhibition

Exhibition of films and cartoons that involve Design and Art that occurs throughout the event.

Lectures

Aiming the community, teachers and volunteers, these lectures are given by professionals of the Design and Arts field.

Exposition

There is an exposition of the work that was done by the students during the event and academic works done by the volunteers.

Study Laboratory

Ilha Design team and teachers select students based on their grades and participation in classes. The selected students are invited to participate in the creation of the Design and Arts Laboratory.

Expected results

- Raise awareness of the importance of Design and Arts as a facilitator of life quality, linking the community with the profession, having expectations of a better income, cultural development and environmental concerns.
- Graduate new designers who are more engaged in Social Design and Eco Design.
- Integrate the University in the communities, backing up the public education, with a possibility of social-cultural development.

History

How did it begin?

Ilha Design was born from two different ideas from Elis dos Anjos (at the time studying the first year of Design at UFRJ) and her mother, Elizabeth dos Anjos (Arts teacher at the Ilha Grande public school): to develop an event that stimulates Design in Brazil as professional and social issues; to stimulate Arts education at the public school Escola Municipal Brigadeiro Nóbrega through an artistic happening.

Quickly a group of friends created a team to develop the event and, despite the inexperience, low age (all members were below 20 years old) and, at first, facing difficulties of acceptance of most colleagues and teachers, the trust of over 50 volunteers was gained, funds were raised and the approval of the government and the local community was accomplished. Then, in 2007 the first Ilha Design happened.

Ilha Design 2007

The first Ilha Design happened during August 22, 23 and 24th 2007 at the public school Escola Municipal Brigadeiro Nóbrega, in Abraão, Ilha Grande, Angra dos Reis, Rio de Janeiro. The project had volunteers mostly from the Fine Arts courses of UFRJ, that gave Design and Arts workshops in a total of 25 activities. The results were amazing, attracting the attention of the local newspaper, that made a special edition for the event.

Ilha Design 2008

After the success of the previous year, Ilha Design became an UFRJ's Extension Project, oriented by the Professor Celso Guimarães, writing periodic reports, receiving scholarships and enrolling in UFRJ's congresses, where Ilha Design received an honourable mention. It also got supported by Eletronuclear, Angra dos Reis's energy company.

According to the Extension National Plan, the definition of extension is as follows:
"Extension from University is the educational, cultural and scientifical process that articulates teaching and researches in a mutual way and makes possible the modifier relation between the University and the society."

The event happened during October 29, 30 and 31st 2008. Since there was the need to develop the continuity at the previous year's community, it took place again at the same school in Ilha Grande, strengthening the relation between the project and Ilha Grande's community. There were 20 workshops, 5 "open spaces", 2 lectures, one exposition and videos exhibition. The 2007 edition brought a much better reception from the community , that even organized a beautiful folkloric dance exhibition specially for the event, and a more serious work done by the volunteers, that dedicated not only to the workshops but also to help the management of the event itself.

Ilha Design 2009

The third edition happened during November 13 and 14th 2009 and counted with a greater stability and confidence of the team, bringing new ideas and incorporating new members. It was the beginning of a bigger promotion of the project to other courses and Universities, calling attention of big Brazilian media related with Design, such as the magazine ABC Design. There were 20 workshops, 5 “open spaces”, one exposition, video exhibition and one lecture.

After the event, two of the volunteers went to Havana, Cuba, to represent Ilha Design at the 7th International Congress of Education, “Universidad 2010”. It was the beginning of the enrolment in international issues.

Ilha Design 2010

This year event will happen during August 19, 20 and 21st 2010, once more at Ilha Grande. Thanks to a greater promotion of the event, more workshops and other activities will occur, improving its artistic universe, including theatrical, musical, literature, dance and circuses activities.

The year 2010 is one of the last stages of most of Ilha Design team at UFRJ’s Design course, meaning that there is the need to find new members to keep the name of the institution. This year volunteers will be watched by the members of the team to seek the most interested ones, that shall be invited to join the management of the project.

Figure 4: Ilha Design’s volunteers and team members

Photo: Andréa Cebukin

Results

There is such a positive repercussion among students, teachers, parents and members of the team that brings an amazing impact to the community, such as the understanding and recognition of the island natural resources by the students of the school, that started developing themselves the ideas and solutions learned during Ilha Design. There is a new comprehension of Arts and Design as ways of integration, economical raise, cultural development and raise of self esteem.

Ilha Design, as an extension project, supplies its duty of relating academic works with the needs of a community. It’s important to emphasize that its impact reaches also the volunteers; it’s much more than just teaching, it’s a mutual learning.

The project has become a Design and Arts study laboratory, where new members with a varied range of knowledge can participate and integrate.

Figure 5: students performing selective collection

Photo: Eduardo Almeida

The team

Today, Ilha Design team has 17 members divided in five groups:

- **Structure:** responsible for making the proposal become real, making so that every idea can be developed. Coordinator: Paula Cristina V. L. Fernandes;
- **Financial:** responsible for the financial management. Coordinator: Karina Amaral;
- **Content:** proposes and generates ideas for the project, based on books, sites, newspapers and other media. Coordinator: Elis dos Anjos;
- **Marketing:** involves creation, communication and adding value to the project. It is responsible for the graphic design of the event. Coordinator: Renata V. Zappelli de Oliveira;
- **Public relations:** responsible for promoting the project, enrolment in congresses, the team integration and giving a positive image of Ilha Design inside and outside the university. Coordinator: Francisco Carriço.

Each group has a coordinator e the number of people involved varies according to the amount of work. This division facilitates the organization of tasks and also allows the entrance of new members.

The promotion of the event is done trough posters, word of mouth and social media such as Orkut, Twitter and Facebook. There are also lectures in congresses of Design, Education or Sustainability.

Being a project of great impact in the community, the student's initiative becomes an example of team work and determination.

Awards and mentions

- Honourable mention at the 5th UFRJ's Congress of Extension Projects.
- Media publications
- Jornal O ECO from Ilha Grande
- UFRJ's Olhar Virtual
- Jornal do Vale from Angra dos Reis
- International Congresses
- 7° Congresso Internacional de Educación Superior "Universidad 2010" – Havana, Cuba
- Sustainability in Design: NOW! – Bangalore, India

Conclusions

In a world full of social differences, it is extremely important the investment in quality education. Social exclusion generates impacts in every aspect: economical, cultural and environmental. With the growth of climate changes, over population and difficulty to supply the demand for food globally, it is necessary to start immediately a change process. This process must not only reach the symptoms of these problems but also its main cause.

Education is the basis for the change from the current lifestyle to a Sustainable one. The Sustainability will only be achieved through the critical thinking on all aspects mentioned above. However, this is a slow process, because it involves new generations, meaning that it should start urgently.

Ilha Design takes part in this change as a way of integration and exchange of knowledge between Universities and a needing community, unveiling the amazing creative potential of people that had few opportunities to develop themselves artistically and show their work. It also shows to the volunteers the value of helping and exchanging knowledge, getting in return happiness and tender, which are key factors of education.

Ilha Design team hopes that similar ideas become more common around the world, bridging the gap between academic centres and communities, stimulating critical thinking and accelerating the change process towards a society where everybody has a fair access to information and equal opportunities, which are essential to the construction of a Sustainable lifestyle.

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Learning-by-sharing

the Learning Network on Sustainability

Megafônicas

Enabling platform event for local discussion on education improvement

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This paper presents a case study of the Megafônicas's system, an event platform that can be used as a tool in improving the social cohesion amongst design students, and its capacity to enhance local and national political engagement through an equal structure. It proves to be a flexible manner to analyze, discuss and propose solutions to ever-emerging issues and problems, serving as a necessary complementary to design education's traditional fixed structures, as well as a horizontal way of introducing content and stimulating debates in a different and more captivating way.

A major focus of this paper is to highlight the difficulty of dealing with issues of professional responsibility, sustainability and social and cultural diversity in design education. The observed challenge concerns the difficulty that the current structures of design education in Brazil face in dealing with these issues and how they can turn this situation by adjusting the way it operates.

It is known that the designer is directly responsible for offering new products and services in the field of material culture. Therefore being a professional who uses methodological knowledge and aesthetics to communicate and to facilitate the use of artifacts and environments. Taking account that many of the design results depend on subjective issues and cultural references, as well as cause environmental impacts, contact with those issues during formal education becomes imperative. Although there are plenty of related publications concerning the environmental impacts caused by the activity, the presence of this topic in the education of the designer is still insufficient and inefficient.

In turn, the issues related to social and cultural issues have a treatment even more difficult, mainly because of its high complexity. However, it can be taken as an example the curricular changes in elementary and high school in Brazil since the adoption of Law nº 10.639/03 that "makes it obligatory to include the teaching of African history and Afro-Brazilian culture in the curricula of schools public and private basic education" (GOMES, 2007: 36) which resulted in the increase and expansion of the discussions about diversity and recognition of differences.

Concerning the debate around diversity and differences, the following issues come up: How can a designer shirk the debate about diversity? How does this professional deal with those issues? How does he choose his visual references? How does he define his role models? Within these questionings, it is easily realized how the designer's role as planner and developer of artifacts requires a much larger social and cultural engagement than what is being offered today. However, the challenge is on how to include ample and complex discussions to the already so large and complex design education structure. One clue is placed by Gomes: "Culture should not be seen as a theme or as a discipline, but as an axis that orients the experiences and curriculum practices." (GOMES, 2007: 28). And as the axis, must be present in all subjects, in all activities.

1 Sustainability in Design Education

A proper definition of Sustainability consistent with the argument proposed here was found in George (2007), Souza (2007: 1-3) and Tischner (2006: 8-11).Thus, this paper works with Sustainability as systemic actions and thoughts of society that seek to guarantee the answer to the needs of the present without compromising the maintenance of life of future generations in view of harmony between humans, culture and nature, seeking equitable distribution of resources by the peoples of the world, respect for differences and diversity, and seeing as essential the transformation of the models of current production and consumption in all its stages of development.

Again we see the challenge faced by the education of the design professional. How to meet the design education's needs in terms of technical and practical knowledge, essentials to their performance, and theoretical basis, in addition with the complex issues surrounding its activity and that interfere directly or indirectly in their results? If design has historically been a practice that answers market demands, today, despite all new theory and experimentation with the market, it is still a challenge to achieve the changes envisaged by the authors based on sustainability.

The strong orientation of the design practice for the market leads to the understanding that the resultant impacts from industrial activities in society are addressed from the technique and technology perspective, forgetting other dimensions such as social, cultural, environmental and resulting in more artifacts. Therefore, to achieve the parameters of sustainable living, the professional designer needs to leave the realm of designing artifacts drivers of high consumption, towards being a designer-articulator of human interactions in the systems and environments. Thus, the focus on the artifact is replaced for the focus on the human interactions. In other words, it withdraws the current focus of design activity from meeting the demands of the market to seeking to meet the needs of society.

However, to make real and viable this type of attitude, designers must first have it incorporated into their training, giving them continuity in their professional practice. One can see that the education of the designer lacks space for theoretical approaches and practice in the pursuit of sustainability, not so much by institutional indifference, but for the time being scarce, in relation to the minimum curriculum structure required. Undergraduate research and extension projects could somehow meet this need. This approach, however, could only be palliative and superficial. What is intended to prove with this article is precisely the effectiveness of a method of addressing issues important to the formation of the designer, at times extra-class, but not released from formal lessons.

2 Brazilian design education

2.1 Context and Problems

The first recognized superior education design course in Brazil was created in 1963, in Rio de Janeiro city. The Escola Superior de Desenho Industrial (ESDI), strongly influenced by the German school Hochschule für Gestaltung (COUTO 2008), became a paradigm on teaching methods and design curriculum throughout the country, its curricular bases being recognized in almost all design courses created since then. However, due to different such as: incentives and governmental benefits offered to design courses through the years, beside several consecutive official curricular changes, as well as the obvious differences generated because of the social, cultural and regional diversity of such a large country, there can be found great diversity in methods, formats and values amongst Brazilian academic design institutions. Such plurality "is one of the largest barriers for designers' integration and articulation nation wide, which interferes with professional representation and regulation" (NICOLAIEWSKY, SILVERIO 2009). While promoting a certain rivalry between institutions, the lack of uniformity in the courses causes detachment and a lack of encounters between faculties, which denies the chance to a rich exchange of knowledge and experience between design students.

Besides missing integration and articulation, the low research activity in Brazilian design education, mostly based on too specific targets or not very wide ranging quantitative results, create an illusionary view regarding the quality of such education. Students, which have found their specific way around this detachment by promoting events and student meetings, have developed researches that aim to find uniformities amongst the different types of teaching institutions. According to Nicolaiewsky and Silvério (2009), there can be found some common problems to each type of design course:

- **Structural or curriculum problems, specific for each institution:** courses with open curricula, without majors or specializations, for instance, often promote an unhealthy dispute for classes based on grades. Another common example is the imbalance between theoretical lectures and practical experiences offered to the students.
- **Public universities' problems:** the bureaucracy involving hiring and terminating faculty contracts leads to a constant rotation of substitute teachers, thus promoting a loss of continuity in the institution's areas of study. Also, it is often perceived that design research, when developed, tends to be closed off in itself, lacking to appropriately disseminate the generated knowledge.
- **Private universities' problems:** the main question is the institution's need to be acknowledged and credited, overly relating design teaching with market needs and rules and, in extreme cases, offering a type of "fast food" service to client-like students.
- **Problems relating to the Market:** most institutions' difficulty in relating academic projects with real life situations, clients and companies is seen as one of the biggest obstacle in Brazilian design education becoming applicable and feasible. The poor relationship and lack of proximity between design professionals and teachers, between market and academy, is also largely debated.

2.2 Design Student Articulation

The Brazilian design student articulation, on the other hand, is a growing movement that shows clear signs of maturity and rapid propagation.

The organization, formed by Base Entities – organized student groups that represent the student body toward administration offices – and validated by the National Student Council of Design (Cone Design) – twice a year forums that gather students from all over the country to discuss and deliberate the common intentions and possible actions of the student class -, has a horizontal and collaborative format that favors adaptability, a necessary asset in an ever changing environment. The Brazilian design articulation's major form of action is the annual organization of the biggest design event in the country – the Design Students National Meeting, N Design. Gathering up to 5000 people, among students, teachers and design professionals, these student events promote debates, workshops, talks, practical and theoretical activities and recreational moments for integration such as parties, that create rich opportunities for experiences and knowledge exchange.

It is within these moments (N Design and Cone Design) that, through the students' interests in propitiating such exchange, the academic diversity in Brazilian design is put to proof and can, then, be better analysed and understood in order to deliberate possible actions and integrated and cooperative improvements to achieve the necessary cohesion. It is also within those meetings that students find their own personal ways of academic improvement and deepening, being normally used as moments of complementary training, in addition to formal academic education received through their design institutions.

3 The Megafônicas System (MGF)

3.1 Origin: Context and Bases

In each university, the Base Entities or Academic Centers responsible for representing the students usually organize and develop several parallel activities such as meetings, design weeks, expositions, conferences, and workshops to complement the university curriculum and discuss specific topics of their interests.

The original Megafônicas's project was created and first organized in 2004 by student members and non members of the UFBA (Universidade Federal da Bahia) arts and design student council . It aimed basically to create an innovative event in order to gather, connect and improve the communication of design students from Salvador, Bahia. The basic requirements were:

- the event must be cheap (or for free) and avoid "vertical" structure (i.e. conference or workshop structure);

- the event should be more dynamic than a round table and allow the active participation of the students;
- the event should allow interaction among all participants.

Figure 1: A round-table during the MGF

Source: Boana Estúdio

3.2 How it works

The MGF platform has been organized 17 times since 2008 all over Brazil, either as an individual event or as part of a big one. The themes are related with local issues and the discussions are registered and shared during national meetings. For instance, in 2008, by efforts of a student group, the MGF was organized in 8 cities to discuss the same theme: Brazilian Design Education. In 2009 and 2010 it has been used mostly as a first activity with freshmen students and to promote political initiatives, or to attract more members to organize other events, and to help formulate the local opinion about a national issue.

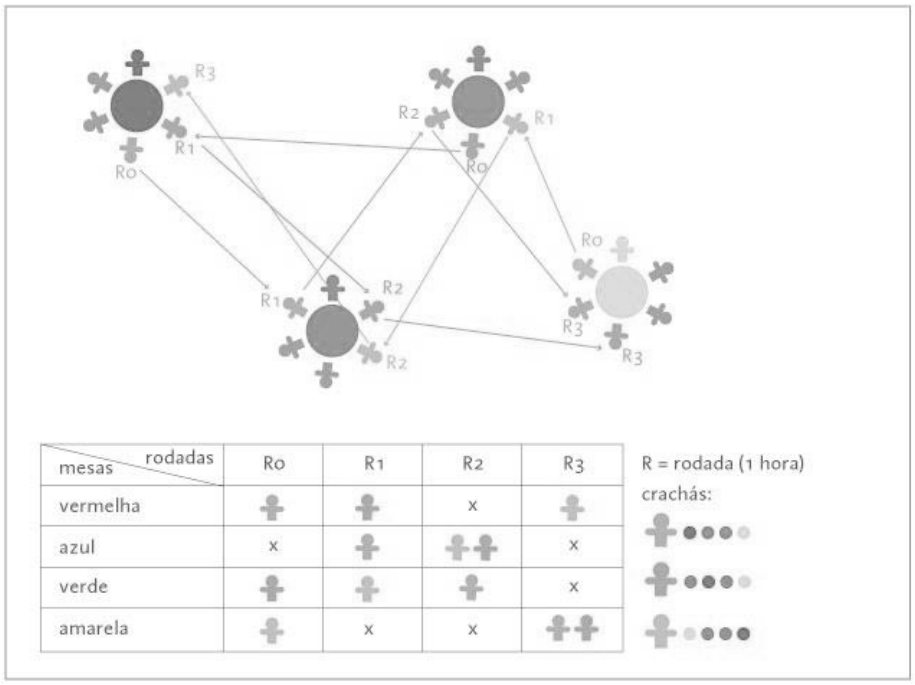
The Megafônicas integrates students through a simple debate event, in a discussion of local problems and a posterior organization of actions for the proposed solutions. The initial challenge was to congregate 100 people in a focused discussion during one day. Since the event should avoid hierarchical and vertical structures, everyone would have the opportunity to listen and talk to each other. By a division of the main topic into three complementary subjects and through three synchronic round-tables, it was possible to drive the discussions and reach tangible proposals.

The Megafônicas's system is a one-day event made up by 3 phases:

- **The opening conference:** A speaker (or a film) presents the main theme of the event. The aim is to create a common base about the topic and to stimulate the discussions during the second moment.
- **The round tables:** There are 3 simultaneous 60-minute round-tables that happen 3 times each. In between them, a short break takes place. Each table represents one aspect of the main theme (e.g. the main theme is "Design for Sustainability", the theme of the table 01 is "Social Dimension", the table 02, "Economic Dimension" and the table 03, "Environmental Dimension")#. Each participant receives an identification with 3 colors (FIG 02), each color represents one of the tables and the sequence determines the routine (e.g. red, yellow, blue – group 01, group 03 and group 02) . The sequence is random thus there are just 6 possible combinations, by doing so it is possible for the students to meet each other in different moments.

Figure 2: A round-table

Source: Erica Andrade http://megafonicas.files.wordpress.com/2008/06/esquema-sistema1.jpg



- **The closing discussion:** A discussion with all participants to show the results of the round tables and to plan the next possible actions.

There are 4 roles in this system:

- Organization: Students that arrange the infrastructure of the event. They are responsible for controlling the time of the moments and providing certificates and post-event register.
- Mediator: This stakeholder is responsible for mediating the debate – i.e. to focus the discussion, to control the time of speak of each participant and to speak on the closing discussion.
- Register: This stakeholder is responsible for registering the activity in the round-table. The resultant document will be used to guide the closing discussion and the further actions.
- Participant: This stakeholder has to follow the event's routine and debate about the topics.

The duration of the event's organization is variable, but usually of a short period. The needed infrastructure is 3 isolated rooms or a big space that allows the debates without disturbance; an auditorium for gathering all participants on the opening conference and on the closing debate; an interaction area for breaks; food and drink provision; chairs, pens and paper; printing material: poster for advertising, identification tags, presence list and form report.

Finally, in the post-event stage all results and actions are registered and published in a website and presented at the National Design Student Council.

3.3 Spread: Free distribution and supervising

According the interviews, in 2007, a student group form Salvador decided to use the MGF as a tool to promote discussions related to Design Education. The aim was also to promote the candidature project to host the N Design of 2009 (with Design Education as the main theme), so the Megafônicas was also being used as an advertising tool.

The group created a toolkit to teach how to organize the event and made it available under a creative commons licence that allows the use of the brand elements and the adaptation of the event to the local needs. Through Internet forums and other social networks, students from all over Brazil helped each other

on understanding how to promote and build up the event, naturally creating a peer-to-peer relationship among all.

The theme of the MGF' 08 was Design Education. The aim was to reflect and debate about our education: the existing problems and how it could be improved. The subject was split in three:

- Education and Market: The debate was focused on the role of the university on the market. With all the new technologies, information spreading and market speed some issues come out (1) what is the role of high education in this scenario and (2) how can the university answer to business and market demands?
- Education and Student: The debate was focused on the relationship between the students' expectations and the university curriculum, as well as the problems concerning the course structure and curriculum and the role of the student in his/her own education.
- Education and Society: The debate was focused on the ethical aspect of design activity. Sustainability issues take place in the discussion, as well as the role of the designer and the university concerning social, ethical and environmental issues.

During 2008, 10 MGF's were organized all over Brazil under the same theme. Having discussed the outcomes of those events in the design student forum, different results were observed for each university.

4. Case Study

Three main results have been observed in the last years related to the Megafônicas. However, these results are not clear and distinguished. They are also related to previous existent conditions and the event by itself is not the only reason. Thus it is important to highlight the role of the event in the noticed changes in the university and around.

A qualitative research was run in June 2010 aiming to clarify the impact of the MGF' events locally and verify its role on the observed results. The research happened in 3 main phases: (1) Analysis of the MGF registers; (2) Interview with the organization committee's members and mediators of MGFs and questionnaire for MGF's participants; (3) Interview, questionnaire and results analysis. Fifteen students and ex-students from 6 different cities have been interviewed about the their university and the related MGF's. They argued about three main topics: The aims and results of the Megafônicas; an analyses of the system and its potential use as a pedagogic tool. All share the following characteristics:

- were organized as a parallel activity (not part of the formal university schedule);
- were organized by students for students;
- aimed the discussions of their own education and stimulated a pro-active behavior of the students, namely the freshman's;

Concerning the MGF' editions of 2008 having the same theme ("Design Education") it is imperative to notice that the results amongst the edition are related to this fact. However, the further editions that took place in 2009 and 2010 (with different thematic but similar approach) also share similar results. These common related results are:

- Enhancement of the cohesion amongst the student,
- Engagement on initiative and extra-class project,
- Student political participation' growth in the university

The MGF editions of 2008, 2009 and 2010 that took place in Bauru at UNESP (Universidade Estadual Paulista Júlio de Mesquita Filho) will be used as reference for the case study presented ahead.

4.1 Enhancement of the cohesion among the students

One of the main observed result is the enforcement of the social fabric in the universities and inter universities after the MGF. In the observed cases, by meeting each other in an open space of free speech, the student community is allowed to interact beyond what is possible in other social spaces.

As an example, the UNESP has 2 design courses (Graphic Design and Product Design) in two terms (morning and night). According to the interview of the student from the UNESP the common action to

integrate the students are basically parties, conferences and workshops (promoted both by the course coordination and students). The problem of gathering all students is the difficulty to find a common subject and an attractive structure to promote integration. The discussion based on what they all have in common (i.e. the course, the problems, the profession) and their role in this space also promotes the sense of community and identity.

It is evidenced by results posterior to the MGF events:

- Integrated events, i.e. Parties, seminars and workshops organized by the students for all students of the course instead of one particular habilitation;
- Maintenance of students communication and mobilization formats such as a free access Wiki that registers the students' activities and actions;
- Reinforcement of the university identity and community by the constant presence in national and regional design events.

4.2 Engagement on initiative and extra-class projects

The MGF event results in a list with actions and ideas that are presented in the end of the day during the Closing Discussion. These are a just guide of what can be done and how you can get involved in activities in your own university.

According to the interviews, the open space promotes the possibility to talk about ideas and solutions and discuss its feasibility and possible impacts with different points of view. Moreover, the specific thematic (shared by them) on social ethic issues and their own role favors a reflection and promotes their activism and leadership behavior.

It is evidenced by the increasing amount of engaged students:

- in event organization and staff (N Design, R Design, Inters and academic weeks)
- that have applied for the Junior Company and to support Student Council activities.

4.3 Student political participation growth in the university

The local Base Entities play an important role on the MGF' organization. Because of their role in the University they are usually responsible for events organization. However in some universities there were no local Base Entity, so in some of the observed cases the students have used the MGF format as a way to gather students and discuss the opening of a Base Entity or to engage more people in academic activities.

This result is evidenced by:

- The opening of the UNESP student council in UNESP;
- The student participation in the student national actions;
- The student participation in the Cone Design.

5 Conclusion

The Megafônicas has similarities with the "Circulos de Cultura" proposed by Freire (1979) originally used on literacy process for poor communities in Brazil.

> Círculos de Cultura are learning units that substitute the traditional school. It reunites a coordinator with some tens of mans from the people in a common work of conquer of the language. The coordinator does not play the role of "teacher", the essential condition of the task is dialogue: "to coordinate, never to influence" (Freire, 1979: 27).

On the Circulos, the student does not just learn how to repeat the use of the words, but knows how to think and reflect about the "tool" in his or her own understanding. The same happens in the Megafônicas system, except the tool of language becomes the tool of Design.

Due to its dynamic the students feel comfortable to express and reflect on their perceptions about the subject and problematize it regarding aspects such as politics, ethics and the environment. The non-

hierarchical context enhances the debate and favours all participants to speak. In addition the student thinks about these topics using his own background and references to discuss, by doing so he reflects about his own social role and how these issues are related with his or her own life.

The mediator (usually a professor, a design professional or an older student) can not influence the discussion, so he or she plays the same non influential role of the coordinator in the Círculos de Cultura.

Although the proposal of the Megafônicas System is not to substitute the traditional manner of teaching design, it shows itself helpful as a flexible complement to the fixed structure of design curricula, bringing ethical and social debates, as well as facilitating student integration, articulation and empowerment. Wide range, complex and polemic subjects such as Sustainability, for example, can gain from the horizontal and free speech space provided by the MGF debates. Since the event facilitates result ideation and development, it can also be largely used for brainstorming, quick solution projects, or even tasks proposed in design classes. In this way, its simplicity in organization and its feasible success results of student articulation permits it to be replicated worldwide, in almost all educational contexts. It is also important to note that, inspite having been largely used as student events in Brasil, the MGF system is in under a Creative Commons license that can be adapted to almost all situations.

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the Learning Network on Sustainability

Collaborative teaching material for discussion on the concept of sustainability in design

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This paper was originated from the necessity of sustainability foundations comprehension and these foundations' usage and appropriation in the construction of Sustainable Design bases. The start point was the lack of especific material to the proposed thematic teaching and also the opportunity to verify the action hypothesis and cooperation in the production of didactic material, as points out literature related to sustainability. Therefore, this investigation is based in the development and sharing of the didactic module to the experimentation with Design's undergraduation students, in different Undergraduation Institutions of Curitiba city (PR), Brazil. The work methodology consisted in sharing didactic material among professors, through a digital platform. After the contents application was done an evaluation from the proposed objectives in each teaching module. From the obtained results, it was checked the importance of these concepts' insertion in Design teaching.

This study comes from the presuppose that the first step to formulate Design's knowledge bases to Sustainability consists in knowing historical antecessors and concepts that structure sustainable theories and practices. From this necessity's verification and the lack of specific material to the thematic teaching, it was searched to share the production and application of didactic modules with Design's Undergraduation students, in different institutions.

To this study's accomplishment two didactic modules were developed, which were applied in the classroom, with 7th grade Design undergraduation students at the Universidade Tecnológica Federal do Paraná (Federal Technologic University of Paraná – UTFPR) and with students of an optional discipline in the Design undergraduation course of the Universidade Federal do Paraná (Federal University of Paraná – UFPR). Obtained results were analyzed and compared, so that could be evaluated the appropriation and comprehension of sustainability conceptual bases by the students. As a first activity's stage, didactic materials were exchanged among professors, which, in the sequence, were applied in the classroom, fulfilling the suggested activities.

After applying the contents an evaluation was done of the proposed objectives in each teaching module. For that, students were previously informed about purposes, working methods and the results of the exercises developed in the activities, which were available at the Internet platform so all involved would be able to consult.

This way, this research tries to contribute to collaborative didactic material development turned to the discussion of Design's sustainability requirements, amplifying knowledge's shared construction and professors and students experiences.

Obtained results consist in the statement that each group repertoires interfere in the objectives, as, for instance, the different group's conformation, being one from the 7th grade and the other one optional. It was also proved the group's motivation amplifies by the fact that these know that other institution is also being analyzed from the application of the same material. And finally, from theses analyses, it was ob-

tained a didactic material that allows the content's reinforcement in some points of difficult assimilation to the students, and that may be shared with professors who want to use a similar content.

This paper initially presents the literature's revision referring to the subjects: education, design and sustainability. From these subjects was done a survey of the main concepts that structure Design's sustainability insertion. In the following, the developed practices in classroom and obtained results from the comparative analysis between the two analyzed institutions are described.

This introductory investigation tries to identify the level of assimilation of sustainability requirements in the investigated groups and to identify new possibilities of inclusion of integrated educational practices, turned to the education "about" sustainability.

Sustainability and Design

In the decade of the 70's, last century, Papanek (1984) already identified designer's responsibility about mass production and introduced sustainability thought in the principles and processes of projectable activity.

Nowadays many authors defend the idea that Design must conduct to real problems resolution and effective changes in the systems of production and consumption, in the sense of promoting a bigger sustainability of these systems (See Lewis et al, 2001; Manzini and Vezzoli, 2002; Sherwin, 2004). Tischner e Verkuijl (2006) affirm that from new abilities'' development, designers may become "facilitators" among consumers and producers, creating innovative systems which attend the necessities and solve real problems, with the maximum benefit to the society and to the natural environment.

However, as the subject was recently included in the curricular bases of Brazil's Design courses and its focus is still restricted to ecodesign and the end-of-pipe processes (FONTOURA; SAMPAIO, 2007) the path to the consolidation of the transition process to a new and complex multidimensional conception of sustainability yet present itself in construction. Therefore, teaching's role towards sustainability requirements becomes of great importance, because it aims to strength the needed composer visions, as well as the construction of the appropriate bases to the establishment of complimentary relations between environment and development.

However, Fontoura and Sampaio (2007) affirm that these lack represents a great opportunity to institutions of Design undergraduation, in the sense of investing in the formation of human resources synchronized to the new environmental, economical and socio-ethics demands, besides supporting and consolidating the development of methodologies and didactic material to Design teaching oriented to sustainability.

Education and Sustainanbility

In the field of Education the proposal of "education to sustainability" or "to the sustainable development" it is part of the renewal of the approached speech in international debates and may be observed in UNESCO's conferences and documents, in Agenda 21, proposed in Rio-92. Its objective consists in amplifying environmental education effectiveness, which did not present the awaited results in the last decades, because it did not show itself able to attend the increasing complexity of the contemporary crisis (LIMA, 2003).

According to Lima (2003) this new educational approach has as objective to integralize social, environmental, economical and cultural dimensions, once many authors argue that environmental education assumed reductionist expressions, because it could not put into practice the acknowledged actions in its speech (See: Sterling, 2001; Tilbury, 1996; Sauvé, 1997). However, Sauvé (2005) defends sustainability is about an essential dimension of the education that structures personal and social development and may not be determined only as an "education for…" or as a "tool" to environmental problems resolution. Likely, Jickling (1994) affirms that "to educate for" suggests a formation or a preparation to the realization of an instrumental objective, it means, to indicate a pre-determined way of thinking that the student will have to prescribe. Therefore, the author defends that education must allow people to do a critical analysis of the context, questioning even the concept of "sustainable development" and "sustainability" and, for that, Jickling (1994) proposes the term "to educate about…", because it allows to capacitate students to argue, evaluate and judge by themselves, participating intelligent and actively of the construction of the debate related to sustainability principles.

In this sense, Jacobi (2003) declares that the subject of sustainability involves a group of authors form the educational universe intensifying the engagement of the many knowledge systems, professional's capacitating and academic community in an interdisciplinary perspective. This way, if the thinking and doing about the environment are stimulated and linked to ethical values and dialogue among the many areas of knowledge, it becomes possible to overcome reductionism and to strength the complex interaction between society and nature (JACOBI, 2003).

To become possible to impel the transformations of an education that assumes a commitment with sustainability values formation as part of a group project, it becomes necessary to think over the social practices and professors' role as knowledge mediators and transmitters. This repositioning is important to the construction of the appropriated bases to the comprehension of the global environment and the importance of each one's responsibility to build an equal and environmentally sustainable society (JACOBI, 2003).

This way, the need of internalizing the environmental problematic and the critical construction of knowledge requires the strengthening of composer visions that stimulate the reflection around individual-nature relations, global and local environmental risks and environment-development relations (JACOBI, 2003). Lima (2003) reaffirms this matter and deffends that a complex environmental education construction, able to respond equally complex problems, implies in going beyond a reproductive, fragmentary and reductionist "market sustainability". The author also presupposes that learning, creation and the new exercise of new conceptions and life, education, coexistence practices – individual, social and environmental – will become able to replace traditional models which have showed themselves inefficient in redirecting to sustainability as a new development paradigm.

Sustainability's insertion in Design's teaching

Since the subject of sustainability emerged in international debates it hás been observed the resurgence of concepts and theories associated to Design and the need of recognizing environmental limits in the project of products and services, considering a bigger contribution to the environment and society (SHERWIN, 2004).

However, there are still many lacks in Design's theory and practice, because this has gone through random transformations reacting to circumstantial or ideological changes, instead of transforming its bases through a radical reevaluation of priorities and necessities (WHITELEY, 1998).

In its origins, Design is the tool, through which the human being shapes his environments and objects and, in extension, society and himself (WHITELEY, 1998). Though, to perform a fundamental role in the construction of innovative scenarios directed to the construction of a sustainable society Design needs a revision of its fundamental concepts. According to Buchanan (1995), it needs also a historical, theoretical contextualization, research and critics, because in the absence of these conditions schools end up forming non habilitated professionals to develop projectable that include environmental, social or cultural requirements of sustainability.

It is observed that since its resurgence, Design schools have suffered influences of the dominant social forces represented such by the political-didactic tendencies as by the productive system and, due these external interferences, many times schools end up assuming a conformist attitude related to the process of formation of a new conscience based on the critics, analysis and action responsible for the future (SELLE, 1973).

According to Santos (2009), Design as is usually known is a product of the Industrial Revolution and, under many aspects, is one of the central factors in the stimulation to the high levels of natural resources consumption observed in the current society. Bauhaus – the first school of design in the world – was created in 1919 to attend the practical needs of the new industrial production (MARGOLIN, 2005). The first concept of design presumed as result "(…) an industrial product able to series production (…) to the (…) satisfaction of certain needs of a group or individual" (LÖBACH, 2001 p.16-17), through the binomial form-function.

In the model formalized originated in Bauhaus, Design is seen basically as a matter of useful functionality, of materials, methods, form and proportion (ZACAR; FONTOURA, 2008). Whiteley (1998) affirms that, since then has appeared many models that influence design's teaching and practice, however characterize them as incoherent and insufficient, because they need a bigger uniformity among its concepts, in order to allow that the many qualities and skills complement or confront themselves in a constructive way.

The theorized model characterizes itself as one of the models identified by Whiteley (1998) and represents the product of an alignment with a more extreme post-modern position that states the total "fusion" between theory and practice. The politic model is marked by a binary and oppositionist thought and it originated the radical designers of the 60's, which by its side originated the responsible designers of the 70's, the "greenish" of the 80's and the ethical of the 90's. This model, although simplest, reductive and not very spread has a big social and political conscience proportion.

Nowadays the most common model in Design's teaching is backed up by "professional" demands and "market" realities, searching to equip design student with skills and techniques that will be useful in the development of works for companies and industry. From this model are originated the consumptionist designers which have as objective to impel economy through redesign and styling and in this case are rarely verified the questionings about the necessity of certain products or even about their environmental, social, moral or personal defects. The technological model presumes that solutions in technology present themselves as the most appropriates to the questions related to design and it is observed a tendency in escaping debates or critical reflections of these teaching model rules (WHITELEY, 1998).

The model of the "valued designer" proposed by Whiteley (1998) presents the necessity of developing a model for a new category of designers, based on a more profound comprehension and more complex of the values related to social, cultural, political and environmental responsibilities. This model preaches the potential of contributing to a better and more sustainable life quality, searching to defend social and cultural ideals more elevated than short term consumption, with its obligatory luggage of environmental degradation.

According to Lima (2003) this renewal is already in movement in the middle of our society through many alternative initiatives, fragmented in many areas of knowledge and activity (including design); although still do not categorize itself in a predominant plan in the global system. From the conceptualization of the subjects and necessity of discussion and comprehension of sustainability requirements applied to design, it was composed the didactic material and pedagogical procedures described in the following topics.

Teaching material and pedagogical procedures sharing

The working procedure consisted in the elaboration and exchange of didactical material among professors of different teaching institutions, which were developed based on common needs. Thereby, to the students of the Graphic Design course at the Universidade Federal do Paraná (UFPR – Federal University of Paraná), was used the material "Sustainability in packing: from ecodesign to sustainable Design", where concepts related to the insertion of sustainability requirements in the packing's life cycle were presented, since the project, proposing the transition of the focus in the products to the focus in the system. To the elaboration and foundation of this content it was used the text "Design for Sustainability: a practical approach for Developing Economies" developed by United Nations Environment Programme (UNEP, 2004) in partnership with other institutions. The main focus of the work was based more specifically in the worksheets that compose the referred material. The concept was presented and discussed with the students that, from the theoretical referential and an analysis of the existing products in market, started the development of a new concept of packing. This new proposition was based on sustainability requirements applied to Design, however as the project was developed in a short period, it was restricted to the proposition of a new concept.

In compensation, to the students of the Universidade Tecnológica Federal do Paraná (UTFPR – Federal Technological University of Paraná) was done the module "Sustainable Design historical context and concepts", in which were presented the concepts-key that structured and originated the principles of the Design turned to sustainability.

This work began with the presentation of the historical evolution of the term "Sustainable Development", its strengths and its main critics. This part of the work was developed from the analysis of texts and discussions in classroom. After the comprehension of the term's origin and evolution were presented the main implications to Design and the possibilities of insertion of sustainability's requirements in all life cycle of the product/service, being able to reach dematerialization of the product, the proposition of systems and the change in life styles.

To a better comprehension of the subject, it was proposed to the students that they chose a Design's case (product or service) and performed an analysis from the studied discussed in classroom precepts. After the case's choice, this was qualitatively analyzed in all its phases of life, having as a goal to analyze the socio-environmental impact in each of these phases, and to propose new possibilities of acting from Design's requirements to sustainability.

Considerations about the activity's performance at the Universidade Federal do Paraná (UFPR – Federal University of Paraná)

Before the worksheet's application it was perceived the need of performing an adaptation to facilitate the application in graphical design area. This adaptation was necessary, because the students of the referred course are not used to work with charts and graphics in their processes of decision in projects. During the presentation of the discipline it was possible to perform adjustments, comments and, with the students' interaction, it was allowed the concepts' introduction. After the oral presentation and the discussion in classroom, it was delivered to the students a finalized work, as example of the same activity already performed in a previous group.

To the development of the project's phases it was offered to the students the material to be fulfilled in Power Point format. This material was worked in classroom with the help of a professor, during 2,5 class meetings, representing a total of 10 hours of activities. As the original material was not developed to the usage in classroom, some of the tasks that were not didactically relevant were simplified or eliminated. The adaptations suggested to the students consisted in executing the task in a simpler manner, privileging the experience of the process phases and, thus, slowly to acquaint the tool.

Considering UFPR's discipline of sustainability has short time, it was clear the necessity of cutting out contents and focusing in some more restrict topics to be deepened. In this sense, the exercise according the proposed in this paper may be used as central activity of the discipline.

One of the challenges to this task was to ask the students to not consider the concepts widely diffused by the media, which strongly focuses in environmental dimensions. These approaches imitated the thoughts and the solutions' proposals. One of the discipline's challenges was to promote the strategic thought along the students, so they focused systems' development, instead of thinking only the product's scope.

UFPR's obtained results

During the exercise's performance most of the teams managed to develop the main phases during class, however in the final phase, where the new proposal would be developed, some teams had to end it out of the classroom due the difficulties found during the activities, compromising the due time. This fact hindered the project's results accompaniment that resulted in increased solutions in the product's design without presenting significant advance in the existing system's design.

From the group's evaluation in the end of the process, it is possible to infer that the usage of a tool, which at first tried to make the work more consistent and more deeply based on sustainability requirements, molded ideas to not advance in creative propositions, even more in considering that the proposals were based in suppositions, not having the limitations usually found in real projects.

However, even reaching restricted results and identifying the need of simplifying the worksheets, this process turned out didactically appropriate. The activity's conduction through this kind of tool allowed the revision, the retention, the documentation and the discussion of the involved concepts, bringing benefits to the discussion in class and to the consolidation of the sustainability's concepts in Design's teaching.

Considerations about the performance of the activity at Universidade Tecnológica Federal do Paraná (UTFPR – Federal Technological University of Paraná)

The collaborative didactic material was applied in the discipline Theory of Design 4, with students of the course Baccalaureate in Design. This discipline has as objective to develop the understanding towards solutions turned to sustainability in Design and has the duration of a semester, this way it was also identified the necessity of cutting the content, once the students need to do again some activities to better understand the explicated concepts.

In order to the concepts to be clearly understood it was necessary to perform more analyses, readings and discussions than the initially foreseen to the classes' development, because it was identified a difficulty in the subject's comprehension. From the discussions that took place in class, it became clear that student's general comprehension about the subject is based on superficial concepts transmitted by mass media, which are based firstly in the reduction of the raw material extraction and ending materials recycling. This way, the concepts used by the students to the qualitative analysis of the Design's case (product/service) were based mainly in these two inquiries, which resulted in very restricted proportions from sustainability's point of view.

Therefore, it was necessary to do the work once more so all product/service life phases could be approached, beyond considering the propositions to the Design's act based on the existing system alteration. For that, it was delivered to the students a script based on Cahpter 2 of Manzini, Vezolli's book (2002), proposing that from the qualitative evaluation of each product/service life phase new propositions intrinsically sustainable were performed to the analyzed case. From this new analysis it was checked that students accomplished a better comprehension about sustainability requirements and their applications from Design.

UTFPR's obtained results

As a final result it was identified that students obtained good comprehension about the subject and started a critical analysis of the existing propositions, widely disclosed as sustainable by the media and the own institutions that originated them.

From the discussions that took place in class it was possible to identify sustainability concepts are not clear and comprehensible to all, and when they refer to Design, usually the project tries to incorporate the minimization or usage of recycling raw material.

It was verified that the levels of acting turned to the proposition of new systems or alteration of ways of life are yet not comprehensible to most of Design's students. However, it is necessary to consider that the education that structures the construction of this knowledge is still based on the formalist composition which originated design, initially turned to industrial production.

After the application of the didactic material turned to clearing sustainability concepts and to the possibilities of Design's acting, it was verified the importance of starting the discipline from comprehension and leveling of these foundations. It was also checked that, even needing to reinforce didactic material with extra analyses and discussions, this was presented appropriate to classroom application and allowed an amplification and consolidation of the proposed subject.

Final considerations

This work was characterized as an opportunity to think society's changes promotion through the amplification of comprehension about Design's applied sustainability requirements and the challenge proposed to the students. Once students needed to offer matching propositions to the presented foundations and to propose solutions to system's change, in the Design's scope.

Realizing that the amplification of the product's focus to systems demands mentality's change, one of the proposed solutions from this research consists in the gradual amplification in the level of the project. This way students' comprehension occurs in a progressive way allowing the fulfilling of these stages and a gradual understanding of the propositions, because it was observed that an activity's deeper performance, as the proposal at this experience, ends up escaping stages needed to knowledge construction.

With restriction to this gradual knowledge construction it is proposed that the discipline is compartmented in many phases, during all student's formation, once one only module do not allow this complexity's gradual amplification, because it would take a lot of time of the course and would make unfeasible its application.

Another alternative to solve this issue would be to simplify even more the tools, in order to allow that its achievement to be accomplished in a more generic manner and to focus in developing and fixating the concepts that involve the proposition of new systems and new more sustainable life styles.

To finalize, it is proposed that Learning Network on Sustainability (LENS) platform offers, beyond professional usage tools, classroom usage adapted versions, once classroom application may offer tools' subsidies, creating a flux of improvements. In this sense, challenge consists in creating didactic material

in adequate level to the knowledge's degree of certain society inserted in certain culture. However, it is seen that this kind of effort is much more efficient because it proposes a group and cooperative work performance, as it was presented in this experimental study from materials' composition and exchange.

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the Learning Network on Sustainability

LeNS South America

Sharing of learning materials regarding LCA and LCD strategies between UFPR/UP and INT professors

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This paper is regarding LeNS South America participation, describing the sharing process of learning materials between teachers of different institutions: a professor of Federal University of Paraná (UFPR) and of Positivo University (UP); and a researcher from the National Institute of Technology (INT).

The subjects agreed that the lessons exchange were: Life Cycle Assessment (LCA) and guidelines for Life Cycle Design (LCD) strategies prioritization. These themes were chosen because they are common issues of the courses offered by the participating teachers.

The article presents the process of creation and sharing of learning materials, presenting the facilities and difficulties raised in this route as well as a critical analysis of the material available, and the process of exchange of materials as a whole. Finally, it is described the positive and negative points of view for the use of shared didactic materials, created for different contexts.

Currently design for sustainability discipline is part of several design courses curriculums in Brazil. Many professors lecture this course at various levels of design management (operational, tactical or strategic) and focusing on the three dimensions of sustainability: environmental, social and, more recently, in the economic dimension. Also in Brazil a network of sustainable design updates members about events and news of this discipline, intituled Rede-Brasil de Design Sustentável.

The first Brazilian Symposium on Sustainable Design and the International Symposium on Sustainable Design (SBDS / ISSD) happened in 2007. In 2009, the second SBDS was held in São Paulo, in which it was launched the Lens South-America. On that occasion twenty-four participants expressed interest in sharing teaching materials, assigning a document to join the LENS South America.

When contacted by the coordinators of LeNS South America, a month after the launching, nine teachers had confirmed their enrolment to the network. As a first action, the participants completed a survey, sent by e-mail with information about the activities and contents lectured by them. The survey results were presented at a meeting, that took place physically and via video conference on February 8th, 2010. At the occasion, each participant presented their activities developed regarding design for sustainability issues to the others members.

During the meeting, the group established an activity for the evaluation of the didactic materials to be made available on the network. A couple of LeNS South America professors were assigned responsible for the development and sharing of the didactic materials. Each member of the group was paired with another member of the network who presented a related project regarding the design for sustainability contents.

A total of twelve professors of ten different institutions agreed to participate in the pilot activity: Federal University of Pernambuco (UFPE), Federal University of Paraná (UFPR), Positivo University (UP), National Institute of Technology (INT), Federal University of Rio de Janeiro (UFRJ), Vale do Rio dos Sinos University (UNISINOS), Londrina University (UEL), Federal Technological University of Paraná (UTFPR), Catholic University of Rio de Janeiro (PUC-RJ) and National Service of Industrial Learning of Paraná (SENAI-PR).

The proposed activity was focused on the development of didactic materials in a collaborative manner between pairs of network participants. The following dynamics was proposed by the LeNS South America coordinator, Professor Aguinaldo dos Santos:

1. selection of partner institution;
2. selection of related thematic for 5 hours of class ;
3. adequacy of class resources for LeNS South America visual identity;
4. recording core class of each professor (slides + audio, for example);
5. uploading ready didactic materials on LeNS portal;
6. use of didactic material developed by the partner institution professor in the current semester;
7. forwarding of students feedbacks regarding the didactic material for the partner institution;
8. a moderator professor will analyze all the modules in order to identify possible improvements, in form to do the modules “talk to each other”;
9. when the materials are ready, they will be made available to the other LeNS members.

In the table below are listed the duo of professors for the activity and their home institutions.

Table 1: Institutions, duo of partners and chosen topics

Source: author, 2010

Duo	Professor/Institution	Topic	Professor/Institution	Topic
1	Manoel Guedes UFPE	Creative Communities and Communities projects	Naotake Fukushima UFPR	Basic concepts of sustainability
2	Liliane Iten Chaves UFPR e UP	Life Cycle Assessment of products	Julio C. Augusto da Silva INT	Ecodesign strategies priorization
3	Beany G. Monteiro UFRJ	Improving the social cohesion	Mariuze Mendes UTFPR	Design in Communities
4	Claudio Pereira Sampaio UEL Jairo da Costa Jr UFPR	Resource use minimization	André Canal Marques UNISINOS	Minimization/to increase the waste value
5	Priscilla Ramalho Lepre SENAI-PR	Facilitating assembly and disassembly	Aguinaldo dos Santos UFPR Jucélia Giacomini PUC-RJ	Optimization of life cycle

This paper describes the process and the partial results of the development and sharing the didactic material by two Lens South America participants: Liliane Iten Chaves (PhD.), assistant professor at Federal University of Paraná (UFPR) and Positivo University (UP) and Julio Cesar Augusto Silva (Dr.), designer researcher at the National Institute of Technology (INT).

The method of environmental requirements integration

Both paper authors lecture in their courses environmental requirements insertion on the product development. The target audience for the INT courses is designers. These are postgraduate courses of short duration, and the target audience for the UP is graduates students of design. The method adopted for the environmental requirements insertion is based on the results of a product Life Cycle Assessment (LCA), followed by the interpretation and ranking of the Ecodesign strategies. Thus, the two Professors determined that the shared lessons would follow the method, focusing on the product Life Cycle Assessment (LCA) thematic and Ecodesign strategies prioritization.

There are different steps and methods for environmental requirements integration on a new product development, but usually as a first action, it is important to obtain a general mapping of which aspects of the product cause greatest environmental impact. The results are used to identify priorities interventions, leading to more efficient and effective environmental improvements.

Therefore, when developing a new product it is proposed that the designer (or the design student) based his/her decisions on a life cycle assessment of a similar product to obtain data regarding materials, processes and life cycle phases with bigger environmental impact. To make a Life Cycle Assessment of a similar product, students must: define the goal and the scope of the LCA, achieve the product inventory, access and analyze the results. The LCA is based on assessing the environmental impacts of all materials and processes used in all phases of the product life cycle: pre-production, production, handling, distribution and disposal.

Being in the possession of the results, the designer can define which could be the product interferences that lead to consequences with less environmental impact. Therefore, he/she confronts the LCA results with the Ecodesign guidelines in order to prioritize the strategies that lead to more efficient and effective results regarding environmental issues. Examples of Ecodesign criteria are: minimizing resources, selection of low impact resources and processes, optimizing products' life, extending the life span of the materials, facilitating disassembly.

Once it is known which the priorities strategies are, the designer can generate ideas to be applied in the product or on its components in order to reduce the environmental impact of the whole product.

Organization of Life Cycle Assessment lesson

This section will present the structure of LCA lesson prepared by Professor Liliane Iten Chaves.

The didactic aim of this lesson was the importance, boundaries and uses of a LCA. The purpose of the lesson was to teach designers and design students to make a simplified LCA of a product, knowing each step to do so. The content framework was divided into:

1. What is a product life cycle assessment?
2. LCA weak points
3. Which are the possibilities to use an LCA
4. LCA phases
5. LCA tools
6. Practical exercise
7. Final results

Content of Life Cycle Assessment lesson

The design for sustainability tools are divided into assessment tools, prioritization tools and tools to guide the project development.

Assessment tools consider the environmental effects caused by the product during its whole life cycle. The other two, are tools that can guide the product development and the designer decision's process to select the best aspects which can lead to results with less environmental impact.

To make an environmental impact assessment of a given production and consumption system, it is necessary to analyze the relationship between what this system assimilates in terms of environmental resources on one hand (inputs), and on the other hand, what this system release in terms of several emissions (outputs), which can be chemical and / or physical agents, like substances, noise, odours, etc.

A LCA can be used at different stages of a product development, but when used in the early stages it can analyze the existing system, allowing to understand which the most efficient interventions are and to better manage the project for results less impacting regarding environmental issues (Vezzoli and Chaves, 2006; Baldo, 2000). An LCA execution is based in four steps (Baldo, 2000, p. 36):

The Life Cycle Assessment of a product analyzes the environmental impact of a product (components, materials, energy, transportation, etc.), through input and output data of substances throughout the product lifecycle: pre-production, production, handling, distribution and disposal.

The LCA is the most known and reliable method to environmental analysis in a product. In fact, it is adopted by ISO 14040. Also, other initiatives of the European Community strengthened the confidence in

using LCAs, as: EMAS regulations, Ecolabel, Integrated Product Policy (IPP) and Environmental Product Declaration (EPD) (Baldo, 2000).

A LCA can be used at different stages of a product development, but when used in the early stages it can analyze the existing system, allowing to understand which the are the most efficient interventions and to better manage the project for less impacting results regarding environmental issues (Vezzoli and Chaves, 2006; Baldo, 2000). An LCA execution is based in four steps (Baldo, 2000, p. 36):

1. Objectives and scopes definition: this preliminary step establishes the study purpose, the functional unit and system boundaries. Some objectives of a LCA could be: to compare the impact between two products, to know the stage of biggest environmental impact, to know the most environmental impacting material, to know the most environmental component of the product.
2. Life Cycle Inventory (LCI): the data of the studied system is collected at this step (weight, unit, material, distance, etc.). Therefore, it is built an artificial model similar to the real system studied.
3. Lifecycle Impact Assessment (LCIA): this is the step of assessment itself, in which the data collected in the previous phase is judged in relation to the impact that it causes.
4. Life Cycle Interpretation: at this stage the results, in form of value, are interpreted for future actions to be taken.

One of the criticisms regarding the LCA is that the tool does not consider the socio/ethical and economic impacts of the system, analyzing and assessing only the biosphere and geosphere, health, human health and depletion of resources.

Results of Life Cycle Assessment lesson application

The Life Cycle Assessment lesson was evaluated on an internal course developed by Professor Julio in which the goal was to update the designers and researchers of the INT regarding design for sustainability thematic. The lesson developed by Professor Liliane, at INT, was evaluated by five professionals' product designers, where four are designers and one is a mechanical engineer.

The evaluation method followed was not a traditional lesson, considering that it was not an undergraduate course, but an extension class offered at the workplace. At INT, students attended the lecture on their computers, followed by Professor Júlio, who was prepared to answer questions or clarify some aspects if necessary. A debate was done at the end of presentation among professor and students, where it was observed that the content was well understood. On that occasion, students were also asked to submit suggestions to improve the didactic material.

In conclusion, the result was very positive as the students learned about LCA applied to design without the direct intervention of a teacher.

When encouraged to suggest improvements, students made comments such as: they appreciated the introduction presented, in which the issues to be developed during the lesson were presented. Moreover, they suggest that at this part of the presentation it could be included a best practice case of LCA, highlighting the assessment importance.

There was some confusion regarding qualitative and quantitative tools. Students suggested linking this topic with the module presentation structure, appearing in the introduction. They also asked to contextualize the tools in the design process, suggesting the same action for LCA tools.

Some students mixed up LCA with inventories of materials impact. The doubt was answered during the discussion with Professor Julio, who was following the lesson. They also suggested presenting the LCA limitations only at the end of the presentation, before the conclusions. It would be interesting also to present a full case before proceeding to the execution.

The lesson purpose was achieved. The students understood the LCA, its function, importance, limitations and steps.

Contents of Ecodesign strategies hierarchy lesson

The lesson regarding Ecodesign strategies hierarchy was prepared by Professor Julio Cesar Augusto da Silva. The lecture's aims were to interpret environmental LCA results, and identify environmental weakness in a product or service in order to prioritize diverse Ecodesign criteria. The lesson also discussed the environmental effects of Ecodesign criteria in different contexts. Key Concepts deal with the lesson:

- Ecodesign criteria and guidelines

- Ecodesign criteria and their effects
- Interpretation of LCA results
- Why prioritize strategies?
- Hierarchization process

At the end of lesson, it is proposed an exercise where students should promote the Ecodesign strategies and guidelines hierarchy from a simplified LCA.

Contents hierarchy of Ecodesign strategies lesson

There are hundreds of Ecodesign criteria or environmental information applicable in the product development project. These criteria are clustered into Ecodesign strategies for didactic purposes.

There are many ways to organize the Ecodesign strategies. Vezzoli and Manzini (1998), for example, suggest an arrangement with five major criteria:

1. Minimizing natural resource uses
2. Selecting low environmental impact resources
3. Optimizing product life
4. Extending material life
5. Simplifying disassembly

On the other hand, Brezet (1997) proposes a model with eight criteria:

@. New concept
1. Selection of low environmental material
2. Reduction of material use
3. Optimization of production techniques
4. Optimization of distribution system
5. Reduction of use impact
6. Optimization of life spam
7. End-of-life optimization

Each of these major criteria is divided into some sub-criteria. In any case, the different way to organizing environmental strategies is merely didactic, ie, the information is basically the same; only the arrangement's choice of each author is different. Each ecodesign strategy has its specific one. Some have a big influence on the distribution phase, but could not present influences on use phase. Another saved energy, but could not contribute to reduce materials consumption, and so on. Thus, considering the results of an LCA, the prioritization of the Ecodesign strategies is an individual process, to be examined in a prioritization case by case basis. It would be ideal to be able to apply all the Ecodesign strategies in the project, but it is rarely possible, because often:

- The strategies are contradictory, in many cases directing in opposite sites.
- It is the costs to implement all strategies.

A careful evaluation of LCA results is important to define which strategies must be taken by the design team as priority, which must be applied when possible and which must be applied only if there is time and resource available.

There are other aspects to be observed by the design team in the process of prioritizing the Ecodesign strategies. Issues such as: company motivations, consumer perception, regional characteristics at the commercialization local, environmental legislation etc.

Results of "hierarchy of Ecodesign strategies" lesson application

The lecture application regarding "prioritization of Ecodesign strategies" thematic, created by Professor Júlio Cezar from INT, was applied by Professor Liliane, in the product design course, for students at the 5th semester (3th year), on the Environmental Management discipline.

The class consisted of fifty-five (55) students. The discipline had a total of 35 hours, and the meetings happened weekly during one semester. The discipline goal was to introduce contents related to the envi-

ronmental dimension of sustainable development thematic. In practical terms, it supported the product design discipline, searching for solutions to introduce environmental requirements into a product development process. In this case, the students were doing a redesign of a mixer. In the first two months they were given theoretical contents regarding design for sustainability. In sequence, students should:

1. Defining the product system.
2. Establishing the product life-cycle, presenting a graphic map of the product "route";
3. Defining the LCA objective, functional unit and LCA boundaries;
4. Raising data for Inventory step;
5. Executing the Life Cycle Assessment of a product and a MET matrix[1];
6. Fulfilling an ideas check list, using a Manual from Vezzoli and Proserpio (?), based on Life Cycle Design strategies.
7. Life Cycle Design strategies priorization.
8. Using a Morphologic matrix, a creativity tool, develop brainstorming of new ideas for the mixer redesign, inserting environmental requirements.
9. Generating a new alternative for the mixer with low environmental impact.

After students had done the LCA exercise, using the Eco-indicator 2005 tool (Goedkoop et al, 1995), they did a check-list of design guidelines for sustainability, introducing five new ideas for each Design for Sustainability strategy. Therefore a total of twenty- five new ideas for environmental requirements were proposed for the mixer redesign.

The Professor Julio's lesson was applied for the ideas prioritization's phase, based on design for sustainability strategies, which presented to be against each other. The didactic material for the lesson was sent by e-mail, since problems occurred in LENS site up-loading. The material was previously studied by Professor Liliane, during the lesson organization. At the occasion, it was observed that the material proposed an activity directly linked with a MET matrix results. So, before showing the power-point presentation, students were asked to complete a MET matrix, based on LCA results developed in the previously lesson. This MET matrix application was not previously planned on the discipline contents.

At the lesson application, it was firstly explained the LeNS South America's project and the didactic material shared with the students. In sequence, the "LCA applied for design: results interpretation and Ecodesign strategies prioritization" lecture started. The slides were presented by Professor Liliane, once the presentation had not audio.

It was not possible to finish the lesson proposed by the activity during the presentation, since the exercise was based on a MET matrix execution. As previously mentioned, this tool had been inserted quickly at the beginning of the presentation to allow students to follow the power point presentation.

The lesson proved to have a very didactic sequence, however, the activity for ecodesign strategies prioritization was not easily assimilated by students, since the sequence proposed on the originally discipline contents was different from the presentation proposal. On discipline proposal, students had to submit five ideas for environmental requirements project integration for each Ecodesign strategy. On another side of the presentation, it was suggested that the strategies should be ranked firstly and then it would be generated environmental requirements alternatives, focusing on strategies priority.

Conclusion

The didactic material sharing activity proved to be an action quite valid. To share the materials, professors had to dialog and exchange knowledge about how to develop and organize their lessons, expanding the repertoire of both professors.

It is recommended to use the proposed method of sharing didactic materials. For that, it is necessary a previous interaction between the professors so that the presentation contents could be effectively absorbed by students. This attention could avoid disturbance in lesson and contents sequence previously planned. A better interaction emerged from this initiative allowing the contents to become more refined for the next exchange activities.

[1] A MET matrix is a simplified tool for LCA development. The initials MET refer to Material, Energy consumption and toxic emission. The MET matrix is a qualitative tool used to obtain an overview of inputs and outputs at each phase of product life cycle.

What emerged from this first experience is a major proximity and interaction between professors. Since the exchange occurred when both lectures were already in progress, it is estimated that in the next activity of material sharing the difficulties will not occur.

After finishing this LeNS South America experience, design for sustainability professors could conclude that developing and sharing didactic material can optimize time. Moreover, the exchange of the knowhow regarding successes and failures in application of environmental requirements insertion on product project methods, can lead to refine these methods and to create new ones. The activity is undoubtedly an excellent way to disseminate information and knowledge acquired by individual members. The experience of another professor observations helps to structure new courses from another point of view on the subject.

Finally, the activity proves to be important for countries where the Ecodesign is not yet widespread and practiced. The activity proves to be particularly interesting for large countries like Brazil, where there are high costs for personal interaction among professors to exchange knowledge and improve the didactic material. Therefore, it is demonstrated that Lens South America network is important to improve Ecodesign in Brazil.

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the Learning Network on Sustainability

Shared Talent

An exploration of the potential of the 'Shared Talent' collaborative and hands-on educational experience for enhancing learning around sustainability in fashion practice

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Shared Talent is a people-centred learning process, inspired by sustainability thinking and values and applied to fashion design and development. The focus is placed on how the students learn and how they consider the impacts of their work as part of the development into what they produce. As the principle investigator in this work, I offer experience drawn from over twenty years designing high profile womenswear collections, in many different locations. This is complimented by having worked with students inside and outside of sustainable fashion education. What I have been a part of with *Shared Talent* is a gently evolving gathering of experiences, relying on the receptivity of the participants and its observations are non-generalisable, so it does not seek absolutes on ways to teach and learn. It does however offer an alternative to most current fashion based course programmes that take the hierarchical approach usually associated with fashion production into heterarchical experiences that emphasise the value of each person's contribution by giving it more prominence in the work.

Introduction

It has so far brought together students and practising designers from different colleges, universities and cities across the world and from diverse areas within the fashion cycle including, design, pattern construction, garment production and management, craft, photography and journalism. To date, *Shared Talent* has seen three manifestations,[1] all developed with the purpose of allowing participants to interact in a way not previously experienced either in the classroom or workplace and to support a specific community or craft threatened by the current fashion model. Through its three manifestations to date, we are evolving a practical educational model that is sustainability in action.

This paper describes and reflects upon the work-in-progress that is the *Shared Talent* learning process; where individual players learn what they do better by seeing what other connected players are doing. It explores an understanding of each player's role in a broader context than just 'me.' It converts the 'me' to 'us' without becoming homogenous, by having distinct and related parts. It sits within the traditional format of what fashion design and development recognises as the skills and processes involved in the manipulation in 3D form of materials, to create pieces that relate to the body in ergonomic, aesthetic, functional, relevance and desirability terms. But it changes the organisational arrangements and power hierarchy, considering each component part of the process in a networked whole.

The fashion context has proven a useful one to a people-centred process like *Shared Talent*. The hands and minds prevalent across the creating of fashion, a process still dominated by human activity even at the most mass produced scale, lends itself readily to the exploration of sustainability values to promote ways of working that can foster an understanding of mutuality as a driver for creativity, fulfil-

[1] *Shared Talent* South Africa 2007, *Shared Talent* Tabeisa 2008, *Shared Talent* India 2009

ment and prosperity. It is envisaged however, that the evolving process of *Shared Talent* has application far beyond this sector, as the fashion sector is, like many others, dominated by a one-way flow of information and decisions, with hierarchies that can stifle creativity. The understanding of ways to nurture mutuality within the fashion process could offer insights to a wider understanding of our interdependence in the world.

This paper presents emerging themes from *Shared Talent* projects to date, to assess the ways in which a networked heterarchy can influence new ways of working congruent with sustainability values, offering creative opportunities to reinforce the sustainability agenda.

Each project has been explored though the narratives of the participants, before, during and on reflection beyond the timeframe of the project itself. An analysis has then been made to see what, if any, lasting impressions the project made on how the participants work and what they do.

These insights show the vitality of ideas that are generated through the process of physical, materials problem solving and how that can be translated into both a written and visual language. As fashion is both experienced and practiced, through this emerges a new form of literacy. The process allows reflection and learning about oneself through looking at the role of others. This has the overwhelming effect of increased confidence in the whole through increased confidence in self and in others.

Shared Talent 1

The first *Shared Talent* educational experience took place in South Africa in July 2007. It involved a group of fashion students from LCF,[2] a Johannesburg-based college[3] and a South African women's co-operative[4] and took place over a three-week period.

It was originally designed to bring together students from across diverse disciplines relating to areas within the fashion industry in order to give them direct experience of small scale manufacture of fashion products; to broaden their understanding about the sorts of things that can be made; and to connect them with producer communities – in this case a women's co-operative. Further aims included the transfer of knowledge from designers to producer communities regarding the preferences and interests of export markets (particularly in the rich North) with a view to future product development and export sales.[5]

The practicalities included the coming together of participants, spending time with each other in workshop facilities to exchange experiences and ideas. It included the unprecedented move to transfer the 'work in progress' onto a stand at South Africa Fashion Week, where the work and the participants were broadcast to the world through the exhibition and its coverage on national television.

Shared Talent 1 was predominantly an informal, intuitive evolution of ideas, not formally recorded.

Shared Talent 2

The second *Shared Talent* evolved from its predecessor, drawing directly on the experience of *Shared Talent 1* through collaboration with Tabeisa.[6] It took place in South Africa and Ghana in August 2008, involving students and graduates from London College of Fashion and a number of women's' co-operatives based in locations across South Africa and Ghana over a four week period.

[2] LCF London College of Fashion, part of University of the Arts London

[3] LISOF is a college in Johannesburg offering design and construction courses in fashion. This is a relatively new area for higher education within SA as part of a growing creative industry. The college is relatively small and its ability to engage in this project was enabled and led by the principal's drive and ambition.

[4] Buotemelo is a women's co-operative in Hillsborough Johannesburg supporting women who are challenged by poverty, ill health, domestic difficulties, with the majority of the participants suffering from different stages of HIV/AIDS. These women develop and share hand based skills across a number of different locally sourced materials, making for the local market in Johannesburg.

[5] Shared Talent 1 was initiated through the Fashion Business Resource Studio and LISOF principal.

[6] Tabeisa supports organisations varying in size from sole traders producing accessories and gifts using recycled materials and local crafts, to small clothing manufacturing units supporting up to 25 members of the local community. Each business was selected based on the growth potential of the highly skilled workbase and the need for design innovation to offer new products for new markets and competitive advantage within a very tired tourist focused market.

It was designed with the aim of bringing usually de-coupled skills across the supply chain together through UK team members working directly with the members of the co-operatives to develop 'production ready' prototypes that could be offered for sale through Tabeisa's retail channel Exclusive Roots. These prototypes needed to be viable for continued production and further development beyond the timescale of the project.

The practicalities included preparation time prior to the concentrated period together at the co-operatives and a 'checking in point' part way through the time, when all participants travelled to one location to discuss the work in progress. The selection of workable styles was refined and finalised so that the submission to Exclusive Roots could be completed.

Shared Talent 2 was also predominantly an informal, intuitive evolution of ideas, not formally recorded.[7]

Shared Talent 3

The third *Shared Talent* educational experience took place in Delhi, India, in July 2009 over a twelve-day period. It involved a group of fashion students from the UK, a group of practicing designers from the UK, a group of fashion students from the Netherlands, a group of fashion students from India and a group of practicing designers from India.[8] Other participants included textile makers, skilled artisans and organisations representing hand-skills, NGOs working with local skills and women's organisations and an experienced UK buyer working with high volume fashion in the UK. *Shared Talent 3* evolved as part of a project carried out by CSF under Defra's SCAP initiative.[9] Preliminary research identified materials sourced in India for their more positive ecological, social and cultural impacts and their potential for application in fashion.[10]

The project was designed to facilitate understanding between designers; between designers, makers and buyers; between people in different geographical locations and different cultural contexts. Specific requirements of the project funders were discussed alongside the aspirations of the participants. It also drew on the experience of the first two projects to discover more about the process and what it can offer to teaching and learning through a sustainability lens.

The practicalities included significant preparation in bringing together the participants firstly through an online video exchange, dialogue through social media networks and semi-structured workshops in both India and the UK. Once in India, participants from the UK and India engaged in an immersive experience, living and working at a venue specifically designed for artists to work.[11] The visiting participants included the textile makers, technicians, NGOs and other organisations that spent a shorter amount of time with the group. The samples produced were presented to a major UK retail company at the end of the project for their feedback. Selected pieces were then showcased at London Fashion Week on their stand.[12] Throughout the project, filmmaker participants recorded the experiences through filming of locations, activities and interviews. The LFW showcase, five-minute film and styled look book form a lasting visual narrative of the project. The project contents have been collated and focused into an online resource for others to view and offer their own contributions.

[7] Shared Talent 2 was facilitated through the Centre for Sustainable Fashion.

[8] Participants were selected from practicing designers based in the UK and Delhi and students from LCF, Pearl Academy of Fashion Delhi and Amsterdam Fashion Institute.

[9] The UK-India Sustainable Textiles Dialogue was a project carried out by CSF funded by Defra and the India Ministry of Textiles. For more details see www.sustainable-fashion.com

[10] For detailed findings of the research see www.sustainable-fashion.com

[11] The Global Arts Village, just outside Delhi

[12] Monsoon offered feedback from their design and buying teams and the opportunity to showcase work at LFW on the Monsoon stand.

Methodology

London College of Fashion courses span the processes involved in the current fashion supply chain, from the manipulation of materials into 3D garments and a narrative and explanation of these pieces through visual and written communication and styling. They also cover the practical implications of development into commercially viable collections for identified potential customers. Currently each of these specialisations are taught as discreet disciplines across three schools and, although encouraged to create dialogues across courses, students predominantly experience this through individual initiative or, at best, through a shared industry-led brief. Curriculum does not include an experiential element where students work *together* on a project in a 'real life' situation.

From the outset, it was hoped that any activity, however discreet and specific, would allow ideas to permeate across the student and staff communities and into the courses via the individuals involved. It was equally important to seek endorsement and support from the Head of College and subject leaders.

In each case, expectations were discussed and agreed by participants prior to project activity. Interest and commitment from participants was secured through a process of call out, interviews and offers to those able to meet the practical obligations of time and eligibility.

Before each of the project's activities started, a programme of preparatory exploratory work was designed and delivered. This needed to be balanced with the desire to work collaboratively between all participants working together rather than taking the usual approach of 'remote design – pre-conceived realisation.'

In each case, initial dialogue was set up between the participant organisations through appropriate and viable means including written introductions, video discussions and the exchange of written, visual and 3D representations of each other's work through *Facebook* and the exchange of ideas online.[13]

Each project's activity included a concentrated time where everyone was together. Initially an exchange of verbal and visual descriptions of each other's lives took place and then a programme of activity was devised to include development workshops, visits to culturally significant places, invitations to each other's neighbourhoods and times to enjoy eating and relaxing together.

In *Shared Talent 2*, due to the geographic location of the businesses, many participants were required to work independently whilst others were working in pairs or living together in small groups and were able to interact on a daily basis. All participants and businesses were brought together in Durban, South Africa, for a five-day workshop halfway through the one month programme.

The methodology of *Shared Talent 3* changed to a semi-formal structure in order to capture data about designers' knowledge and awareness of sustainability and their ways of working using three different methodologies. Two of these methodologies used longitudinal data gathering approaches. The first explored the participants' understanding of sustainability before and at the end of the project. The second was to investigate the individuals' ways of working both before the project commenced and after it had finished. The third method involved gathering detailed qualitative data about the participants' thoughts, attitudes and ideas to key themes in advance of the time they spent together in India.

The process and findings of this study form the main basis for this reflection.

What sustainability means to me

As part of the selection process, with the aim that all applicants could experience some part of the project, each person (in both the UK and India) was asked to bring along an object, image or story that epitomised sustainability to them. This was explained to two other members of the group. These sustainability ideas were drawn into themes as they emerged.

This question was revisited during and at the end of the project through individual interviews and group discussion to see if sustainability ideas had changed (or not) and in what way (or not).

[13] Through these discussions, a mutually developed design brief was formed; ambitions around the viability of the collaboration beyond the project timeline were discussed as well as 'ownership' of final products.

How do I work?

At the start of the project, each individual was asked semi-structured questions about the ways in which they work as part of their current practice.

Six months after the conclusion of the project, interviews were held with a number of participants, asking the same questions about ways of working in order to better understand the changes (if any) that had taken place.

Chain letter conversations

In order to gain rich data about the participants' approaches to design and knowledge of sustainability four email 'chain letter' conversations were circulated among the group. This took place initially through *Facebook* and then by posting up the questions inside the studio to invite comments during the 10-day workshop process. This was to garner information about the participants' approach to the *Shared Talent* process.[14]

Outcomes

In *Shared Talent 1* the visible manifestation of the project communicated the story of the project and documented the physical pieces produced through the time spent together. The securing of a stand at South Africa Fashion Week, allowed a focus and platform for the project, but also a very restrictive timescale for experimentation. The solution was to transfer the development workshops and to spend the week with everyone on the stand continuing the experimentation as a 'work in progress'. This offered a way to place the work within a fashion context whilst offering a new experience to the women from Buotemelo who had never been into this event, or even this part of town. Thus broadening scope and expanding horizons in small but distinctive ways.

The finished pieces were brought to London to exhibit to the public and to potential buyers and press. In consequence to the London exhibition, Buotemelo received their first export.

The outcomes for the student participants included the subsequent setting up of a fair trade accessories business, embarking on MA Fashion and the Environment and developing a collection later exhibited in Estethica.[15]

Further recognition was given to the project and its work through The Green Gown Awards[16] where the project won the award for Social Responsibility 2008.

In *Shared Talent 2*, each co-operative was able to develop products that were ready to sell through Exclusive Roots[17] thus fulfilling the ambition to support the financial stability and continuing benefit of the project. The skills exchange that took place between the students and graduates and the women in the co-operatives offered new insights into where each participant's own work was positioned.

The prototypes were developed into production and many are ongoing sales lines at Exclusive Roots, through which each co-operative continues to sell their work.

Other outcomes include the subsequent development of a fashion business, focusing on sustainability thinking, showcased at Estethica at LFW.[18]

In *Shared Talent 3* a collection of pieces stemming directly from the project was presented at Estethica at LFW, in Delhi at India Fashion Week and through a British Council event in Delhi. These visual artefacts were also captured through photography in a magazine format[19] directed to a fashion-savvy audience and a five minute film was made as a visual précis of the experience.[20]

Additional outcomes offer a more interactive way for audiences to connect to the project through an online resource connecting designers to producers in the context of sourcing in India.

[14] Chain letter conversation details were recorded during the workshops

[15] Estethica is a section of London Fashion Week focusing on design with ethical and ecological criteria

[16] The Green Gown Awards are annual awards given to UK universities for their contribution to sustainable development and are organised by EAUC The Environmental Association for Schools and Colleges

[17] Pieces were photographed and offered for sale internationally through Exclusive Roots website www.exclusiveroots.com

[18] Estethica is the section of London Fashion Week where designers are selected against 'sustainability and aesthetic criteria.'

[19] Shared Talent www.sharedtalent.com

[20] Shared Talent film shown at LFW, Defra website, BBC news on line

Various participants developed important contacts and links including additional showcasing of the work and returning to India to work with one of the producers.

Data gathered in accordance with methodology included written reflections, filmed interviews and self-reflective video diaries, group discussion documentation, observation and mapping. This rich data has been collated into the following emerging themes.

Participants' Responses

The *Shared Talent* process provided an opportunity to explore the practice of teaching and learning fashion design in a way where sustainability values like co-operation, participation and resourcefulness were strongly expressed. As part of this process, we explored the response of participants to *Shared Talent*, recording this in a range of ways before, during and after the formal project activities. The participants' responses were often intuitive and emotional rather than analytical. They were also wide-ranging yet, within this diversity, distinct themes began to emerge. These themes are discussed below.

Greater reflexivity

For many of the participants, *Shared Talent* offered perhaps the first opportunity since graduating from college to deeply question their own motivations and identities as designers and to explore the values of their own design practice. For some participants, this reflexivity also appeared to trigger a deeper questioning of other aspects of fashion collection design and development. For example, processes that had previously been taken for granted as 'common practice' were scrutinised and participants began to discuss their experience of such processes and possible alternatives. This was recognised as surprising as fashion design is notoriously secretive. As one designer put it, "sharing felt like something radical to fashion."[21]

The reflexivity triggered by the *Shared Talent* process appeared to offer a new angle on fashion where sharing can be seen as an avant guard practice, a new type of aspirational behaviour that could perhaps offer an alternative ethic or code of practice for fashion. By offering a way of working that encourages exchange as a part of development, it is possible to encourage a shift from the current fiercely protective system where secrecy and hierarchy are seen as a means to creative and financial advantage, to one where competitive advantage is seen through the sharing of knowledge, inspiring individually distinctive application.

Shared Talent participants – like most other learners – had a tremendous thirst for knowledge at the outset. Calls for a 'how to' manual were slowly but surely retracted as participants explored the reality that there is no template for new ideas generation and that 'preparation and permission' is offered ultimately from authentic dialogue with others and ownership of your own actions.

In some cases this enhanced reflection led to exhilaration and excitement in the participants at newfound knowledge and strength gained from each other's support. In other cases, increased thoughtfulness generated inertia caused by the overwhelming complexity of the issues. A little like lifting the lid on Pandora's box; and then feeling crushed by a flood of information, choices and consequences that sometimes plunged the participants into a flood of emotional responses that were difficult for them to manage.

To a certain extent the project framework, which required participants to produce tangible outcomes, helped mitigate some of the feelings of being overwhelmed for it made those involved respond to this new information by making; by fashioning garments from fabric and working through the issues in physical forms.

The self-questioning elicited by the *Shared Talent* project of the participants reflected a number of key social, cultural and developmental perspectives. There was a clear delineation in focus between those living in India and those from either the UK or the Netherlands. For the Indian participants, sustainability was thought of first and foremost in terms of human wellbeing. For the others, ecological integrity was foremost in their minds. These different perspectives inevitably offer an opportunity to learn more about both the issues and other cultures. In the case of *Shared Talent 3* this learning was expressed by those participants from industrialized countries looking to less-industrialized ones for examples of good practice.

[21] Follow up interview March 2010

Thinking and learning through making

Shared Talent was a practice-based project and the intense pleasure associated with 'making' was expressed by many of the participants. More than that, it was even seen as a 'need'. The act of making was recognised by the participants to heighten the vitality of the conversations; it gives material, tangible, texture to the dialogue. It linked the active experimentation of practice with values. It is the 'result' of hard work and energy put in. Part of this is expressed through the fact that through sustainability when in object form can be, 'experienced, held, touched, and responded to emotionally'. What are more vital and original sustainability ideas can be generated through material experimentation, actual problem manipulation and resolution.

"We discussed what sustainability means to us collectively and individually every night and worked on our ideas during the day in the workshop."[22]

"I had heard about sustainability before, but now I have experienced working towards sustainability, which inspires me much more." [23]

"I finally feel as though I know what I am doing, now that I am actually 'doing' something, making garments." [24]

Seeing time pressures differently

Shared Talent was an immersive experience that required participants to agree to commit their time to do this. Indeed time pressures dominate most fashion professional's day-to-day work. Participants spoke of the 'indulgence' of taking time out of their normal practice to be involved with *Shared Talent*, but recognised that once relationships, honesty and trust had been established, working together enabled them to 'do more, do better, do faster,' and to enjoy the process as well as the outcomes. There was frequent reference to the feeling of 'being honoured to have been a part of something so meaningful.' This fulfilled one of the key aspirations for participants at the outset, the achievement of 'meaningful design work.'[25]

"The whole space was full of positive energy. It had a feeling of something meaningful that all of us had indulged in. the exchange of ideas, approach and culture was helpful in the realisation that design is the language which helps us to connect and contribute to each others and our own work."[26]

Most fashion, from luxe through to supermarket fashion, works on a short or very short-term development cycle. Vision, reference points, production, showcasing, acceptance and success are all realised within a very restrictive time and reference frame, whilst operating within a fashion system that operates in a fixed way that has not changed in our lifetimes. *Shared Talent*, whilst also taking place in a limited time frame, creates a bridge to the longer-term through alternative values and experiences.

"I want to find a way of working that is informed by all that I have seen and heard and to show something by the end of our time in Delhi, but I don't want to panic and create shortcuts and a return to 'normal' ways of working."[27]

"In a different place, you have to adapt to different times. Nobody here can just do things the way that they do them usually. This is a different set up."[28]

Participation feels good

While the initial motivations of the participants varied from the more selfish to more altruistic, without exception all those involved described the positive effects of participation in *Shared Talent*. An incredible energy was evoked both through the creative and professional engagement of the participants which led to a feeling of renewal of their ideas, skills and practice inspired by the broader context of sustainability.

"Through the overall experience, I feel enriched and come away feeling inspired and my design practice reinvigorated. Things weren't perfect but for a project with a brand new format, I felt confident in my own and other's abilities."[29]

[22] Participant reflective diary (UK participant)
[23] Participant reflective diary (Indian participant)
[24] Participant reflective diary (Netherlands participant)
[25] Hopes, fears and expectations were collected at the outset of the project
[26] Evaluation form Shared Talent workshop in Delhi
[27] Participant comment during workshop in Delhi
[28] Participant reflective diary (Indian participant)
[29] Participant feedback evaluation form workshop Delhi

While participation in *Shared Talent* felt good, particularly during the immersive workshop, it was also tinged by the financial and market power imbalance between buyer and producer countries. For the Indian participants, involvement was motivated not only by self-development, but by the capacity to make contacts, endorsements or introductions to new 'markets' in the West; the reality of the economic dimensions of such work for participants from emerging economies.

Courageous thoughts and actions

Prior to the *Shared Talent* experience, a significant number of participates struggled to feel confident in the sustainability aspects of their own work or in what they had to offer others. Post *Shared Talent*, by contrast, participants described their enhanced practical capabilities in three areas:

Increased confidence to do more for and by themselves after seeing their own contribution to the group.

"Now I know how it can apply to me (sustainability) and what I can offer. I am sure that I will always keep sustainability in my head"[30]

Increased confidence to work collectively, without being literal or constrained by the traditional hierarchical roles within the design and development process.

"Working collaboratively on an actual design can be frustrating and indecisive. Offering advice about each person's own part is a much better way forward for me."[31]

Increased confidence to imagine new working structures and relationships.

"Conserve works in such a unique way, taking a problem (street refuse) and turning it into a never ending source of usable materials, (plasticized sheeting) using what the rubbish-pickers choose as the starting-point for design."[32]

This improvement in capabilities offered dynamic ways in which to work that gave confidence, increased a sense of community, equality and fairness amongst participants and hence became an example of 'culture change in action.'

"New knowledge helps me to make new decisions."[33]

In conclusion

The hope is that the data and observations gathered through this work will aid the understanding of how to embody sustainability content and ways of thinking in fashion practices. The descriptions and reflections articulated here are modest and participant reliant viewpoints that offer an alternative to mainstream ways to educate that could provide further potential benefits. We need to prepare students to be relevant because of their point of view, not because of a specific product that they have made, but we see that both the process of making and attributes held by 'things' are of great significance in our lives and in the lives of others.

We aim to integrate the principles of sustainable design into a framework around which designers can share new methodologies, thus creating an exchange whilst retaining the individuality of the designer. This requires a collective building of knowledge, skills and values and channels for exchange in order to empower designers to individually engage with a collectively agreed set of criteria and to overcome barriers. This is a very new approach for fashion design – a discipline characterised by its elusive nature, its secrecy and its fierce protection of ideas and rights to ownership. We need to change direction from the

[30] Participant reflective diary (Netherlands participant)
[31] Participant reflective diary (Netherlands participant)
[32] For details on Conserve see www Conserve joined the project to talk about their work.
[33] Participant reflective diary (Netherlands participant)

traditional model of competition, to encourage sharing of expertise, thus opening up the potential for innovation and surprise. This new 'sustainability in action' framework re-positions designers as communicators across the product development process, empowering them to contribute to real change in the way that fashion is perceived, created and consumed.

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the Learning Network on Sustainability

Pedagogic support through learning-by-sharing

The case of an inter-disciplinary workgroup for postgraduate design students in South Africa

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This paper discusses the creation of DRAW – an acronym for Design Research Activities Workgroup. The workgroup evolved out of a need to support postgraduate students at the Cape Peninsula University of Technology (CPUT), South Africa. The idea of Design for Sustainability (DfS) in CPUT is still at a formative stage; DRAW is the first group within the University to work within the DfS-specific research paradigm. One of the core objectives of DRAW is to provide a platform for supervisors and postgraduate students of all design disciplines to interact on a regular basis whilst simultaneously offering peer-support. The workgroup embraces the collaborative spirit of *Ubuntu*, which engenders a participative ethos amongst diverse actors in a learning-by-sharing experience. One of the pivotal events hosted by DRAW was the launch of the Learning Network on Sustainability (LeNS)-Africa. The LeNS conceptual framework was introduced to an audience of lecturers and students from various design disciplines in order to orientate them towards pedagogic and didactic applications of Design for Sustainability and Product-Service Systems.

Introduction

Under the conference theme of Design Education for Sustainability (DEfS) the paper takes an interpretive stance, in alignment with appropriate qualitative methods. It interrogates the Design Research Activities Workgroup (DRAW) community-of-practice wherein the various actors provide personal views on the benefits and challenges of being active members of such a group. DRAW was established in order to provide a supportive environment for postgraduate students, which would counter the low throughput rates caused by loneliness and a shortage of supervisors. According to M'Rithaa (2010d) there was a need to create a forum which supported the learning-by-sharing, so the more was shared, the more was learned among the peers.

This paper has been divided in five sections; the first discusses DRAW and its objectives, values and group dynamics. In the second section *Ubuntu* as a participative ethos amongst diverse actors is introduced and is followed by the third part which puts *Ubuntu* in the context of a learning-by-sharing experience. The fourth section discusses the pedagogical and didactic implementation of Design for Sustainability. The last part interrogates the future aspirations of DRAW and discusses the methodology used in this study.

Design Research Activities Workgroup (DRAW)

DRAW was founded on 10th March 2009 by Mugendi M'Rithaa (Industrial Design educator, researcher and postgraduate supervisor), a group of postgraduate students and other interested parties at the Cape Peninsula University of Technology (CPUT). The workgroup has formally been recognized by Professor Cronjé, the dean of the Informatics and Design Faculty in CPUT. DRAW is made up of registered postgraduate students from the faculty of Informatics and Design. These students are voluntary members of DRAW and vary in their disciplines as well as the departments in which they are registered. The students research a self-generated topic within their department. Presently two postgraduate supervisors participate in DRAW, for necessary guidance.

DRAW has been established for a number of reasons. The first one is to support the design departments in specific, as they have an unique way of working. Designers typically work from a practical, problem solving point of view, while postgraduate research emphasizes a more theoretical kind of underpinning. M'Rithaa (2010c) identified a need among these postgraduate designers to discuss their research within a multi-disciplinary design group who speak 'the same language'. The second reason for establishment is to have a platform where supervisors and postgraduate students could meet on a regular basis while simultaneously offering peer-support.

Thirdly: "*DRAW builds on the joint Bachelor of Technology (Btech) presentation initiative. Some of the present postgraduate students actually participated in these presentations, and were already aware of the benefits of bringing a multidisciplinary design group together* (M'Rithaa, 2010c)." Moreover, one of the most critical stimulus for the formation of DRAW was the need for a peer-support mechanism in order to support the postgraduate students in their solitary research journey.

Academic loneliness

A significant amount of research has been done, including research by Professor Cronjé, where the number one reason why postgraduate students fail to complete their studies is academic loneliness. Conrad and Phillips (1995) confirm that among the numerous factors associated with withdrawals or delays in PhD completion, social and academic isolation was critical, as did Welsh 1979; Powles 1989 and Whittle 1992. Two of the DRAW students, who had started their Masters research before the establishment of DRAW, confirmed that loneliness and a feeling of isolation does play an important role in postgraduate research, as Munyai explains: *"By the time I came to DRAW I had gone through the lonely process in research. […] You do your research but because there is no interaction you don't hear how other people deal with certain situation or certain things in research (Munyai, 2010c)."* Suskin adds to this: *"That loneliness becomes a desperation, to really find a social contact and to have a support group (Suskin, 2010c)."*

The values of DRAW

Draw can be described as a community of practice, where a common practice brings people together. Within DRAW the members are all designers, the students are on postgraduate level and there is a specific underlying agenda of Design for Sustainability (DfS).

> "A community of practice is an informal, self-organised network of peers with diverse skills and experience in an area of practice of profession. Such groups are held together by the members' desire to help others (by sharing information) and the need to advance their own knowledge (by learning from others (Businessdictionary, 2010)."

DRAW, as a community of practice, has identified three core values; authenticity, participation and emancipation. *"Authenticity is significant as all participant are to be pure and open to each other in terms of the discussion, we want to contribute towards a common wealth, pool together whatever input we have* (M'Rithaa, 2010c)." DRAW is participatory; it encourages participation from postgraduate design students as well as supervisors and other key actors in the Informatics and Design Faculty. Moreover, during the DRAW meeting each member has the opportunity and is encouraged to share his/her research experiences in a non-prescriptive way. In addition DRAW is emancipatory and flexible, on a weekly basis members discuss and agree by consensus the critical concerns of the following meeting. When a member has an urgent topic or issue to discuss, it will be incorporated in the programme. If there

is a need for certain information, lecturers in that specific area of knowledge are invited to share their expertise and experience with the group. This is also how LeNS Africa was incorporated in the DRAW program, as several members are employing Design for Sustainability and Product Service Systems in their research.

Peer-peer versus supervisor-led learning

"Research learning can be usefully interpreted in terms of entry into communities of practice, where peer learning becomes one powerful tool for describing and developing a rich understanding of the learning resources available (Boud & Lee, 2005:513)." For this to succeed an egalitarian and flat power structure is critical so that the quality and scope of learning can be enhanced.

> "This can be seen as one important move to disperse and horizontalise pedagogical power and authority. For this work to be useful as a resource for informing developmental work in research degree pedagogy, it must be supplemented by a theory of learning that is situated, positioned, socially differentiated, intellectually heterogeneous and geographically dispersed (Ibid)."

Phillips 1989b; Conrad 1992; Conrad et al., 1992 confirm developing groups which enable thesis writers to discuss their research progress and findings with peers also reduce the academic isolation and increase the chances of completing the postgraduate course. Within DRAW, besides the encouragement and guidance by the supervisors, the students also support each other in their collaborative research journey, building a strong case of 'peer-support'. The essential aspect of peer-learning is the mutual learning experience, peers learn from each other by drawing pedagogical attention to the ideas of other peers. Within this specific environment students may participate in a number of activities such as sharing methodologies, co-writing papers, presenting at conferences and participating in faculty-based seminars.

In an academic community of practice such as DRAW the traditional power structure between supervisors, students and practitioners fades as these participants are *"challenged to integrate these roles as part of their learning* (Huizing *et al*, 2007:10)." When students and supervisors interact as peers the research environment unfolds as a pedagogical space. Supervisors learn from their students and become more aware of new methodologies and literature through this exposure (Boud & Lee, 2005). The supervisors participating in DRAW can also be seen as ´peers´ as the platform promotes an egalitarian and flat power structure. Within DRAW, according to M' Rithaa (2010c):

> "The traditional relationship with supervisors is no longer valid, […] but there is a specific window of opportunity in which a supervisor can play a part, the rest of the time we are just 'doing life'. You are a human being, I'm a human being and that continues. So I don't allow that role or function to define the long term academic relationship and I don't allow it to cloud my understanding of my unique responsibility in the process."

The interpersonal relationships between all participating actors is significant, it encourages: *"…treating one another as human beings who have strengths and weaknesses, personal satisfactions and disappointments, good days and bad days, just like everyone else"* (Cryer, 1996: 59). This is also essential in the Ubuntu principle, which is a cornerstone in DRAW.

Ubuntu: a participative ethos amongst diverse actors

DRAW incorporates a practice that is as old as the African continent itself; a collaborative spirit known as *Ubuntu*. M'Rithaa is a firm believer in the principles and spirit of *Ubuntu* and when the group was started the principles of *Ubuntu* became integral to the foundation of the group (M'Rithaa, 2010d). The group has been set up so that learning by sharing forms one of its core values; this would strengthen the group and its learning experience.

Ubuntu is African humanism and it forms the core of the social ethics that is employed in the African value system that is established by the Bantu speaking people (Eklund, 2008:14). The expression "Umntu, ngumuntu ngabantu" is the Zulu phrase used to sum up the meaning of *Ubuntu*. The Bantu languages

all have variants to this phrase and when translated to English it means "a person, is person through other persons" or " I am because we are (*ibid*)."

Ubuntu is our shared humanity, it is the way people treat each other and their surroundings. The principles of Ubuntu have been passed down from generation to generation in the African value systems. There are many qualities that are related to *Ubuntu*, some of these principles of *Ubuntu* are: caring, sharing, respect, affection, sympathy and humanity (Eklund, 2008:15). The *Ubuntu* spirit teaches that if we care for those around us and provide mutual support we are reaffirming our own humanity (Louw, 2001). When the spirit of inclusiveness is present in a community it engenders positivity within the community which strengthens the community. This supportive structure creates the thread which holds the community together (M'Rithaa, 2008:2).

Its relevance and importance is mentioned by the recognition it has received by the South African government. It is mentioned in the White Paper on Social Welfare as: *"The principle of caring for each other's well being* (South Africa, Department of Social Development. 1997)*."*

Ubuntu in the context of a learning-by-sharing experience

DRAW has employed the principles of *Ubuntu* to help curb the academic loneliness and isolation that is experienced during the research process and these principles have allowed for an enhanced learning experience. DRAW's structure is fairly simple, the supervisor(s) chairs the meetings that are held on a weekly basis and if one of the supervisors is not available for a specific meeting then one of the group members is chosen (randomly) to chair the meeting. With *Ubuntu* everyone is welcomed and their opinion is also valued. DRAW has also incorporated this principle, since DRAW is inclusive, open to all and those who are part of the group and all are encouraged to share their opinions and ideas. Discussion is how all major decisions are reached in DRAW; this is also part of the *Ubuntu* way of life. The members of the group are all allowed to voice their concerns until an agreement is reached (Louw, 2001)

One of the most important principles of *Ubuntu* is sharing and caring for one another and DRAW members have incorporated this as part of their way of approaching research. One of DRAW's unique characteristics is that the group is made up of members from a total of six countries bringing with them embedded knowledge; this enriches the learning process when the members engage in discussions. The members share information that they have on various subjects relating to the members research that may interest the group, thereby widening the knowledge base of the group. *"This concept was initiated because the preceding idea of learning was becoming outdated in the sense that learning was not only restricted to the period of 18-23 years, it is now a lifelong process* (Thijssen *et al*, 2002:3)."

The old models of learning where the teacher provides information and the students try to absorb what has been presented, restricts the learning process because it does not allow for the student to form their own ideas and construct their own knowledge bases. The learning-by-sharing model is based in the principle that a greater understanding is reached through a shared learning process. *"Knowledge is created as it is shared, and the more it is shared, the more is learned"* (Thijssen *et al*, 2002:6). This model is centered around the student where the student creates his or her own learning route, the role of the teacher/supervisor is to organize the process and to advice the student where necessary. If this model is implemented, then the learning process moves from a passive process to an engaging and participative one (*ibid*).

In DRAW the members look at each other and recognize the genuine "otherness" in each other and we are able to care beyond the academic level. The members of the group are aware that one's personal life influences the academics process. The members know that through interaction with others, as Eklund (2008) states as well, we become more in tune with our humanness, contributing to our personal growth. DRAW members are aware that together more can be accomplished, as the African saying goes: "If you run alone you run faster, if we run together we run farther".

Pedagogic and didactic applications of Design for Sustainability

> "One of the pivotal events hosted by DRAW was the launch of LeNS-Africa. The LeNS conceptual framework was introduced to an audience of lecturers and students from various design disciplines in order to orientate them towards pedagogic and didactic applications of Design for Sustainability and Product-Service Systems (M'Rithaa, 2009)."

The pedagogic-didactic concept deals with issues concerning the 'how' (tuition) and the 'who' (the role of the individual involved in the tuition) of advanced training courses (Neptune, 2007). The questions of 'where' and 'when' for the location and the time as concerns the DRAW meetings are established to be fortnightly. In this case the 'how' would be outlined through the concept of 'learning-by-sharing'. While the 'who' would be the postgraduate students' enrolled in the course who voluntarily chooses to become members of DRAW. The concept of learning-by-sharing was further advanced by the launch of LeNS Africa, whose ethos is a copy left approach. This furthered the aims of DRAW whose main objective is to facilitate the presence and participation of fellow peers in a student's research journey.

LeNS is designed as a web educational tool that instructs other lecturers of current academic processes used in the dissemination of information in the area of DfS to their students at university level. In the above described framework here are presented the vision, the ambitions and the tools developed within the *Learning Network on Sustainability (LeNS) project*, an Asian-European multi-polar network for curriculum development focusing on Design for Sustainability focused and (Product- Service) System innovation, financed by the European Commission under the Asia-Links programme (M'Rithaa, 2009). LeNS aims to develop and diffuse design for sustainability in design schools in a trans-cultural perspective, where design researchers/educators in industrialized and emerging countries share knowledge and come out with a design education agenda able to respond both to local and global sustainability challenges.

The main output (tool) developed by the project is the *Open Learning E-Package (OLEP)*, an open web platform that allows a decentralised and collaborative production and fruition of knowledge produced as learning outcomes. It can be described as a modular e-package of teaching materials (texts, slide shows, audio, video, etc) and tools for designers, that design educators (but also students and professionals as designers, entrepreneurs and interested persons/institutions) worldwide will be able to download (free of charge), modify, remix and reuse (copy left).

The evolving didactic and pedagogical tools (such as the OLEP one) provide an excellent place to begin interrogation of design for sustainability without the usual encumbrance of prohibitive start-up costs – a factor that typically restricts the participation of Higher Education Institutions (HEIs) in developing (and developed world) contexts. There are didactics in the Department of Industrial Design that orient the students toward *Ubuntu.* This orientation led to the implementation of sustainable design concepts that resulted in the development of resource conscious designs. As this is one of the core principles of DfS; using natural resources more efficiently, the additional support from LeNS came at an opportune time. According to M'Rithaa (2010) DRAW as a growing platform for the expansion and deliberation of DfS in the area of design can map out future objectives following the LeNS structure. The academic research area would contain literature, methods, study materials and seminars. Figure 1 below illustrates one of the presentations during the LeNS Africa launch.

Figure 1: LeNS Africa introduction in CPUT

Source: Bergevoet, 2009

Future aspirations

A qualitative research methodology was appropriate in this study, the DRAW members have participated in-depth semi-structured interviews, a questionnaire and focus group in order to collect the data. The data was transcribed and analyzed according to emerging thematic codes, a SWOT- (Strength Weakness Opportunity Threats) analysis performed to establish the opinions of the DRAW members in the context of future aspirations. The SWOT analysis will be outlined in a narrative format to allow for the varied input of the multi-faceted group to be better captured.

Strengths

Although DRAW is only about a year old, it has built a solid platform for the support of postgraduate design students during their research journey. The participants in this study have identified several strengths of being active members of DRAW, one of them being the consistency within the group. DRAW has a consistent core of members who attend the weekly meetings and exchange their research experiences. Through this consistent knowledge-sharing the members have become familiarized with each other's research which gives them the know how to recommend methodologies or literature. This input creates a platform for interaction within the research field that is otherwise seen as a singular effort. Chisin explains: *"I think that it has a positive impact on your academic work and I think the quality of the argument and the quality of the dialogue has been strengthened because of the consistency of the attendance and the consistency of the meetings (Chisin, 2010b)."* This consistency also supported the development of close bonds among peers, a few DRAW members have identified the platform as an extended family, as Foudazi (2010c) explains: *"This DRAW group is a supportive group. We share everything; we laugh and cry together."*

DRAW has facilitated a supportive platform to tackle the lonely journey of a postgraduate student, the members acknowledged the importance of this supportive system. It is seen as more of a social support than an academic one acting more as a group that supports a positive competitive attitude . Although research progress is discussed, the peer support helps in the realisation that others are encountering the same obstacles in their journey and that we can help each other and improve together . This sharing of information allows the group to introduce each other to any contacts and material that may assist another member. (De Flaming, 2010a; Foudazi, 2010c)

Although DRAW is a multidisciplinary platform, several of its student apply similar theories (such as DfS and PSS) and methodologies in their research, they cross-fertilize their ideas during and outside the meetings. This learning-by-sharing from different backgrounds and views informs them of connections between disciplines that typically don't necessarily interact with each other within CPUT. Chisin (2010b) adds to this: *"Because there are many people to use as sounding boards, like a focus group, you get fired up and then ideas start to flow and it fleshes out your research more."*

Weaknesses and threats

DRAW has a semi-structured setting where the focus of the next meeting is not always set beforehand. The founder of DRAW sees this flexible setting as a strength that makes it possible to tackle urgent topics straight away. However, some of the members described a sometimes chaotic situation that can occur caused by not having a fixed programme. Moreover, a number of DRAW students are studying part-time and are unable to join meetings on a regular basis. They become somewhat detached from the consistent group and the topics that are being discussed. A more structured approach has been proposed, Chisin (2010b) suggest that: *"… in order to keep the group together and to keep the input of everybody, maybe if a rough program can be drawn up and it can be posted before hand, so that the working guys can identify where they would find the most value added topic."* In addition to this a semi structured agenda would allow members to bring to the fore information relevant to the days topic as it relates to the group.

Ubuntu plays a critical role within the DRAW platform, if the egalitarian and equitable power structure is not embraced by new supervisors and other key members, the spirit of DRAW will be jeopardised (M'Rithaa, 2010d). The consistency of the members in DRAW is absolutely important; therefore another threat is that the greater part of the students in DRAW plan to finish their postgraduate study this year. Considering their internationalized backgrounds, there is a risk of DRAW losing its critical mass. M'Rithaa (2010d) acknowledges this threat, though thinks it can be overcome: *"The minute we increase the supervisors component in DRAW, to at least 5 or 6 supervisors, then DRAW is sustainable, the supervisors act in a custodian role and are core members of DRAW. Even if the students come and go, the supervisors are the ones who ensure continuity of DRAW."*

Opportunities

After comparing the strengths, weaknesses and threats, the members identified a number of opportunities and future aspirations for DRAW. Even though DRAW is already a multidisciplinary platform, not all design departments have been involved in DRAW. A majority of the member have suggested to engage these remaining design disciplines within DRAW so that a more inclusive, inter-departmental approach can emerge in future. Relating to this Maina (2010c), also sees an opportunity for DRAW to: *"… be more inclusive and join other forums so as to increase the knowledge base of the group."* M´Rithaa (2010c) also sees an opportunity for DRAW to link up with the Bachelor design students in CPUT and support them during their research journey, share the DRAW groups´ knowledge and simultaneously learn from them, he calls it: 'each one teach one'.

The group has sees the need to activate a social networking forum in order to make DRAW more accessible to its diverse membership. DRAW members already share networks an contact persons, there is an opportunity to create a database of all the contacts, for future DRAW members. Suskin adds to this: *"This would also create a relationship with the industry and I would like to see this University work on this relationship. So that when the time comes and we do want to create a product, we have a possible outlet (Suskin, 2010c)."*

M'Rithaa believes that DRAW could champion the creation of a research niche area around DfS that will take advantage of expansive DRAW-membership (M'Rithaa, 2010d). Suskin (2010c) adds to this: "*government and other institutions can draw from this expertise*." The summary of the SWOT-analysis can be found below in Table 1.

Table 1: SWOT-analysis of DRAW

STRENGHTS	WEAKNESSES
• consistent knowledge sharing and formation of close bonds through *Ubuntu* and learning-by-sharing • supportive platform and peer support to tackle lonely research process • link DRAW with Bachelor student for support and learning-by-sharing	• Semi-structured setting of the meetings sometimes chaotic • Without *Ubuntu* the spirit of DRAW will be jeopardised
• Engage all design disciplines in CPUT and join forums • activate social forum for accessibility • create research niche area around DfS	• DRAW too reliant on consistency of students: lose critical mass
OPPORTUNITIES	THREATS

Conclusion

This paper shares a promising case that supports the LeNS methodology and learning-by-sharing in a unique South African setting. One of DRAW's unique characteristics is that the group is made up of members from a total of six countries bringing with them embedded of knowledge, this enriches the learning process when the members engage in discussions. Perhaps the most pivotal characteristic of DRAW is the contribution of the *Ubuntu* principle. Within an academic context it is a unique and personalised way of forming relationships that sees the realization of an individual within a group setting. Similarly, it enhances a greater understanding of different cultures and backgrounds.

Even though DRAW is a multidisciplinary platform, several students have found a commonness and apply similar theories and methodologies in their research and cross-fertilize their knowledge during the meetings.

DRAW could use the LeNS website as a template to create a platform for DRAW members who upon completion leave the University so as to allow them to interact with present members and add to the knowledge base.

Further research could be done in the area of: relationships created through the different facets within the group in context to the internationalized, multi-disciplinary and multi-cultural aspects within DRAW.

We wish to acknowledge the contribution and support of all the DRAW members in writing this paper.

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the Learning Network on Sustainability

'Design*in* Schools'

Jinu Kurien
DesignWorks, India

'Design*in* Schools' is a concept for design – research, education & practice. The concept hopes to build synergies between design practice & design education, to offer cross-disciplinary programs for learning in K-12 schools. The objectives of the concept mirror the background of Sustainability in Design: NOW as outlined in its website. The objectives are as below:

- Building on the role of design for sustainable development
- Shaping a proactive position for the designer for the challenges in design – research, education & practice.
- Sharing of the latent knowledge & resources within the design community with the public domain.

Evolution of the concept

The concept has evolved from various premises in our dual role as design professionals. As a practice, we have an on-going engagement with clients involved with education & child-care. Our interest in education extends beyond practice as educators in professional design institutes.

Listed below are 3 premises that emerged out of these roles, which enabled the shaping of the concept:

1. Majority of the opportunities in our practice have been in the areas of education & childcare, especially with K-12 schools. We offer services in architecture & communication design of a varied nature & scale to these clients. In all the design processes, our interface with the institution has been promoters/ administrators. Rarely in the process have we got an opportunity to interact with the teachers & the students, the end users of the learning environments? This is a condition that we have tried to work around in conventional design processes, but with limited success.
2. My sister was once confronted by her school-going daughter with various queries for a project on pre-historic Egyptian civilisation. She struggled to keep up with the queries & for some reason, directed them to me. Luckily, I teach History of Western Architecture at Pillai's college of Architecture, Navi Mumbai, so I was able to stand my ground and contribute to my niece's learning. They were quite interested in the knowledge shared but could not associate my profession with the study of humanities & culture.
3. We took part in a competition called 'Creative Future' hosted by the British Council in India. The competition hoped to identify creative ideas with business potential & incubate them through a special program at IIM, Bangalore. The competition was developed on the assumption that creative talent often fall short of business vision & acumen. The cross-disciplinary platform between business & design was created to counter that condition.

These premises held the following pointers:

- Can responses to a design problem be reinforced by participation & closer interaction with the end users, through new methods & tools?
- Design education is enriched by lateral movement between disciplines. Can this knowledge base be shared outside the design community in the public domain at varied scales?

- As designers, can we build cross-disciplinary platforms outside the domain for a wider outlook of the future?

These pointers led to the concept of 'Design*in* Schools'.

Synergies

Our capacities as design practitioners & design educators exist independently of each other. The value in 'Design*in* Schools' lies in building synergies between these diverse capacities to create programs for learning & sharing in K-12 schools.

Education can influence our sense of responsibility towards diverse aspects of life, including a sustainable future. Teachers & children have a large stake in the future; any vision for the 21st century should accommodate them. If teachers and in particular, children are sensitized about design & creative thinking, it will stimulate a public awareness within the society which, in turn, will help in sustaining our cultural and environmental heritage. This approach is fairly new; there are still many challenges in the formulation of a comprehensive educational model through which children can be educated on the basic concepts of design. For instance, should we take a more creative approach to teach the concepts of design or should we take a more classic approach, resembling the educational system through which a design student is trained.

These questions may not have objective answers at the moment. 'Design*in* Schools' does not aim to work on any rigid model of design education for schools, but to build an organic structure which is founded on awareness & appreciation of the medium.

The composition of resources is critical to the concept; the intent is to go beyond design and build a lateral structure of resources & knowledge base. Besides design professionals, 'Design*in* Schools' will be enriched by partners with leadership in domains like mathematics, environment, management, hospitality, travel, arts & culture.

A structure like this will enable us to address a key objective of the conference

Box 1: Sustainability in Design: NOW!

Source: www.lensconference.polimi.it

> Promoting all possible synergies & processes of learning-by-sharing, enabling effective knowledge base & know-how sharing, osmosis and cross-fertilization in an open & copy left ethos.

'Design*in* Schools' programs

Listed below are two program structures for application in schools:

Design – education & awareness

'Design*in* Schools' can act as a resource body in the realm of design for a school, be the designer-in-residence. Various learning programs can be formulated to supplement existing formats. For example, an architect/ designer can be a resource person for courses in Art & Craft, History & Culture. Lectures & workshops on Creativity & Design Thinking, subjects which may be outside the curriculum but extremely relevant can be offered. Counselling for careers in design can also be a part of this structure. These programs can be offered to teachers & students, can have multiple aims; amongst others help build a dialogue for design & nurture creative thinking. It will also enable learning-by-sharing processes between the design resources & the school.

Collaborative design

'Design*in* Schools' & the institute can collaborate over a design requirement, collectively seeking solutions, thereby making the institute an equal & active participant in the design process. The effort can enable stronger solutions & can act as alternate methods of learning & problem solving for the student, teaching & design com-munity. For example, the institute & 'Design*in* Schools' can work together to develop new signage systems for the school over a design workshop that can be embedded in to the curricular or co-curricular program of the institute.

The tricycle approach for design practice

We have outlined the disconnected relationship of the designers with the end users of the product/ service in a school. Through the concept of 'Design*in* Schools', we hope to bridge this disconnect in the design process. The designer can come in direct contact with the student & teaching community, a rarity in the linear design processes. By building interactions with the end users outside the typical design process, the venture can act as a research ground for the design services & introduce new methods & tools to formulate design responses.

Through these possibilities, the design professional can get engaged in a tri-cyclical approach as outlined in Table 1. The designer can thus cater to multiple objectives for the individual & the community.

Table 1: The tricycle approach

Design education	Design research	Collaborative design practice
• Share	• Observe	• Participate
• Teach	• Record	• Collaborate
• Learn	• Process	• Respond
• Review	• Assimilate	• Assess
• Introduce	• Adapt	• Facilitate
• Orient		

Design and society

A National Design Policy has been framed for India, was approved by the Union cabinet on February 8th, 2007. The Confederation of Indian Industry (CII), the National Institute of Design (NID), and the Department of Industrial Policy and Promotion (DIPP) with inputs from design professionals worked towards formulating this policy to look at many issues concerning design education, design application, design promotion, design standards, etc. The process began with a draft concept of the policy in November 2004, followed by the first draft in October 2005.

Box 2: National Design Policy

Source: Ministry of Commerce & Industry, Government of India

The vision for a National Design policy envisages the following:

- Preparation of a platform for creative design development, design promotion and partnerships across many sectors, states, and regions for integrating design with traditional and technological resources.
- Presentation of Indian designs and innovations on the international arena through strategic integration and cooperation with international design organizations.
- Global positioning and branding of Indian designs and making 'designed in India' a byword for quality and utility in conjunction with 'Made in India' and 'Served from India'.

- Promotion of Indian design through a well defined and managed regulatory, promotional and institutional framework.
- Raising Indian design education to global standards of excellence.
- Creation of original Indian designs in products and services drawing upon India's rich craft traditions and cultural heritage.
- Making India a major hub for exports and outsourcing of designs and creative process for achieving a design-enabled innovation economy.
- Enhancing the overall tangible and intangible quality parameters of products and services through design.
- Creation of awareness among manufacturers and service providers, particularly SMEs and cottage industries, about the competitive advantage of original designs.
- Attracting investments, including foreign direct investments, in design services and design related R&D.
- Involving industry and professional designers in the collaborative development of the design profession.

The strategy to achieve this vision would focus on strengthening quality design education at different levels, encouraging use of designs by small scale and cottage industries and crafts, facilitating active involvement of industry and designers in the development of the design profession, branding and positioning of Indian design within India and overseas, enhancing design and design service exports, and creating an enabling environment that recognizes and rewards original designs.

ACTION PLAN:

The Action Plan for implementation of the National Design Policy will have the following components:

- Setting up of specialized Design Centres of "innovation hubs" for sectors such as automobile and transportation, jewellery, leather, soft goods, electronics/IT hardware products, toys & games which will provide common facilities and enabling tools like rapid product development, high performance visualization, etc. along with enterprise incubation as well as financial support through mechanisms like venture funding, loans and market development assistance for start-up design-led ventures, and young designers' design firms/houses.
- Formulation of a scheme for setting up Design Centres/Innovation Hubs in select locations/industrial clusters/backward states, particularly in the North East.
- Preparation of a plan for training of trainers and for organizing training programmes in specific processes/areas of design and continuing education programmes for practicing designers from Design Centres/Innovation Hubs.
- Preparation of a mechanism for recognizing and awarding industry achievers in creating a brand image for Indian designs through the award of a India Design Mark on designs which satisfy key design criteria like originality, innovation, aesthetic appeal, user-centricity, ergonomic features, safety and eco-friendliness.
- Encouraging Indian firms and institutions to develop strategic alliances with design firms and institutions abroad to gain access to technology and know-how improving Indian design.
- Creating mechanisms for sustainable quality improvement in designs in India.
- Laying special focus on up-gradation of existing design institutes and faculty resources to international standards, particularly the National Institute of Design (NID) and its new campuses/centres. With a view to spreading quality education in designs to all regions of India, four more National Institutes of Design on the pattern of NID will be set up in different regions of the country during the 11th Five Year Plan. The possibility of new models for setting up of such institutes, in keeping with the current economic and educational paradigms, will be explored. In this context, the public-private partnership mode could also be an option.
- Initiation of action to seek "Deemed to be University", or 'University' under section 3 (f) of the University Grants Commission Act, status for the NIDs, so that they can award degrees of B.Design and M.Design, instead of just diplomas as at present.

- Encouraging the establishment of departments of design in all the Indian Institutes of Technology (IITs) and all the National Institutes of Technology (NITs) as well as in prestigious private sector Colleges of Engineering and Architecture.
- Upgrading quality of engineering design, machinery design, process design, design materials, environmentally sound and socially and culturally relevant designs.
- Encouraging the teaching of design in vocational institutes oriented to the needs of Indian industry, especially small scale and cottage industries, in primary and secondary schools as well as tertiary educational institutions.
- Introducing short-term training courses and continuing education programmes by NID and other design institutes targeting on needy sectors and catering to the diverse sectors including agricultural and art sectors.
- Organising workshops and seminars to create more awareness than at present among industrialists, particularly in small scale and cottage sectors, in different parts of India especially on the intangible aspects of design processes.
- Sustaining and strengthening India's traditional knowledge, skills and capabilities while being sensitive to global heritage so that our shop floor workers, craftsmen and artisans could be engaged in manufacture of innovative products and contemporisation of traditional crafts for broad spectrum of uses and niche markets.
- Facilitating the establishment of a Chartered Society for Designers (on the lines of the Institution of Engineers, the Institution of Architects, the 'Medical Council', the Bar Council, etc.), to govern the registration of Design Professionals and the various matters relating to standard-setting in the profession.
- Setting up an India Design Council (IDC) with eminent personalities drawn from different walks of life, in particular, industry, whose functions, inter alia, would be as follows:-

1. Undertake design awareness and effectiveness programmes both within India and abroad
2. Act as a platform for interaction with all stakeholders.
3. Undertake R&D and strategy and impact studies.
4. Accredit design institutions.
5. Develop and standardize design syllabi, etc. for all institutions in India imparting design education.
6. Conduct programmes for continuous evaluation and development of new design strategies.
7. Develop and implement quality systems through designs for enhancing the country's international competitiveness.
8. Coordinate with Government to facilitate simplification of procedures and systems for registration of new designs.
9. Assist industries to engage the services of designers for their existing and new products.
10. Encourage design and design-led exports of Indian products and services including outsourcing its design capabilities by other countries.
11. Take effective steps towards "cradle to grave environment-friendly approach" for designs produced in India so that they have global acceptance as 'sustainable designs.
12. Enable the designers in India to have access to global trends and market intelligence and technology tools for product development and innovations.
13. Encourage close cooperation between academia and industry to produce proprietary design know-how while encouraging creation of new design-led enterprises for wealth creation.
14. Encourage and facilitate a culture for creating and protecting intellectual property in the area of designs.

The draft of the National Design Policy primarily focuses on professional education, promotion of design in industry and commerce. The intentions are well placed, should strengthen the cause of design. However, there is no mention of design awareness & sensitivity in the public domain. How can we work on the foundations?

There is a role for the design professional here. The design community needs to step out of its co-cooned existence & play its part at the elementary level. 'Design*in* Schools' hopefully will make a step in this direction. The role of the designer can expand beyond conventional definitions, to generate creative capital for the future.

Over the course of developing this idea, I have been fortunate to interact with people from various disciplines. The process of sharing and reviewing ideas and the learning that emerged from those exchanges have been priceless. Very often, we dig deep in to a discipline to find a valuable thought or idea, but often an idea of value is not found in the centre of a discipline, but in a space between them.

'Design*in* Schools' workshops

'Design*in* Schools' is at an incubatory stage. The idea has been only been shared with schools & institutes within our existing network. The following workshops have been conducted or planned for the near future:

1. Creativity & Engineering, Workshop for teachers, Agnel Polytechnic, Navi Mumbai
2. Design Thinking, Workshop for students, Fr. F C Rodrigues School of Management Studies, Navi Mumbai
3. The learning environment as a catalyst, Workshop for teachers, Euroschool, Jodhpur
4. The Squirrel House Project, Workshop for teachers and students, Euroschool, Navi Mumbai & Ahmedabad (Proposed)

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DESIGN PRACTICE FOR SUSTAINABILITY (DPfS)

Approaches, methods and tools for product design for sustainability practice

the Learning Network on Sustainability

Environmental requirements for the product development process in the make-to-order furniture industry

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The environmental requirements integrated by small enterprises in the make-to-order furniture industry inside the product development process (PDP). Another attempt was to identify the internal and external factors that led to the incorporation of these requirements as well as those requirements needed to have a sustainable production system. In recent years, the complex issues involving the transformation process of the industry and the interests related to the environment have multiplied. This enhance have greatly influenced the micro and small enterprises which are the most affected by the difficulties of adaptation in the enterprise culture to new challenges in conformity with the environment and the sustainable development. For this objective 18 micro and small enterprises were analyzed in the Furniture Pole of Itatiba- SP, in relation to the adoption of environmental requirements in the PDP. The data was collected using semi-structured interviews and in loco observations, analyzing each activity of the PDP and the environmental requirements related to them, identifying at the end of the analysis the viability of improvement for the sector. The outcomes show that the economic factors determine the way in which the enterprises respond to the environmental issues, how adequate their companies according to laws and regulations or by the reduction of production expenses. Moreover, the absence of qualified professionals for the sustainable production leads to increment the difficulties to structure these sector.

Product development is a complex process, related with almost all the functions of the company. That is why the company transforms data about market opportunities as well as esthetic, functional, and normative requirements, in information for the commercial product manufacture (CLARK & FUJIMOTO, 1991; WHEELWRIGHT & CLARK, 1992).

The establishment of efficient actions in the management area of a project has been a contractor challenge since 1960. Nevertheless, some dilemma appeared when applying these actions, because they defy the planning board of product development, especially for innovative projects with new market requirements.

Some studies reveal that the project and the development stages influent 80% of the environmental impacts caused by the product (MAYLOR, 2001)

In the 1980´s, environmental requirements began to be integrated in the product development process (PDP), as an answer to the increasing social pressure for the incorporation of environmental management inside the strategic planning area of the industrial sector, looking for the sustainability of the production systems. This was a preventive and continuous strategy, with emphasis on the product, with the objective of assuring an improvement of the environmental performance of the company and the reduction of operational expenses, aside from enabling the socio-environmental certification and the access new market targets (VEZZOLI, 2007).

The inclusion of environmental requirements to the PDP, tries to answer the internal and external constraints of the company, such as, the public policy for the rational use of the natural resources and for the

pollution control. This is expressed in the form of norms and laws; the market will, formed by consumers and investors, which are gradually changing their values, becoming more “green”; to the community interests; convey through citizens and third sector actions, the need of reducing water and power consumption in the manufacture processes; the adoption of less toxic supplies on the manufacture process; and the volume reduction of hazardous waste, among others.

When the environmental requirements are properly used in the PDP, they can contribute strongly to attend the new market demands. However, they turn the planning activity even more complex, being necessary that the professionals involved in the project be more trained and updated (MALAGUTI, 2005).

The project planning stage in the furniture industry is one of the most important stages where is possible to reduce the negative impacts of the production process. Is in this stage where the best environmental requirements for the product development must be considered. They must be based on aspects like: the application objective, the product characteristics, the local and regional environmental conditions, the significant environmental aspects of the productive chain, the legal requirements and other social requirements, the market requirements and the availability of human, material and financial resources (COSTA e GOUVINHAS, 2003).

The national furniture sector is expressive, formed by more than 16.000 micro, small and medium enterprises, source of 190.000 jobs. These enterprises are in general, familiar business, from national capital, strongly segmented and straight. They are mostly localized in the south and southeast of Brazil and they produce house and office furniture. In relation to the raw material, there is a predominant use of wood from native and planted forests, plywood and reconstituted panels (fiber plies, chipboards, MDF (Medium-density fiberboard) and others) (GORINI, 1998 e ABIMÓVEL, 2006).

The furniture production is made upon the system of make-to-order. This kind of productive process (RUSSOMANO, 1979) causes more preparation time and planning, comparing with the operation time, producing small batches of a great variety of commodities. This is the predominant model in this sector, especially in the micro and small furniture enterprises, because they are affected by difficulties of adaptation to the industrial and development processes, to its organizational culture and management model and to the new environmental and sustainable development challenges. Furthermore, this kind of company is inside the forest-based sector, which due to its characteristics is the pole of strong environmental references and requests, resulting from the public policy development toward the conservation of the natural resources.

The copy system and the participation of external PDP doers in the micro and small enterprises of the furniture industry are predominant. These agents can be the consumer, and/or professionals related to the areas of decoration, engineering and architecture. In this context, how to incorporate the environmental requirements in the PDP?

This study aims to portray the process of incorporation of environmental requirements by micro and small make-to-order furniture industries in the PDP, benefiting the understanding of the motive factors for this inclusion, the environmental requirements accepted by the companies, the agents involved in the process, its attributions and challenges for the best handling of the environmental issues in the product development inside this sector.

This study is appropriated, since it helps to prepare the sector to answer to the current and future environmental requirements, facilitating the adequacy process of the manufacture systems, control and correction, creating suitable products to the emerging demands. Moreover, this will allow the development of a reference model to the product development, adjusting the main environmental requirements that must be integrated and adopted by the sector.

Methods and material

Research type and study location

For this research, the case study methodology was used, this is, an empiric study of the activities inside the job routine. This type of research is the best to carry out a study where there are complex and variety of events and factors. (BONOMA,1985)

The descriptive case study allows understanding the phenomenon inside its context, by the means of activity observation and/or groups. (YIN, 1994).

This study was developed in the Itatiba municipality, 80 km away from the capital of the state. Itatiba was considered in the 1970´s the “capital of the colonial furniture”, due to the similarity of the furniture

to the European furniture of the colonial period; sturdy, full of grooves and ornaments, made from hardwood, commonly from native forests from the North and the Northeast of the country.

Currently, Itatiba is only considered a secondary furniture pole, caused by the crisis in the sector in the 1980´s, being formed by micro and small familiar enterprises, with a total amount of national capital and down the make-to-order system.

For the data collection surveys and semi-structured interviews with open and closed questions and observations "in loco" were made.

The sample to select the companies was intentional and non-probabilistic, in an effort to favor the qualitative collection of the information. For this purpose, they were selected using data from the Labor union of the furniture Industry, and from the data base of "Itatiba furniture" program, carried out in 2004 by SENAC "*Luiz Scavone*". From the 20 companies founded, only 18 agreed to take part of this research.

Characterization of the product development process – PDP

A characterization of the PDP was made based upon a chronological analysis of the activities, with inputs and outputs, having as final objective the development of a new product (DAVENPORT, 1994). Starting from this approach it is possible to clarify the critical links between this process and the environmental demands from internal and external factors of the company, as well as the interactions between the designer abilities and the information provided by the several functional sectors of the company, essential for the development of the products (SALERNO, 1999; ROZENFELD, 1996).

The stages of the PDP were designed sequentially, although, in the practice this stages overlap and interact continuously. The modeling of the PDP includes other aspects as information flow for the decision making and for the resources used in the process. This formal and integrated description of the process is useful for the construction of a reference model.

Identification of the environmental requirements

The identification of the requirements was based on the applied activities in the product development process. For each input and output system, the appropriate environmental requirements to minimize the impacts and enhance the product lifecycle must be presented. (MALAGUTI, 2005)

This way, specific literature references related to the efficiency of the systems of product development, were seek, finding the main environmental requirements related with PDP activities. (MANZINI e VEZZOLI, 2006; VEZZOLI, 2007; MALAGUTI, 2005) Table 1.

Forthwith, a list containing qualitative concepts to estimate the degree of the applied requirements according to the established criteria was used, as shown in table 2.

The association of the environmental requirements and the PDP stages allowed analyzing the motive factors related to the application of these procedures in the companies. This permitted the identification of which sectors and who managed the decisions inside the job routine of the enterprises, creating the integration process of environmental requirements inside the make-to order furniture industry.

Characteristics of the make-to-order production system

According to the obtained data, the make-to-order product development process of furniture was identified inside each activity of the macro stages of the PDP, responsible for the stages flow.

Since it is a production based on the make-to-order system, according to the customer needs, those requirements must be identified and transferred as project requirements, and this should be named the first step of the product development process. As soon as the enterprise is able to fulfill the customer requirements, the sales sector look for some information to begin the manufacture of the project. The information the sales sector searches is: type of raw material, matte, dimensions, preliminary budget, delivery deadline, suppliers.

Was sighted that the furniture production in the make-to-order enterprises, uses hardwood as well as reconstituted panels randomly, or even, both type of material integrated, using the hardwood for the matte

grooves and ornaments and the panels for the main structure of the furniture like: doors, lateral sides, coverage, etc.

In figure 1 a flux gram represents the furniture development process down the make-to-order system, characterized by the pre-development, development and post development macro stages.

The production flow represents the process stages, which begins with the customer, who talks with the sales department introducing her/his requirements for the furniture project, commonly based on personal opinions or decoration magazines, or even in some cases, they present a pre- design project. After complying with the customer needs, her/his requirements are communicated in the form of designs or sketches available in catalogs or magazines to the project sector. The salesmen interfere very little with the decisions and desires of the customer, showing, this way, a good image of the company.

In the project department, the design is remade with specialized software or manual tools, verifying the dimensions of the furniture, and when necessary, "in loco" observations are made in order to remove any doubt. The participation of the designer is restricted to the adjustment of the design to the standardized lecture on the production system, accompanying a job order where the materials and the matte of the furniture are specified. With all these things listed, the order is then given to the director, who makes the budget of the product and returns it to the sales department. After having the budget, the sales department gets in touch with the customer and informs s/he, about the price and the delivery deadline. If the customer wants to change something in the design or does not agree with the budget proposal, s/he will talk directly with the director until they make a deal.

When the job order and the design are in the production department, the manufacture process begins. The first step is to classify the project inside the production line (1) or (2), according to the raw material needed for its manufacture. For the hardwood line, the pieces are cut, following with the surface planner and with the flattening. After, the piece passes through the wood router, the router and the drill. Finally it goes to the assembling and matte steps, where the sanding, the painting and the assemblage of the furniture piece are made.

In the production flux gram, the stage containing more steps occurs in the hardwood furniture production (1). This enlargement of the number of steps reflects more costs, processes and waste generation, comparing to the panels furniture production (2), which uses standardized pieces, with surface matte, what makes it easy to work with, being necessary only to cut, stick and assemble. This reality shows how these companies are still concerned with the satisfaction of the customer needs and requirements related to the project. But the customers do not always demonstrate knowledge about sustainability processes or decide to buy a product with innovative solutions or that causes less environmental impacts. This is why the enterprise must improve the structure of their productive system and must create strategies to plan proactive actions.

Incorporation of environmental requirements in the PDP stages

In figure 2, the percentage of the enterprises working with the make-to-order production system that adopted the environmental requirements inside the PDP is presented.

The 61 % of the visited companies showed lack of initiative of joining the environmental requirements in the product development process, caused because they do not know these requirements or simply because they are not interested in adopting these practices. However, this outcome shows that there are plenty of possibilities to work with environmental practices inside this sector. Among the most important environmental requirements, these were found: the reuse of systems and manufacture components; the purchase of renewable materials original from forestry management areas and with official documents issued by governmental organizations that allow the exploration and transportation. Even more, because this is a make-to-order production system, the main requirement of the customer regards the durability and lifetime of the product. The marketing is another important component of these companies, looking for a market place recognition, but this is not always reflected in an ecological efficiency inside the productive system.

The frequency of environmental requirements (figure 3) founded in the form of practices inside the enterprises is illustrated as follows.

The reuse of parts and components in the sector of furniture manufacture is a wide-spread practice, being practiced in all the studied companies. This occurs because there is an awareness of the waste of material that is noticed in the stages of the process.

In 16 companies the environmental requirements regarded the raw material; wood, as the main component of the manufacture of furniture, highlighting that comes from renewable sources, diminishing

themselves, the owners, of any responsibility related to the other supplies used in the process derived from petroleum, largely used in the matte stage, which are the main pollution factor inside the process, because of the emissions (caused by lack of proper painting booths, extractors and filters). Most of the micro enterprises use painting booths with water curtains, not caring about the disposal of the untreated water, commonly directed to the public sewage lines.

In 8 companies two environmental requirements were identified: the reuse of systems, subsystems and components in the project department, looking for more efficiency. This is, the companies reuse project development processes looking for the improvement of solutions in the current projects. In this sector, it is common the use of computer software to model furniture or to adapt a demo project to the customer project, or from a previous project developed by the company. Parallel, there are some actions practiced in the transport department, like the reuse of parts from pieces damaged in the stocking stage. In some cases, they also reuse the logistic delivery systems and furniture maintenance, making a better planning that promotes time and expenses economy.

Other two environmental requirements founded in six enterprises were the interaction with the market, identifying accurately the project specifications and the desires of the customer, favoring the decrease of mistakes in the manufacture process. This will also lead to the extension of the product lifetime, caused by the proper usage of suitable materials, looking for the best physical, chemical and mechanical functions that the product will have to bring, not putting in risk the esthetic of the product.

Only four enterprises mentioned the use of ecological marketing as an environmental requirement in the product development process. This occurs because occasionally they exhibit projects in national and international events, in partnership with architects who use certified wood.

The table 3 presents an assessment of the environmental requirements mentioned above related to the macro stages of the PDP, qualified by insertion concept, and the people in charge of those involved sectors as well as their activities.

From the outcomes, it is possible to infer that the environmental requirements are poorly incorporated in the activities of product development, or even in the decisions of the manufacture process.

It was detected that the environmental practices considered by the Itatiba pole enterprises show an economic concern, because in one way or another they are related to expenses.

When the theme in the furniture industry is the renewable raw-material, the discourse is detoured to the harvest of hardwood coming largely from the north of the country, where most of them does not have a management forestry certification, needing extra care for the transportation of this material due to the intense inspection and the consequent payment of fines. The discourse is also detoured when the topic is the use of plywood and reconstituted panels that in the first moment do not cause troubles, but after a time of use the disposal of these pieces becomes a problem, due to the hazardous components of them; adhesives made from urea-formaldehyde (UF) or phenol-formaldehyde (FF), harmful at the end of the product lifetime, when the material is burned or used to soil coverage.

The size of the enterprises causes the lack of investment in “clean’ technologies for the final disposal, or responsibility for the post sale of the products.

The other issue identified as “good”, was the reuse of parts and components because when the product development process ends, the quantity of materials used and the generated waste are calculated, then they are disposed near the enterprise and burned, to decrease the volume. Rarely, this waste was stocked for specific purposes, like small parts of small objects of decoration or from the structures as a way to reduce the waste.

For the directors of these enterprises, the waste use can be reverted as profit, looking again from an economic point of view overlaying their economic interests to the detriment of the environmental ones. From the answers given by the companies regarding the environmental requirements was possible to establish which the most important factors for the decision-making process of requirements inclusion.

The main factors that motive the micro and small enterprises to integrate environmental requirements inside the furniture projects are shown on table 4.

The main internal factor mentioned by 10 enterprises was the one of expenses reduction in the project and in the process, relating it to systems and components reuse, what is visible for the direction, which is always looking for the reduction of expenses. Six companies presented as factors the market requirements, mainly related to the durability of the products adding environmental and quality values of the raw material as an exigency in the furniture manufacture.

As an external factor, the adequacy to environmental laws and regulations was mentioned, regarding the use of environmental requirements for raw material, demanding certification as well as harvest registrations and transportation licenses. To make feasible the competition among the enterprises of the furniture pole, was the last factor presented. This competition must be promoted by the use of ecological mar-

keting that is currently considered as fashion. However, the benefits generated by the use of environmental requirements inside the PDP are noticeable, not only because of the market tendency, but as a form to optimize the production, reduce expenses, inclusion of actions to rationalize tools and materials use, and mainly, to be respectful to the natural capital that generates energy and supplies.

The adoption of PDP methodologies requires qualified staff. This is important because the tasks involving the management of the activities inside the product development process and the changes inside the current system are not simple. This occurs because it demands a structural change to adapt the system to the environmental requirements which at first sight demands changes in the valorization of professionals of this area with specific skills for these functions.

Many people consider that a product designer is an artist seeking to add esthetic value to the products. The truth is that these professionals are highly qualified to analyze processes, identify detours and production risks, include proactive practices inside the company, look for the innovation of the products and services and even manage projects and work groups. In table 5, the curriculum of this education program, the professional performance, the sector and the make-to-order PDP model, largely used in these enterprises, are presented. All these aspects express a reality away from the ideal one.

A facilitator from model 1 interacts between the customer and the project designer, helping them to speed up the production processes, suggesting requirements and decreasing the production risks. For model 2, the project designer works redesigning the pre-projects from the sales department, not having the power to interfere in the decisions made on the previous stage. These things difficult the inclusion of environmental requirements, causing at the same time a delay to release the project for the production process, because in most of the cases, the information from the sales department is inadequate and new visits to the place where the furniture will be installed have to be done in order to confirm the information. In some cases, new visits of the customer to the store have to be done in order to solve doubts.

In the Itatiba Pole, from the enterprises visited, 15 are managed according to the model 1 of PDP, and only to employees have a technical degree in industrial design but with poor experience in the field (5 years, and 3 months, respectively).

In the other enterprises the staff members have degrees in a variety of knowledge fields, such as: Physical education, Management, Engineering, Law, Accounting, or even, employees with a high school degree. These people know the job because it was transmitted by the previous generation, or constructed after years of experience in the field (until 35 years).

In the enterprise E8, with model 2 of PDP, even the professional of the project department (architect), has less experience (4 years) than those working in the other enterprises of the pole. The architect is able to include environmental requirements in the product project, without disappointing the customer demands, because he has autonomy to change the specifications and to look for innovative and less expensive solutions for the enterprise and for the environment. This happens because the enterprise has a strong organizational structure that integrates the work teams, assessing the activities and registering the mistakes.

Having qualified professionals as part of the staff of these companies is important because they are able to deal with the project development process and to interact with the productive processes and systems to make feasible the insertion of environmental requirements and the change of consumption patterns. These will lead to the decrease of the impacts caused by the sector.

From these outcomes it is possible to infer that the main challenge for the make-to-order furniture industry is related to the organizational structure of the enterprises, that until today have not recognize the importance of appointing qualified professionals to the products design. These professionals have an important function since they make possible the interaction between the macro stages of the PDP, favoring the improvement of the production system linked to the environmental sustainability.

Conclusions

The outcomes of this study show that there are gaps for the insertion of the environmental requirements in the PDP down the make-to-order system. Furthermore there are possibilities of improvement and optimization of these systems for the furniture manufacture.

By the means of the characterization of the activities inside the PDP and the requirements related to them, it is possible to identify in which stages the environmental procedures are well recognized and ap-

preciated, making possible adjustments in the administrative organization as well as in the planning of proactive environmental practices.

The inclusion process of environmental requirements in micro and small enterprises is characterized by internal and external factors, related to economic aspects regarding decision making. Minimization of expenses and materials in the process, adequacy to laws and regiments are the main encouragers, making that the enterprises only move on corrective procedures in the PDP.

It was possible to identify in the process, the roles played by the people in charge of the activities of the macro stages of the PDP, being disconnected among them, making difficult the control of the activities, contributing for isolated decision making issues engendering mistakes and obstacles for the implementation of the environmental requirements.

The project designer represents shapes and measurement. S/he almost never interferes or promotes the integrated management of the system, since his/her knowledge is limited to the design process gained with years of experience in the furniture industry. The product designer with specific knowledge about PDP, gained with academic courses, should be the suitable professional to manage work teams as well as systems of production. This kind of person will joint more sectors looking for the economic, environmental and social improvement of the enterprises.

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the Learning Network on Sustainability

The Rhizome approach

Integrating the tenets of sustainability through design in the bamboo sector

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This paper focuses on the role of design as an enabler to achieve holistic sustainability in the bamboo sector. Bamboo as a material dovetails well into the growing demand for sustainable products. It is a renewable viable timber-replacement material which has the potential to create livelihood opportunities for the rural and urban poor. Yet, most contemporary bamboo product designs focus primarily on bamboo's potential for eco-design and for commercial viability, and in consequence contribute to the unsustainability of social and cultural factors.

The paper presents the Rhizome approach developed though the process of action research, related to the work of the author with bamboo-working communities. The framework is designed to facilitate the design of products which take into consideration the social and cultural tenets of sustainability alongside the economic and ecological tenets.

Introduction

Design decisions and specifications have a significant impact on sustainability due to their economic, environmental, social (White et al, 2008) and cultural spin-offs. More than 70% of the costs incurred over the product life cycle (Waage, 2005), including product development, material production and processing, fabrication, distribution, use, and end-of-life handling (Waage, 2005; White et al, 2008) are determined by design decisions. Many product life cycle impacts that need to "cleaned up" could be eliminated or minimized by envisaging and addressing them at the conception and design stage (Maxwell et al, 2003). This back-casting and visualization exercise is possible because design is a "problem-solving activity lodged between art and science (Greenhalgh, 1997)", which has at its core the design process, based on research, analysis and synthesis. These tools allow designers to create diverse and distant scenarios – including sustainability related scenarios- and innovate accordingly.

Yet, despite these facts establishing a strong case for sustainable design, a commonly accepted roadmap or methodology to actualize the potential of design in addressing sustainability and sustainable-development is not yet in place. This is essentially because a universally accepted understanding and definition of sustainability is yet to be arrived at despite the vast body of scholarship on the nascent science of sustainability.

Sustainability is being recognized as a multifaceted and complex concept which is shaped by the interconnectedness of all the integrated systems in our world (Komiyama and Takeuchi, 2006; Shedroff, 2009). Although sustainability has always rested on a balance of these interconnected systems, our understanding of the emerging discipline and science of sustainability, and recognition of specific tenets that influence it, has expanded from the ecological context during industrialization; to include the social and economical tenets of the Triple Bottom line (Elkington, 1997), and the cultural tenet of the Four pillars model (Hawkes, 2001) post industrialization. In the future, more tenets will likely be identified, and important "sub-tenets" will likely be isolated from existing "umbrella tenets", from the overall network of connections between systems and entities that influence sustainability (Reubens, 2010a).

Interestingly, there is a tremendous resonance in the natures of design and sustainability: both are constantly evolving in meaning and understanding (White et al, 2008). The creative, intuitive, and fluid nature of design positions it to solve complex and dynamic problems, such as those related to sustainability,

through unorthodox means. While there has been progress in addressing the ecological tenet of sustainability through tools such as the Life Cycle Analysis (LCA), Eco-compass etc., and through strategies such as Ecodesign, Design for environment(Dfe) and Closed-loop Design, there is little integration of holistic sustainability criteria, especially a systems-based view of sustainability, in mainstream design processes (Waage, 2005).

This paper reports on action- research that investigates the role and potential of design in addressing the social and cultural tenets of sustainability alongside its ecological and economical tenets, in the domain of bamboo.

Bamboo is a highly renewable timber-replacement material which restores degraded lands, prevents soil erosion and helps mitigate water pollution (Reubens, 2010a; 2010b). The tremendous interest in bamboo as a sustainable material has led to versatile and innovative contemporary designs, ranging from the Asus Bamboo Eco book computer and the I Pod Bamboo Shuffle case, to bamboo textile products ranging from bed linen to lingerie, to bamboo houses, furniture and lifestyle accessories, to bamboo crash helmets, medical products and cosmetics. Workshops such as “Bamboo Boards and Beyond” facilitate by M.P. Ranjan in 2002, and “Dutch Design Meets Bamboo” (van der Lugt, 2007) have successfully explored bamboos potential for innovative applications through a “technology-push” (van der Lugt, 2007) approach, where bamboo was used in an industrially processed form. While the resulting products, concepts and explorations, like the several applications described earlier, have contributed to the appreciation of bamboo as a commercially viable i.e. economically sustainable, and renewable i.e. ecologically sustainable material; they do not address the social and cultural tenets of sustainability as effectively. This is because actualizing products produced through industrial, technology-intensive protocols push traditional bamboo-working communities lower in the value addition chain: from being involved in all the processes from growing to final assembly, their role becomes limited to growing, managing, harvesting, transporting and at the most primary processing of bamboo (Reubens, 2010a; 2010b).

Bamboo has a tremendous potential to positively impact the social and cultural tenets of sustainability given that it is easily available to poor communities is Asia, Africa and Latin America in their natural environment, often, even in their homesteads. Bamboo’s linear fibres allow it to be easily processed using simple tools including by marginalized groups such as women. Bamboo-based enterprises require lower capital, raw-material and machinery investments than other micro, small and medium enterprises. Crafting bamboo is part of traditional non-industrialized production, social and cultural systems.

Designs that allow traditional bamboo-working communities greater participation in the production to consumption chain can address the issue of sustainability in a holistic manner, while simultaneously actualizing bamboo’s potential to allow for economically viable, culturally sensitive, socially equitable, and eco-friendly production (Reubens, 2010a; 2010b).

Barriers to sustainable innovation in bamboo product development

As discussed above, the thrust area for the development of designed bamboo products is bamboo processed through new industrial technologies: technologies which exploit and bring to fore previously unknown possibilities of bamboo as a material. This is despite the fact that these new industrial materials and technologies do not leverage bamboo’s potential to address sustainability in a holistic manner.

Many of the barriers to sustainable innovation in product and service development identified by Maxwell et al (2003) are relevant to the bamboo sector. These are outlined below:

- Lack of approaching sustainability holistically by simultaneously addressing the social, economic and cultural tenets alongside the ecological tenet
- Inability to mainstream sustainability concerns in the business system, thereby not facilitating the sharing of sustainability related experiences and concerns across the business itself
- Lack of integrating sustainability criteria, (social, economic, ecological, and cultural) at a strategic corporate level alongside traditional criteria such as market, quality, technology etc. and thereby also in the design brief
- Focus on “cleaning-up” product end-of-life environmental impacts rather than addressing sustainability holistically at the concept generation or design stage

- Lack of focus on achieving sustainability across product supply and value chains from the Original Equipment Manufacturer upwards and downwards

In addition to these, the action research on which this paper reports indicates that a lack of awareness of non-traditional, non-industrial production to consumption systems and value-chains is another major barrier to sustainable innovation in product and service development in general, and in the bamboo sector specifically. The word "industrial designer" implies a strong connect to the process of industrialization: an industrial designer by definition is therefore a designer trained to work along the industrial principles of division of labour and assembly line production (Rees, 1997). Rees argues that the work of industrial designers is defined by the production process and that "designers design for the industry, rather than for the consumers of the products of the industry. It is a way of thinking about the world which, by implication, denies the social, cultural and economic significance of consumption" (Rees, 1997).

While traditional industry set-ups are familiar to designers, alternate set-ups, such as sustainable "development" oriented set-ups, where rural bamboo producers form the enterprise; are largely unfamiliar to designers in terms of structure and working. Designers therefore apply design methodologies and processes, which are rooted in industrialization, to rural enterprises and producer communities (Reubens, 2010a).

The resulting designs often do not succeed, or realize their potential for social or cultural reasons (such as the dynamics of a caste system, or material culture parallels by the producers), organizational reasons (lack access of proper organizational structure) or logistical reasons (bad infrastructure and communication, health of workers, transport etc.). These same factors that are so crucial to the success of a product in an alternate, and often BOP production set-up, are taken for granted in an industrial set-up (Reubens, 2010a).

In industrialized set-ups the designer's role is based underlying principle of division of labour, but in non-industrial set-ups a more systemic overview is necessary. Unless designers are oriented to integrated scenarios or provided with a framework or guidelines regarding how non-industrial set-ups function, they will not understand clearly why the product is not successful, or cannot be manufactured. Consequently, they will veer towards the familiar conventional industrialized set-up or "technology push" approach, which is comprehendible and thus manageable by them – and which at best addresses the ecological tenet of sustainability, especially as this is becoming unavoidable given the current policy and regulation environment. Incidentally, designs utilizing renewable materials like bamboo are ideally positioned to leverage the holistic sustainability that can add richness to our material culture (Walker, 2008) by offering non-industrial, labour-intensive, localized, community-centric production to consumption, and value-chains.

Innovative approaches such as Ideo and BSR's "A-B-C-D Approach to Making Better Products" (White et al, 2008) also recommend marrying "human factors" and "systems analysis" through design analysis, and integrating sustainability into the ethos of design. The A-B-C-D approach also highlights the need to transition from the traditional "design-pipeline" mode of product development, where there is a lack of oversight on the end goal, and the focus is on a specific task at hand; to the "design funnel" process, where the inputs from conventionally unconnected parts of the organization are integrated and narrowed down or "funnelled" towards a more collaboratively developed design process: this builds organizational sustainability intelligence.

The Rhizome approach

The Rhizome approach is named after the "Rhizome Framework", which is elaborated on later in this paper. The framework was developed by me during this action-research process to function as part of a holistic system, where the natural resource management, community mobilization and organization, market analysis, design and development, skill training, capacity building and institution building are part of a comprehensive strategy.

The Rhizome approach aims to address the barriers to sustainable bamboo product development identified earlier. The approach consists of a 7 point system which is represented in Table 1.

Table 1: The Rhizome approach

Step	Barrier	Aim	Mechanism
1	Lack of knowledge about sustainability	Inform designers about sustainability, its identified tenets, and the inter linkages between them	Book titled “Bamboo in Sustainable Contemporary Design” which discusses the linkages between bamboo, sustainability and design
2	Lack of holistic oversight of production to consumption and value chain	Sensitize designers to the systemic production to consumption and value- chain picture	Exposure visits to traditional bamboo-working communities, community enterprises, industrial enterprises and the other stakeholders in the PCS chain
3	Lack of including sustainability at a strategic level in the overall approach	Provide direction on the larger goal and its blue-print that the organization is aiming/aspiring for	Sharing and explaining the Rhizome framework for an overall picture towards which all departments will work jointly.
4	Lack of including sustainability criteria alongside traditional criteria in the design brief	Articulate sustainability criteria in the design brief so that it can be addressed early on at the design concept stage	Clear brief to “design a commercially-viable bamboo product, using local production capacities, that leverages indigenous knowledge systems.”. Provision of a “sustainability check-list” to clarify the criteria desired in the product.
5	Lack of collaborative design process	Provide inputs from different disciplines so that the design process is collaborative and different concerns are represented and addressed	Constant linkage and interaction with representatives from the PCS and VC including experts in the fields of sustainability, production, marketing, community, finance etc.
6	Lack of tool to measure holistic sustainability against indicators	Increase designers accountability to consciously, and seriously factor sustainability into the design, and to provide an opportunity for evaluation against the same indicators outlined at the concept stage	Using the “sustainability check-list” as the indicators, perform a 360 degree evaluation of the design, which includes self evaluation by the designer, and cross- validation of results by a sustainability expert and a community representative
7	Lack of keeping design team in the end loop of product actualization	Continuing the collaborative design process by keeping design team in the loop until the final product actualization stage, thereby retaining the overall perspective of the product sustainability	Involving design team in all changes required from the perspective of the product actualization, until all issues, including production systems, costing etc. are resolved.

Step 1: The Book

This step addresses the fact that in order to design sustainable products, designers have to be knowledge-able about the concept of sustainability in general; and in this specific domain, the inter linkages between bamboo, sustainability and design. Expertise in this field, similar to most sustainability related fields, lies outside the expertise of traditional designers (White et al, 2008). To bridge this gap, I have written a book titled “Bamboo in Sustainable Contemporary Design”, which encapsulates my experiences while working at the International Network for Bamboo and Rattan (INBAR): I worked at INBAR for seven years, as part of an expert interdisciplinary team in the area of bamboo based development. The book is aimed at designers and the layout is therefore very visual and includes a lot of pictures and diagrams. The first step of the action-research is sharing the book with designers so that they can access pertinent and basic in-formation on sustainability, bamboo and sustainable design in an appealing format.

The book includes sections on sustainability, sustainable development, a sustainability timeline, sustainable design and bamboo vis-a-vis sustainable design. It also includes sections on bamboo as a material resource i.e. the morphology of bamboo, bamboo usage and traditions, the natural characteristics of a bamboo culm and their design implications, and species-wise resource planning considerations. Different processing set-ups and the facilitating, enabling and challenging factors pertinent to each set-up are discussed. Production and material information, such as joinery for different applications, methods of restructuring bamboo ranging from traditional to industrial techniques and potential combination materials are also covered.

Step 2: Exposure visits

This step addresses the fact that designers, like the other actors in the production to consumption chain have lost oversight of the systemic picture. This loss of the systems perspective makes it difficult to approach sustainability in a holistic manner: designers look at addressing immediate issues (such as the fragile ecological situation) rather than looking for holistic, integrated and sustainable solutions.

Step 2 builds on the earlier overall introduction and orientation to sustainability and sustainable design, especially with regards to the bamboo sector, the book provides. The aim is to provide a first-hand exposure to how the various different, yet interlinked, actors of the value chain together contribute to sustainability or unsustainability through the production to consumption process. This is achieved by exposure visits of designers to traditional bamboo-working communities to understand their lives and traditional social, economic, cultural and ecological systems. Designers also interact with stakeholders and actors in a community enterprise set-up, as well as from an often contrasting industrial enterprise set-up, which allows them to directly internalize the potential for realizing sustainability through a paradigm shift in the production set-up, including production volume, livelihood opportunities, preservation of the social and cultural nucleus, and the use of materials (Walker, 2003).

Step 3: Rhizome Framework

As discussed earlier, a holistic strategy to achieve sustainability and reduce unsustainability is not often part of organizational mandates: the designer therefore lacks both an immediate reference point and the backdrop of the larger organizational scheme.

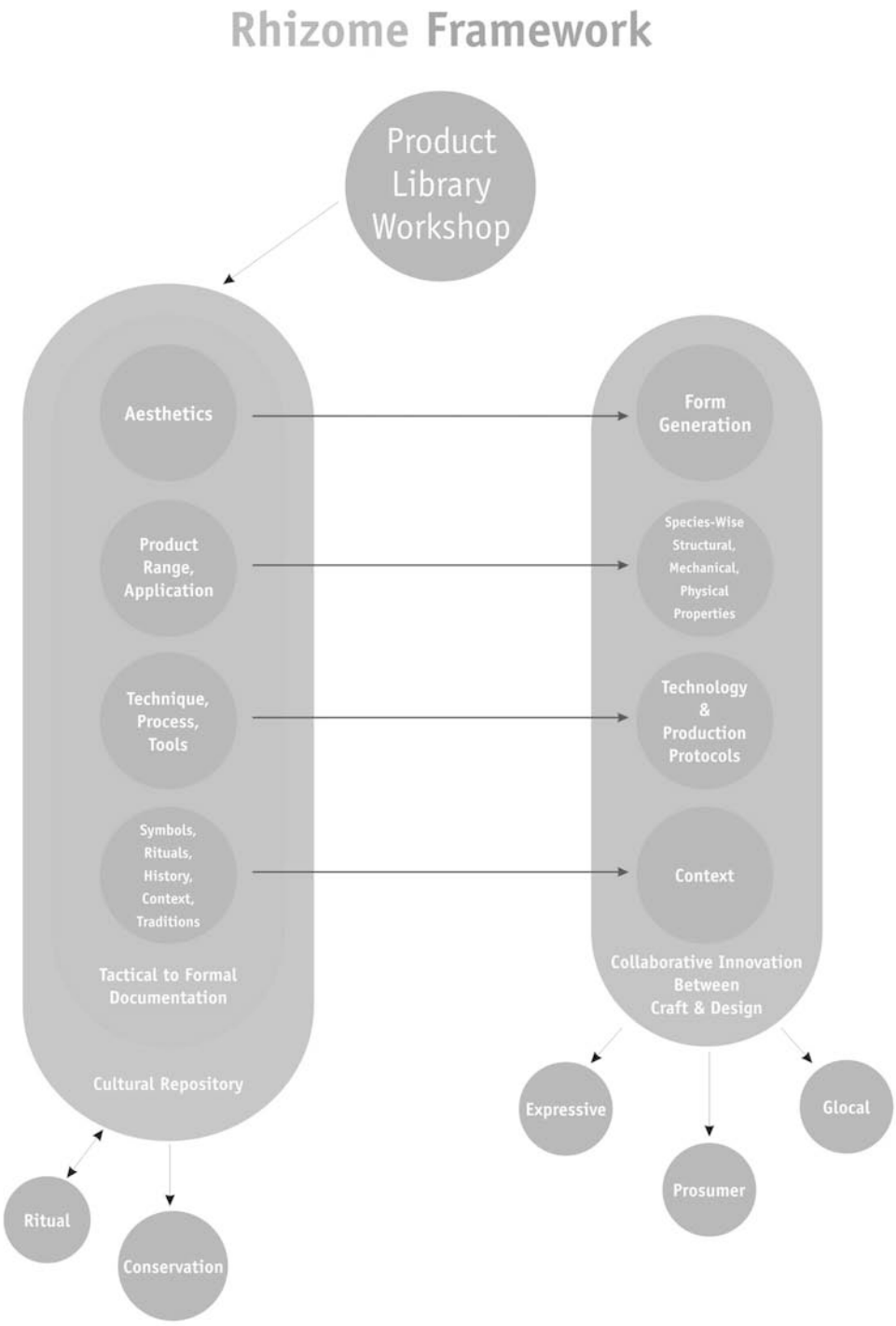
The “Rhizome framework” (Fig:1) is one of the main outputs of the larger action-research this paper draws on, which examines ways of providing an overarching strategy for holistically sustainable production to consumption systems for the bamboo sector, through design. The framework is a proposition towards a model which offers different design directions, to harness local and craft-based production possibilities.

Bamboo-craft is a vital force in communicating and substantiating the culture and tradition of bamboo-working communities. Simultaneously, bamboo’s huge commercial potential can be exploited to help contribute to large scale employment of these indigent communities, who do not have much capital, but are rich in indigenous knowledge and have a strong skill and resource base (Ranjan, 1995). Therefore, the Rhizome framework seeks to use indigenous knowledge as a design input during the innovation process. The indigenous knowledge is viewed by the designer in the context of the sustainability, and factored into innovation in collaboration with the craftsperson. This collaboration between the two maximises the skill and knowledge each of them brings to the innovation process. The craftsperson brings indigenous knowledge and practices that have been validated over the passage of time to be more sustainable than not. Many of the concepts of sustainability have underpinned craft practice (Rees, 1997): the use of local materials, or, expertise and therefore production in a single material, which allows for ease in sourcing, production and repair, and also in eventual disassembly and recycling have parallels in eco-design (Reubens, 2010b). The designer brings value with his access to information and technology on current issues, including sustainability. Both inputs are complementary and supplementary.

The framework deliberately focuses on technologies which are closely linked to craft-production modes, in order to secure the craftsperson a higher place in the value chain; and bring in greater sustainability and equitability into who controls the means of production, who labours and who profits (Sonal Mehta, Eklavya Foundation, personal communication). The technologies are deliberately “low-tech” as opposed to “technology-push” (van der Lugt, 2007) approaches in order to allow organic evolution of

craft-based production by thousands of craftspersons (Dormer, 1997) and producers to a sustainable end in contemporary applications through design (Reubens, 2010b).

Fig 1: The Rhizome framework



The framework is named after bamboo's complex underground rhizome system. Each rhizome either sends up a shoot or sends down a root, and networks itself to other rhizomes to form a stable mesh which prevents soil erosion. A rhizome is not amendable to any structural or generative model: it is a map and not a tracing (Deleuze and Guattari, 1987). Similarly, the framework developed looks at three distinct directions which are independently and interdependently sustainable, and prevent the erosion of social,

economic, ecological and cultural capital (Reubens, 2010b). The seemingly disparate tenets of sustainability i.e. the social, economic, ecological and cultural factors, the multitude of producers with varying skill levels, and the complexity of each system scenario in developing countries reinforce that there can be no single model on which base design for craft production systems. The framework is therefore designed to be flexible enough to encourage and promote diversity by being adaptable to different contexts; while remaining strongly rooted in the interconnections between the social, economical, ecological and cultural tenets of sustainability (Reubens, 2010b).

The framework identifies opportunities for the bamboo producer to be an artist (Expressive) and/or a vernacular production and marketing link of an interdependent sustainable community(Prosumer) and/or a producer and perhaps even small businessman (Greenhalgh, 1997) rooted in producing sustainable products (Glocal): each through proposed directions of evolution for the bamboo craft mode and local production capacity.

Further information on the framework including its working mechanism can be found in my article in the Journal of Craft Research, which is currently in press.

Step 4: The brief and the sustainability checklist

In the absence of a clear brief which clearly articulates the desired sustainability criteria, the onus of incorporating sustainability into the design brief is on the designer: this is difficult, considering that sustainability has not been part of the expertise of traditional design function (White et al, 2008). Step 4 therefore includes providing a clear brief – to design a commercially-viable (economically sustainable), product made from mature, sustainably-harvested bamboo (ecologically sustainable), using local production capacities (socially sustainable), that leverages indigenous knowledge systems (culturally sustainable).

The current mode and proposed changes the brief envisages are illustrated Table 2.

Table 2: The current and proposed modes of production for small and traditional bamboo producers

Tenet	Current : Unsustainable	Proposed: Sustainable
Ecological	Requires extraction of immature green bamboo for interlacing	Reduces immature green bamboo used in handicrafts by providing production options using mature bamboo
Social	Unviable livelihood causes distress migration which affects the traditional systems of social interdependence	Prevents distress migration by providing a viable livelihood to marginalized communities thereby protecting the social nucleus
Cultural	Loss of indigenous knowledge because of craft becoming obsolete and economically unfeasible	Records indigenous knowledge though the product library component of the Rhizome framework, and offers recontextualized design directions thus facilitating cultural preservation and evolution
Economical	Not viable source of income for producer and therefore contributes to rural indebtedness	Provides income opportunity directions by leveraging viable contemporary markets

In addition to this, a sustainability checklist has been developed as part of this action research. The checklist supplements the rules of thumb developed in the Design for Sustainability (D4S-DE) Manual (1997), with inputs from Global Reporting Initiative (GRI) Sustainability Reporting Guidelines(2000) and “The Fourth Pillar of Sustainability” (Hawkes, 2001) to address social and cultural criteria, alongside economic and ecological criteria. This checklist makes the designer aware of the potential and desired criteria that can make a product more holistically sustainable. The checklist also serves as an indicator of sustainability factors achieved, once the product is developed.

Step 5: Dialogue and Technical Backstopping

White et al (2008) outline the need to bridge diverse actors within the organization to facilitate transitioning from a pipeline design sequence to an integrative design process. This logic has parallels in the pre-industrial innovation processes, where design, production and marketing were anchored in a single person, or close group, thus allowing for constant dialogue and technical backstopping between the actors.

The Rhizome approach facilitates developing systems, methodologies, platforms and frameworks that allow for communication and collaborative decision making and "participatory design" (Shedroff, 2009) by encouraging and actively facilitating a constant linkage and interaction between the actors of the production to consumption and value chain. Designers are ideally placed to facilitate this process since they are good at intuitively "uncovering evidence of emotions, values and meanings, and are particularly adept at communicating often ethereal or esoteric information" (Shedroff, 2009).

Step 6: 360 degree evaluation against the sustainability checklist

The sustainability checklist was introduced in step 4 as a tool to help designers be aware of the indicators of the social, economic, ecological and cultural tenets of sustainability. In step 6, the designed product is evaluated against the checklist by the designer. The product is also evaluated using the same checklist by a sustainability expert and a community representative. These three sets of data allow for investigator triangulation (Denzin, 1978) as a method of cross-validating the data from multiple sources to identify regularities and discrepancies between the data sets. The result yields an indicative "sustainability-quotient" of the product: this can be used as a reference for further development and also figured into the marketing strategy.

Step7: Final Product actualization

In the traditional pipeline design sequence, the production, costing and marketing revisions often happen between the time product is realized and is marketed. By this time, the product design function is essentially disbanded (White et al, 2008) and changes in the product are often made without the information or agreement of the design team. As a result, nobody has the bird's eye view of the product and the cascading effect of the changes – including vis-à-vis sustainability.

Step 7 therefore involves incorporating the necessary tweaking and changes arising as a result of step 6, and the additional feedback from the actors across the production to consumption chain; in a continued collaborative manner. The design team is therefore in the loop along with the other design collaborators, until the final actualization of the product.

Conclusion

This paper has focussed on two main aspects: Understanding why designers facilitate production of bamboo products along an industrial model, and proposing the seven point Rhizome Approach, which facilitates designers figuring in holistic sustainability through collaborative innovation. Though the paper discusses these aspects in the context of bamboo craft, this research is relevant to the design of products using renewable materials in labour intensive situations i.e. developing countries in general.

It is very important that designers view the concept of sustainability in a systemic manner, so as not to simply capitalize on the market opportunity that the trend of "green design" presents, but to go beyond this to develop products that are strategized within systems of integrated social, economic, ecological and cultural sustainability. The organization's commitment, overview and investment in technical backstopping and dialogue across the organization is a huge step towards ensuring that product designers and integrated design teams are aligned to innovate on sustainable products, and equipped to do so.

While pilot design projects using the Rhizome Approach have already been trialled over the past three years, a consolidated design workshop with 30 participating designers is scheduled early in 2011. Following the workshop, the products will be evaluated using the sustainability checklist in line with Rhizome approach, and a graphic representation of the "sustainability quotient" of each product will be developed as a product labelling. It is hoped that the innovative and sustainable products developed as a result of this workshop and action-research will contribute to the existing scholarship on formulating a road-map for designers to design more sustainably, holistically.

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the Learning Network on Sustainability

Borrowed materials

Laser-finished textiles for a closed-loop polyester economy

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In order to design for closed-loop (cradle to cradle) systems where waste materials can become inputs for new production, the textile industry needs new tools and processes with which to create fully or truly recyclable products.

However, rather than being cyclical and self-perpetuating, the current means of textile production are linear and one-way. Finishing processes often mix materials from different 'metabolisms' creating complex hybrids that are irreversible. With this ever-increasing demand for performance and functionality, it is the design of these products that prevents them from being effectively recycled and leaves us with a legacy of waste (Allwood et al, 2006).

This practice based research project set out to explore innovative technologies that afford new opportunities for textile finishing, with a particular focus on the recyclability of synthetic thermoplastics. Polyester, the most common textile synthetic fibre, represents as much as 60% of global fibre production (Morley, 2009) and can be recycled to virgin material quality over and over again if kept 'pure'.

The research concluded that there is potential for 'design for recycling', enabled through a new set of technological processes, specifically 'laser-welding.' This new technique facilitates the production of complex and functional products that maintain their monomaterial credentials, which are essential if they are to be fully recyclable.

Figure 1: Samples shown at Green Scin, the materials experiment, March 2009

Source: author

Applying Cradle to Cradle (C2C) Design Principles to Textiles

Current textile Recycling

Over the course of the last decade, the fashion and textile design industry has been evolving to meet the fast-changing demands of consumers newly alert to the environmental impacts of their purchases. Recycling, once a niche, craft activity has become more common and sits alongside other corporate initiatives that attempt to reduce waste, carbon emissions or toxic chemicals from a products lifecycle.

> In times of textile raw material scarcity, (and rising population) the recycling of end-of-life textiles has become a necessity, and craftsmen and industry are viewing textile waste as a valuable resource. Legislation around disposal and producer responsibility (take-back) make it increasingly important to develop processes to design textiles that are easy to recycle. (Gulich, 2006)

However the eventual result, no matter the intention, are products that can no longer be reused and so end-up in landfill.

> Recycling by itself, only postpones the arrival of the discarded material at the landfill, where it may never biodegrade, may biodegrade very slowly, or may add harmful materials to the environment as it breaks down. A genuinely sustainable future depends on creating closed loops, or cycles, for all industrial commodities, including polyester. In a closed loop, materials would never lose their value and would recycle indefinitely. (Livingston, 2003)

A Cradle to Cradle Approach

Designers have been addressing this problem and seeking to produce better, more sustainable ways of working, using Cradle-to-Cradle (C2C) design principles based on natural systems that eliminate the very concept of waste. All materials are viewed as continuously valuable, circulating in closed loops of production, use and recycling. It is a movement that has the potential to move recycling systems from a limited 'extended life technique' to that of truly perpetual material flows which retain value through each reincarnation.

First coined in the 1970's by Swiss Architect Walter R. Sahel, the term C2C was refined at the beginning of the new millennium by German chemist Michael Braungart and architect and designer Michael McDonough, who promised a new way of thinking about "making things" in their collaborative publication the Hannover Principles, which they followed up with Cradle to Cradle: Remaking the Way We Make Things in 2002. A book that has undergone many reprints and is now a cult read.

Designers working to this end can adopt many different approaches, but the central theory involves diving all materials into two main systems, biological or technical.

1. Biological materials can be returned to **biological cycles** (the earth) where they harmlessly decompose and become food for plants and animals while rebuilding nutrients in the soil.
2. Technical materials can be returned to **industrial cycles** (manufacture) when no longer useful, thereby supplying high quality raw materials for new products.

Box 1: Principles of cradle to cradle design

Source: Developed from McDonough & Braungart 2002

> The overarching mantra of C2C is waste equals food; a principle, based on natural systems, that eliminates the very concept of waste. All materials are viewed as continuously valuable, circulating in closed loops of production, use, and recycling. To adopt these principles designers need to acknowledge two defined material metabolisms within our material landscape and design intentionally for one or the other.

The Designers Role in Facilitating Recycling

C2C is a dialogue that celebrates new design and creativity. It is a methodology which, rather than focussing on logistics and technology to solve our resource problems, places the designer at the centre of the solution (Goldsworthy & Lang, 2010).

> Generally it is the designer who decides on the structure of a product and the best materials to use, taking function and budget into consideration. The materials chosen have an influence on the process

> of manufacturing as well as on the process of recycling and disposing the product at end of life. Indeed they predetermine all these processes. (Gulich, 2006)

For textile designers this means two very different approaches for working with either natural or synthetic materials at all stages of the production cycle. In the case of biological (natural) fibres the key concern is to prevent use of any chemicals, which would cause harm if they were leached into natural systems as material is returned to the earth through biodegredation. For synthetic materials the priority is to design products, which can be effectively recycled in perpetuity without loss of quality.

There are several approaches, which can be used to complement this overarching design strategy:

Box 2: Complementary Approaches to cradle to cradle design

Source: Developed from McDonough & Braungart 2002

Design products which are:

- ULTRA-BIODEGRADABLE: Designing with materials that biodegrade back into the environment, without leaching harmful dyes and chemicals.
- MONO-MATERIAL: Simple use of one material makes for a cleaner path to recycling.
- DESIGNED FOR DISASSEMBLY: Clever construction methods that use bindings and fixings without the need for glues or metal fasteners ensure easier reuse and recycling.
- UP-CYCLED: Adding value to materials through redesign.
- CLOSED-LOOP: Design with materials that can be infinitely recycled without losing quality.
- USE APPROPRIATE MATERIALS: Take advantage of the natural characteristics of materials. By selecting materials wisely in this way designers can avoid harmful additives.
- DESIGN TO AVOID DOWNCYCLING: The practice of recycling a material in such a way that much of its inherent value is lost (for example, recycling plastic into park benches). This could include temporary reformations / upcycling / designing to embed reuse.

B. Gulich (Wang, 2006, p27) suggests ‘designers should keep in mind how a product, meant to be sold tomorrow, can be recycled or disposed of the day after tomorrow’, suggesting that a designer has the power to ‘design in’ recyclability at the beginning of the creative process. He goes on to suggest that one way of doing this may be the development of single polymer design or single material systems. Products consisting of only one material are ‘pure’ and easy to re-use. It is not generally necessary to deconstruct the product prior to reprocessing.

However, this suggests a paring down and simplification of design and construction not always appealing to the designer or indeed the consumer. Is it possible to create textile products pure enough in construction to enable recycling yet complex enough to vary in function and aesthetic?

Opportunities & Barriers for a Closed-loop Polyester Economy

Repolymerisation of polyester

Polyester is a common textile material, from the technical cycle, representing as much as 60% of global fibre production (Morley, 2009) and as such needs to be preserved as a recyclable resource. In a 2003 report, US based furnishing supplier Designtex described their vision of a closed-cycle polyester economy, where all polyester fabrics are recycled perpertually.

At this time, repolymerisation of polyester fabrics had been successfully trialled but was not yet commercially available. However, this changed in 2005 when Teijin launched their EcoCircle system in collaboration with pioneering sportswear brand Patagonia and the polyester economy became a viable scenario.

The process works by reclaiming the valuable chemicals embodied in the waste polymer, which is then used to make new virgin-quality materials. Unlike other material recycling, this breakthrough technology represented a measurable reduction in CO2 emissions and energy use, when compared with production using virgin resources, and could be repeated without loss of material quality.

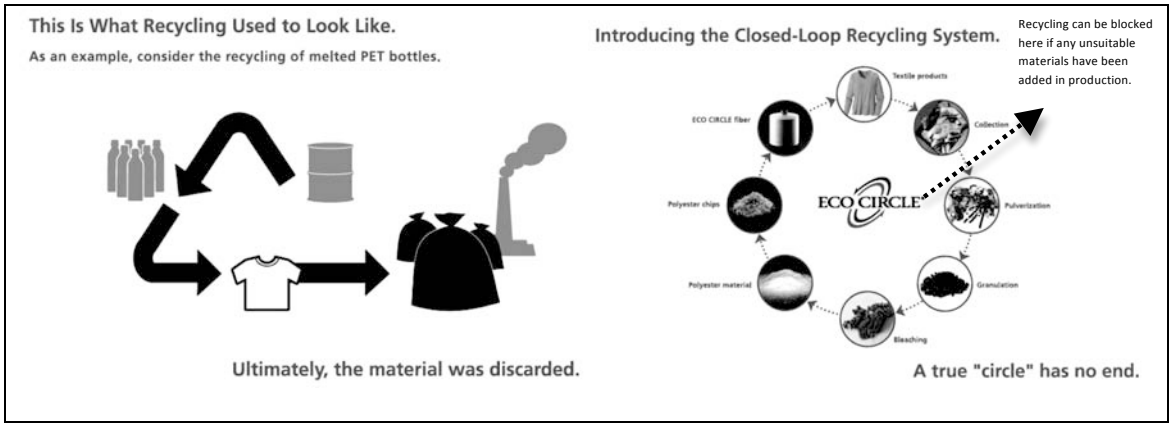
If polyester textile products were kept ‘pure’ and preserved as monomaterials during their production they could be returned, thus avoiding landfill or downcycling, as often was the case.

The environmental argument for recycling polyester

> The widespread use of recycled polyester is a benefit to the environment because it conserves non-renewable resources and reduces the release of harmful emissions into the biosphere. This is primarily accomplished by reductions in the amount of energy and oil needed to make virgin polyester, along with reductions in the accompanying releases of greenhouse gases into the atmosphere. (Livingston, 2003

Figure 2: EcoCircle polyester recycling process

Source: Diagrams courtesy of Teijin Fibres Ltd, www.ecocircle.co.jp



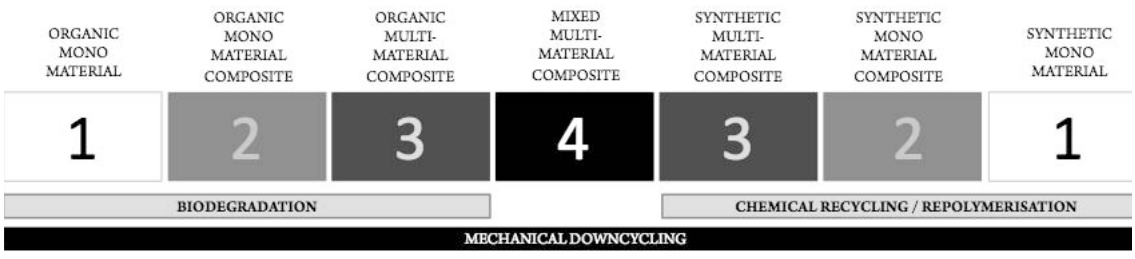
Barriers to the closed-loop recycling of polyester

Many textile processes, nonwoven constructions, chemical finishing processes, coating, lamination and composite materials render products unsuitable for recycling and destined for landfill (Horrocks and Anand, 2000). For example furniture manufacturers often apply their own specifications for finishing fabrics before they are installed on seating and architectural products. The processes used in finishing the fabrics often include chemical backings, which are contaminants, most of which in use today are incompatible with breaking down polyester and repolymerising it.

This is also true of many finishes used in the garment industries, including trimmings and fixings. But we cannot simply remove these finishes from use. They are an essential part of the textile industry and have been at the core of many innovative textile products during the last decade. For example, coating and lamination offer methods of improving and modifying the physical properties and appearance of fabrics and also the development of entirely new products by combining the benefits of fabrics, polymers and films. However these finishes also move a material from its most easily recyclable construction (a monomaterial) to a multi-material composite, which is impossible to recycle with current technologies.

Figure 3: Recyclability of material constructions based on Wang, 2006

Source: author



Fashion cycles continue to move in ever decreasing cycles, requiring quicker turn around time, and a quicker response to market changes and fluctuations. European fabric and garment producers are all seeking ways to achieve greater operational flexibility, in order to respond to this more demanding market.

There is also much talk of individualisation, fragmentation and personalisation within the consumer market. It has to satisfy not only the traditional demands, of being fashionable, and practical, but must also appeal on a more subjective and emotional level. There is also the very important need to produce a more environmentally acceptable product in a sustainable manner, and to be able to dispose of it or recycle it correctly. Manufacturers are greatly concerned with the effective use of energy and materials, plus the need to shorten capital cycles, factors of interest in all areas of textile and garment production.

These challenges are encouraging investigation into what finishing treatments can offer, how they may be able to assist in meeting these demands, whilst producing a textile or garment that appeals to both the objective and subjective demands of the consumer.

The finishing of a fabric is now equal, or in some cases more important than the fibre or the construction, and can often be a quicker and cheaper method of introducing different design features and functions into a textile. Through finishing techniques, fabrics can now take on new aesthetics and functions. They can be manipulated to be hard, soft, shiny or matt, they can be moulded, they can protect, and they can now also be bio-active and interactive. New ways of combining textile layers are introducing performance composites capable of a wide range of functions and responses.

> The finishing of a fabric, the final stage in it's making, is fast becoming as important as it's construction: it is also where the look, texture and performance can be dramatically altered. Treatments include holographic laminates, silicone coatings and chemical finishes which devour surfaces they come in contacts with. (Braddock-Clarke, 1998)

So there is a paradox between keeping a textile 'monomaterial' and recyclable and the need for innovative finishing to add aesthetic and functionality to fabrics. This project set out to find an alternative way to impart these finishes to polyester textiles without making the resulting materials incompatible with repolymerisation.

The Laser as a Tool for Clean Textile Processing Techniques

The challenge was to find ways of manipulating the surface of polyester, a thermoplastic material, which could dramatically alter the surface aesthetic without the need for toxic chemicals or adhesives, thus preserving recyclability.

Lasers create heat and when used with thermoplastic materials cause melting. This creates the potential for various surface effects to be achieved without the adding of any other materials – simply by controlling the way the laser interacts with the material. During this project I explored the potential for a new series of finishing techniques using the laser with 100% recycled polyester.

The Use of CO2 Lasers for Environmental Benefit

Lasers are certainly not new in the textile industry: Other designers have explored the potential of innovative laser finishing with regards to environmental benefit.

Janet Stoyel was one of the first designers to establish the laser as a finishing tool for textiles with her company 'Cloth Clinic' started in 1994. In particular her work to explore the devore process through laser finishing, uses no dyes, no chemicals, no wet finishes and no stitch. Devore is a particularly renowned pollutant, generating chemical and colour waste and also generating large quantities of fibrous sludge. Of her innovative work in textiles Janet has written:

> By inventing futuristic processes and harnessing the latent design potential of Photon Laser and Ultrasound technology, I realise permanent effects on materials in an environmentally holistic manner, without dyes, chemicals or wet applications, challenging conventional material concepts through the ultimate marriage of engineered materials and technology. I exploit the characteristics inherent within a material, changing molecular structures, alchemically transforming surfaces (Stoyel, 2009)

Anne Smith's Altered States project (1998-2000) also explored the potential of laser cutting and etching technology, as a method for environmentally low impact methods for producing decorative effects on fabrics. The project focused on the exploration of the aesthetic and commercial viability of the application of laser cutting and marking technologies to interior, furnishing, fashion and accessories materials, and resulted in a patent on the 'application of laser cutting and marking technologies to generic flooring materials'.

Savithri Bartlett's doctoral research project, completed in 2006, at Loughborough University School of Art and Design (LUSAD), accepted the challenge to archaic fabric printing technology by suggesting an innovative route of dye uptake and surface design of textiles. The use of lasers as a means of controlling dye uptake at the surface of textiles was achieved by changing the quality of the material surface, thereby controlling colour intensity achieved during dyeing.

Adapting Laser Welding as an Innovative Finishing Tool

For my own doctoral research I have been concentrating on the area of 'laser welding' as a process for investigation. Laser welding was identified as an area of potential innovation for textile finishing and explored through a collaborative investigation with TWI, an engineering research facility based in Cambridge. The resulting material samples illustrated many new finishing and resurfacing techniques. Some were replacements for traditional methods and others, were completely new processes, which would be unattainable with conventional tools. Recyclability is preserved, while aesthetic, function and innovation retain priority in the design process.

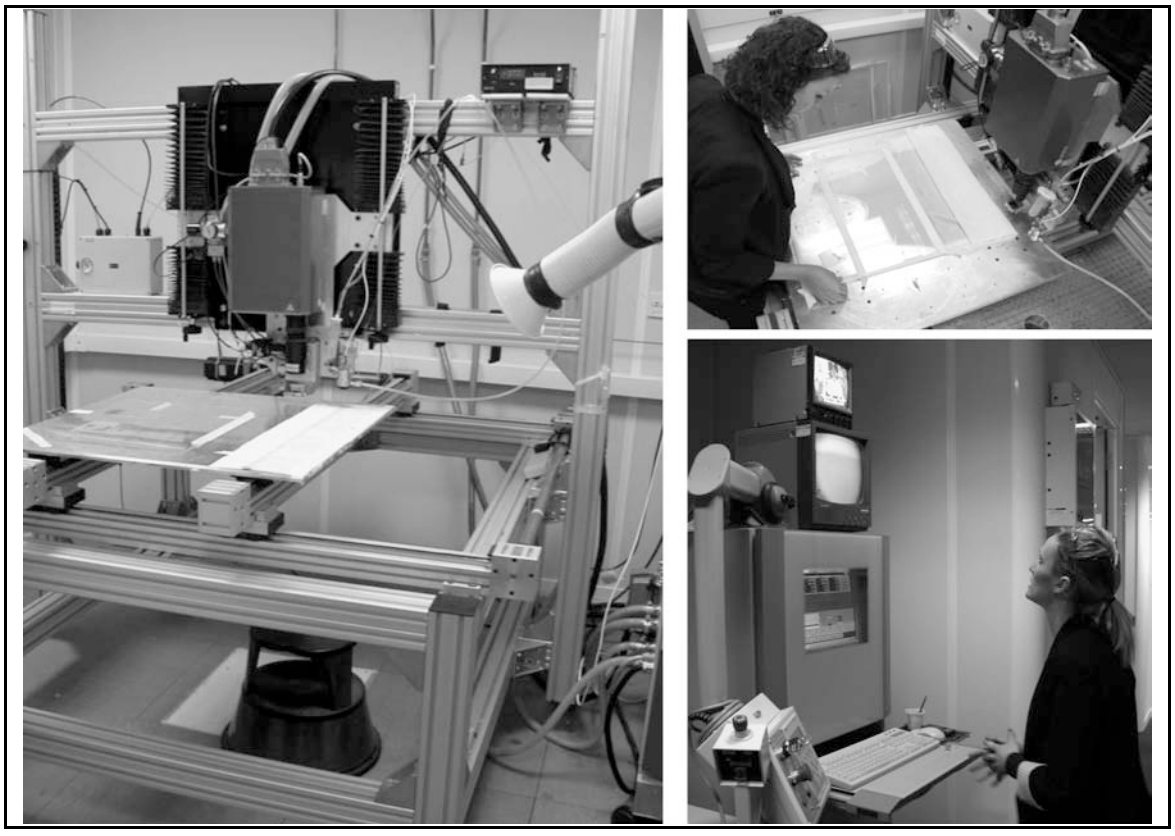
One of the key advantages of this technology over the more commonly used CO2 lasers is that they work with a much lower energy consumption and are more controllable which enables complex effects to be designed into a single process. The potential for the use of laser welding to increase the productivity and quality of welded seaming of fabrics for garment production has been previously explored, but my focus was on the surface finishing of the fabric.

Experiments: Exploring Technology with a Craft Approach

The practice based research was designed very much as a 'design' process. Working closely with a technical specialist, also trained as a designer, enabled a hands-on, craft approach to be used with experimentation based on action and reflection throughout the study.

Figure 4: Working at TWI during PhD project, 2009

Source: Images courtesy of The Science Museum, London



Materials were sampled and further tests designed according to the results, which were often unexpected.

> Traditional makers form an in depth understanding of the materials and tools that they work with, through various combinations of hands on experience, and technical/scientific understanding. Through this dialogue with materials and processes they are able to develop an individual aesthetic, a personal visual vocabulary. (Masterton, 2005)

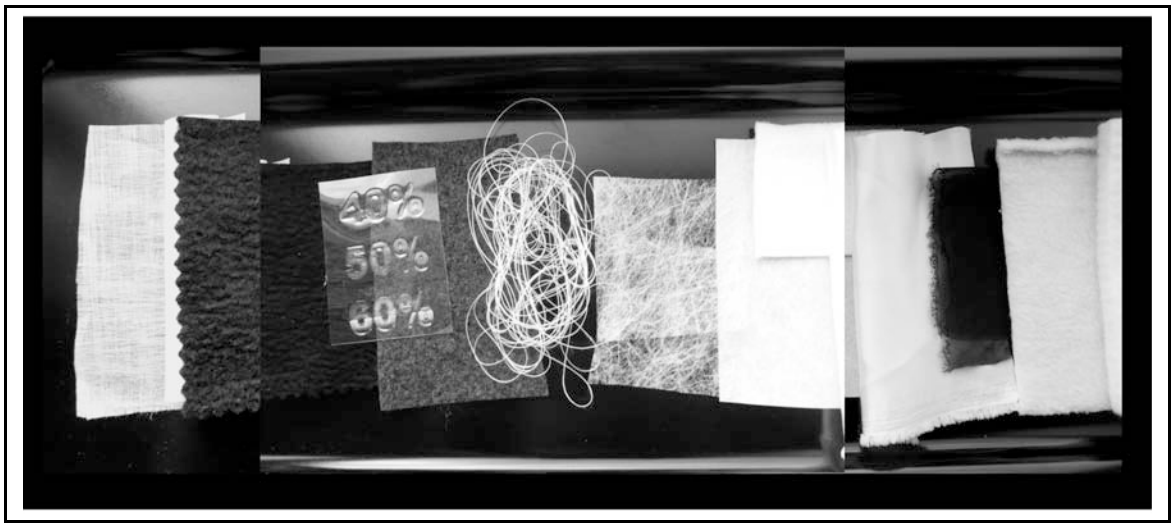
There were several stages to the experiments:

- finding ways to overcome the limitations of the available equipment
- optimising settings for mark making and welding with the chosen materials
- identifying and exploring finishing techniques which could be achieved through this process

I used many different constructions of polyester materials in the tests; knitted, woven, nonwoven, yarn, monofilament, sheet and fibre. This enabled maximum variation of results whilst still retaining 100% monomateriality.

Figure 5: Various polyester substrates used during experimentation

Source: author



The various fabric constructions and weights varied the type of effect or mark that could be achieved through the application of the laser. These ranged from a single layer transparency effect to a much more complex construction on multiple layers bonded without any surface marks – and a variety of effects between the two.

Results of Experimentation

After initial testing I designed the study to investigate 3 main approaches:

- Multi Layer Composites
- Single Layer Embellishments
- Nonwoven Constructions

As this technology had been previously employed mainly as a stitch substitute, that is to create seam bonds for garment construction, I began by experimenting with multi-layer composites. A previous body of work for the 'Ever and Again' project (Earley, 2007), had looked into the use of CO2 laser welding as a tool to resurface low grade recycled felts in order to 'upcycle' them to a higher value material product. The CO2 technique had not always produced controllable or successful results but I quickly discovered that laser welding could produce much more sophisticated and subtle effects, bonding layers together with minimum disruption to the surface of the materials joined.

Sampling explored stitch replacement (for quilting, sashiko, 3D constructions), and resurfacing techniques (emulating embossing, double faced laminations, jaquard effects). In some cases at certain power

settings I observed that the top surface was affected. Where in the exploration of seaming this would be considered undesirable, in the exploration of finishing techniques this opened up a new area for investigation.

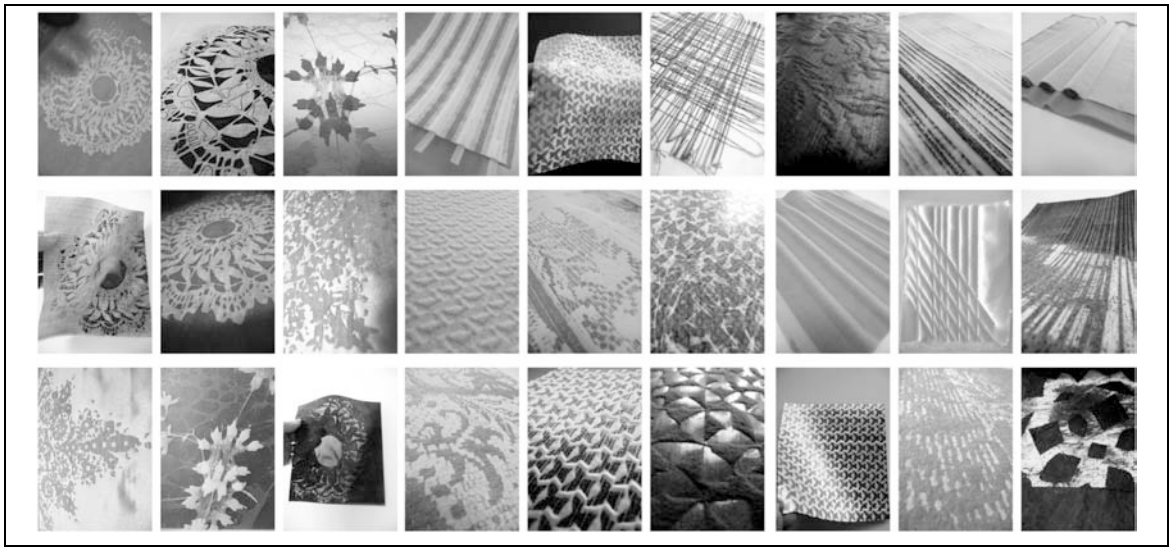
When the laser was applied to single layer materials two main characteristics could be achieved. Transparency was the result in certain material substrates, such as fine satin weaves, and emulated a devore finish. This surface effect has been explored previously by designers using the CO2 laser. However, the use of the laser welder gave more easily controlled results with less destruction to the surface of the material treated.

More dense textile constructions and materials resulted in a melted surface effect akin to spot lamination or coatings. This led to a further group of experiments which explored surface embellishments beading, sequins, embroidery, flocking and foiling – all achieved without the use of adhesives or stitch.

The final experiments leading on from observation of the bonds created between yarns in the experiments to emulate embroidery, were based on the replication of web formation, perhaps alternatives to lace or nonwoven constructions.

Figure 6: Selection of final samples developed during PhD project 2009

Source: author



In all over 20 existing textile processes were emulated and explored successfully resulting in materials not only created from recycled polyester materials, but also suitable for full chemical recycling into high value polymer of virgin quality.

Conclusions and future work

Current processing and finishing methods such as chemical coatings or lamination, commonly used in the textile industry's ever growing desire for performance and functionality, create barriers closed-loop recycling, by mixing materials with different reprocessing needs into an irreversible state. These complex hybrid materials designed in the ever-increasing drive for performance and functionality, leave a legacy of waste and prevent inclusion in future fabrications.

The research set out to find alternatives to these traditional finishing techniques, which could be employed to preserve monomateriality in polyester materials in order to work within this system. Working within the boundaries of the technological metabolism, the aim was to find new technological tools for creating monomaterial textile products. These tools enable aesthetic and functional features as well as recyclability. This was not intended as a search for a replacement to all traditional and low-tech processes, but as a complementary set of techniques.

Through a practice based and design-led project, I explored many techniques using laser-welding to produce varied finishing effects, which worked on the principle of controlled manipulation of synthetic surfaces without the contamination of additional materials.

The resulting prototypes showed that several effects, which would normally need chemical coatings or adhesives, could be achieved without any added agents. Colour could still be achieved through the usual dyes as they can be 'burned off' as part of the recycling process. The result was a collection of textile prototypes demonstrating techniques, which could be used to create products 'designed for recycling' within a future polyester economy.

Notes

- The Clearweld ® process was invented and patented by TWI. It is being commercialised by Gentex Corporation. The process uses lasers and infrared absorbing materials for precise joining of coloured or clear synthetics. It offers superior engineering advantages compared to today's adhesive and solvent bonding, and ultrasonic, vibration and hot-plate welding methods.
- The practice element of the project was supported by the Textile Environment Design (TED) cluster at Chelsea College of Art & Design, with technology access from The Welding Institute (TWI). The project was funded with a SPARK Award from the Materials KTN. With special thanks to Jo Lewis (TWI) for her technical expertise and help throughout the project.
- Recycled polyester materials were provided by Teijin Fibres Ltd.

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About the author

Kate Goldsworthy is a textile designer, lecturer and researcher, formerly based in the Textiles Environment Design (TED) department at Chelsea College of Art and Design, and now Course Coordinator for the MA Textiles Futures course at CSM, UAL. With extensive materials and process expertise, her passion lies with issues of sustainability in the textile world, particularly the recycling and reuse of polyesters. Her current research explores these themes along with new manufacturing processes and digital technologies to create novel finishing techniques for synthetic textiles.

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the Learning Network on Sustainability

Sustainable lighting product design

A new approach and an industrial case study

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This paper presents a new sustainable approach for lighting product design with the final aim to encourage/facilitate designers to adopt sustainable, easy to use and effective approaches, which will ultimately help to shift from traditional to sustainable consumption/production. The approach has been designed with the following stages: 1) Definition of the Life cycle of a lighting product, 2) Definition of the scope of eco-design action, 3) Review of Legislation directives related with lighting products, 4) Analysis of case studies of similar related projects, 5) Review of Life Cycle Assessment (LCA) prescriptive tools, 6) LCA Tools previously reviewed and other LCA analysis software-based tools were then combined/selected in a timely manner to match/support decision-making processes during various synthesis/analysis stages of the design process. This approach developed, explained and demonstrated through a case study, based on a lighting design project carried out with the lighting company ONA, Spain. To conclude, results and advantages/disadvantages of the approach are discussed.

Introduction

Today's production and consumption is causing a negative impact in the planet. Current industrial activities and consumer behaviour are leading to the depletion of our limited resources and the 'artificial' introduction of other harming sources (waste, emissions) in the environment. Statistics (EC, 2008) shows that our activities are having a profound negative impact in the planet; thus the need for tools to monitor and assess the impact of our industrial activities has become crucial. Monitoring and assessment is the first step towards the reduction/elimination of industries environmental impact. Integrated Product Policy (IPP) (EC, 2003) already is providing a set of mandatory (legislation) and voluntary tools in order to minimize/eliminate these impacts. The European Commission (EC) have been showing through environmental indicators the activities of industry regarding different criteria (energy, waste, etc.) in order to monitor the impact produced by industry, and assess their activities towards established targets set by the EC and the Kyoto protocol (UNFCC, 1997). The environmental indicators (EC, 2008) clearly demonstrate that a lot of the targets set by the commission have not been accomplished yet. For instance, The Kyoto protocol (in relation with green house emissions) which set a goal to reduce an 8% from 1991 to 2008-2012, it has not been accomplished so far, and the statistic-charts do not show a promising expectative for the future years (EC, 2008). Lighting products represent part of the total amount of consumer products produced by industry, therefore representing part of the impact produced in the environment. The impact produced by these types of products could be reduced/eliminated with the use by designers of effective sustainable design methodologies. Although there are already methods, tools and techniques to support (through prescription or analysis) design of environmentally friendly products (Brezet, H., and Van Hemel, C., 1997; Byggeth, S., and Hochschorner, E., 2006: 1420-1430; Dewulf, W., 2003; Graedel, T.E., and Allenby, B.R., 2003; Hur, T., Lee, J., Ryu, J. and Kwon, E., 2005: 229-237; Karlsson, M., 1997; Lewis, H., Gertsakis, J., Grant, T., Morelli, N. and Sweatman, A., 2001; Luttropp, C., and Karlsson, R.,

2001; Meinders, H.-.P., 1997; Nordkil;, T., 1998; Pommer, K., Bech, P., Wenzel, H., Caspersen, N. and Olsen, S., 2001; Schmidt-Bleek, F., and Okodesign, 1998, Stevels, A., Brezet, H. and Rombouts, J., 1999: 20-26; Tischner, U., Schmincke, E., Rubik, F. and Prosler, M., 2000; Wenzel, H., Hauschild, M. and Alting, L., 1997; Bhamra, T., and Lofthouse, V., 2007; Weidema, B.P., 1997; Giudice, F., La Rosa, G. and Risitano, A., 2006; Graedel, T.E., 1998; Graedel, T.E., and Allenby, B.R., 1996; Guinee, J.B., 2002), these are usually focused on general products, not lighting products in particular. In addition to this, some current methodologies and tools can be time-consuming, thus not suitable for lighting product designers' tight-deadlines; and usually their implementation may not be applicable in different contexts (Guinee, J.B., 2002). This paper introduces the first stage of a new sustainable approach for designing sustainable lighting products through a real case study (lighting product) with ONA lighting company, with the final aim to develop from the on-going design process feedback an optimum, easy-to-use an effective sustainable lighting product design methodology for lighting designers.

Life-Cycle Design (LCD)

In the introduction it was mentioned the need for sustainable design methodologies/tools in order to reduce the environmental impact of lighting products. The majority of methodologies/tools already available for this purpose are based on Life-Cycle approaches (Vezzoli, C., and Manzini, E., 2008), that is, approaches that take into account the whole life-cycle of products. This holistic (or cradle to grave) approach takes into consideration every product's life cycle stages, from extraction of materials to End of Life (EOL) (Fig.1). This is necessary in order to find out and assess the total environmental impact of products; only then impacts can be reduced/eliminated.

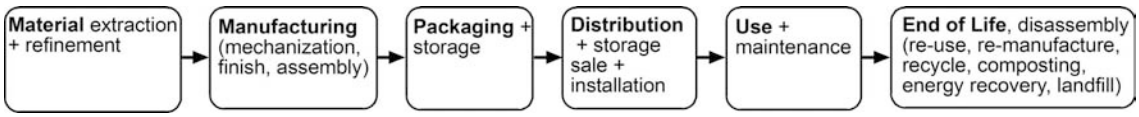

Figure 1. Lighting product life-cycle stages

One of the tools that adopts a life-cycle approach and can be used to assess the environmental impact of lighting products is the Life Cycle Assessment (LCA) tool. Today, standardization of LCA methodology has strengthen its status as perhaps the most important tool for assessing a project's overall environmental impact (Malmqvist, T. 2004). LCA-based tools can be classified in several types. In general, there are three types of LCA tools: "Prescriptive", "analytical" and databases. "Prescriptive" tools usually provide guidelines or "rules of thumb" which might be provided within manuals/handbooks, guidelines, ratings and some type of checklists, whereas "analytical" tools support the data analysis of a product system. Databases can be used alone, or to support the analysis of other software-based LCA detailed/streamlined tools. "Analytical" tools can be classified in detailed and streamlined/screening LCA tools, depending on the quantity/quality of the data assessed and the method to assess it (Finnveden, G., and Moberg, A., 2005; Vezzoli, C., 1999). Streamlined/screening LCA tools, are usually used when there are time or financial constraints, and represents a less thorough and quantitative exhaustive approach. These tools present a lot of advantages for identifying in a practical and easy (less time consuming) manner environmental strength and weaknesses within product system life cycle stages. As it will be seen in upcoming points different types (prescriptive, analytical and databases) of LCA-based tools have been used during the preliminary stages of sustainable lighting product design process.

Scope of the eco-design

The first step of the sustainable lighting design process is to define the design scope. In this case the aim of the design was to create a new sustainable lighting product, not to redesign an existent one by adding eco-features, thus this type of project could be considered an eco-innovation (Tischner, U., Schmincke, E., Rubik, F. and Prosler, M., 2000).

Problem definition

The second step of the process is to define the problem. This is defined through the briefing or specifications, which will guide the creative process. The briefing defines the boundaries or constraints that limit and filter the creative output (solutions). Thus, for solutions to be satisfactory, they will have to match or approximate the specifications stated in the briefing. Problem definition comprises a set of specifications related with criteria such as: cost, aesthetics, materials, manufacturing processes, weight etc. In the present project, these specifications were defined by ONA lighting company (ONA, 2010), according to their strategic objectives. The company wanted to develop a new lighting product taking into account a sustainable approach. Thus in addition to the usual set of specifications of a non-sustainable design project, new sustainable design specifications were added to the briefing. According to the initial briefing the product had to embody the following features:

- Modular, so it could be customized according to customer needs
- Aimed at contract/domestic markets
- Allow indoors/outdoors use (approx. IP 33)
- Provide the exact amount of light where needed, in order to avoid wasting light (and energy), so the quantity/quality/distribution of light has to be easy to control.
- Aesthetically coherent/neutral
- Allow different modular options, so customer could choose between different options using the same standard module.
- Use energy-efficient light sources
- Allow to be used as: hanging/wall/track lamp
- Allow the possibility to incorporate different type of transformers/power light sources.
- Produce different type of lights (i.e.: accent, ambient, etc.)
- *Be sustainable*: Sustainable design criteria was defined with data from legislation that affect lighting products, information from Life Cycle Assessment (LCA) carried out in other lighting products (case studies), eco-design guidelines, checklists, and rules of thumb. In the following points these elements which informed the briefing's sustainable design specifications will be explained in more detail.

Sustainable design specifications – legislation

The third step in the process is to find directives and legislation that applies and affect the design of sustainable lighting products (In Europe), in order to take them into account when creating the environmental profile of the product specifications. The main European directives are the following:

- *EuP (Energy using Products) directive* (EC, 2005): This directive will (among other things) ban the commercialization of incandescent lamps for *household lighting* as follows: (equal/more than 80 watts from 2009; equal/more than 65 watts from 2010; equal/more than 45 watts from 2011; equal/more than 7 watts from 2012; lamps with S14, S15 and S19 bases from 2013, lamps with bases E14/E27/B22d/B15d and voltages equal/less 60 volts, and lamps class C halogen energy saver. Also ban the commercialization of lamps for *street, office and industrial lighting* as follows: T8 halophosphate lamps, T12 florescent lamps, metal halide lamps from 2012, High pressure mercury lamps from 2015, and poor performing metal halide lamps from 2017. Special purpose lighting is not affected by the EU directive. Within special purpose lighting is included: Pet care-lighting: Aquariums, terrariums; Disinfection-lighting: Germicidal lamps; Display/optics: Stage and studio lamps, theatre lamps, TV lamps, studio lamps, photo lamps, projection lamps; heating-lamps: Infrared heat lamps for comfort healing, infrared heat lamps industrial applications, infrared heat lamps for animal rearing, infrared heat lamps for healthcare; Traffic/signalling: Aircraft signalling, train lighting (including signal lighting), signal lamps, automotive lighting/lamps; household appliances: Oven lamps, fridge lamps; other: temperature and shock proof lamps, mirror lamps.

- *The Waste Electrical and Electronic Equipment (WEEE) directive* (EC, 2002): It affects any importer, re-brander or manufacturer of products that requires electricity for its main purpose. These will have to finance the cost of treating (i.e.: mercury in lamps, PCB in ballasts, etc.) and recovering the types of products you import, re-brand or manufacture. For this purpose all these products should be marked.
- *The Restriction of Hazardous Substances (RoHS) regulations in Electrical and Electronic Equipment directive* (EC, 2002): This directive is concerned with the avoidance in products of some harmful substances such as: lead, mercury, cadmium, hexavalent chromium and brominated flame-retardants: PBB and PBDE.
- *The Packaging and Packaging waste directive* (EC, 1994): Its main objectives are: reduce packaging material excess, to eliminate/avoid specific hazardous substances/materials, inform the consumers about content of product/packaging, reduce the amount of waste at end of life of the packaging, to increase/promote the re-use and recycle of packaging waste, translate to the producer/manufacturer the responsibility to recuperate and recycle its packaging. This directive is not specific to lighting products only, and affects any type of product that uses any type (primary/secondary) of packaging.

Sustainable design specifications – case studies

The fourth step is to inform the sustainable design spec. with the usual highest environmental impacts of lighting products and the correspondent eco-design recommendations after the assessment. Because the aim of this project is to create an eco-innovation, not to re-design an existent product, it is necessary to create an "imaginary reference" (with ideal sustainable lighting product specifications) which will be used as a reference to create the new eco-innovation. In order to do this, environmental impact assessment results carried out in other lighting products (of similar type, if possible) have to be analysed, and highest impacts found taken into account as a "general" reference or points for improvement in the briefing.

The case studies (2) results analysed were assessed using the streamlined life-cycle assessment tool eVerdEE. The first case study (Profile lighting Ltd and Eco-SMEs, 2010) consisted in the assessment of a recessed fluorescent luminary (Ambience T5 luminary, from Profile lighting Ltd.) for use in offices and other commercial buildings. The luminary was made of powder-coated Zintec body with an aluminium reflective louvre and four 14-Watt fluorescent lamps, together with a number of other smaller components. High-frequency electronic ballast controls the start-up and operation of the luminary. Although the assessment shows that major impacts are focused on manufacturing of some components (85% of the total weight of the product), usually the major impact on energy-using products is focused on its use phase. However this simplified assessment did not take into account this stage, so the manufacturing stage becomes the one with highest impact.

Eco-design recommendations of this product were the following: 1) use aluminium or plastic instead of Zintec, as this is lighter, require less material, have good corrosion properties and is easier to recycle; 2) local sourcing of materials and components; 3) reduce overall volume of product and components; 4) reduce energy demand during the use-phase: by using energy-efficient light sources (i.e.: LEDs or more efficient fluorescent lamps), design of the lighting product so it can be sourced from renewable energies (i.e.: solar, wind, human) during its use, or incorporating automatic heat sensors to be more energy-efficient; 5) establish take back systems should be established /adopted in order to re-use/recycle materials and components; 6) reduce the number of different materials; 7) coating should be removed, or use compatible coatings with the base material; 8) use as less material (in case of using aluminium) as possible or use recycled aluminium; 9) avoid use of lead in components and welding.

The second case study (Urbis Lighting and Eco-SMEs, 2010) consisted in the assessment of a street lantern (Sapphire 1 street lantern, from Urbis Lighting). The luminary was made of die cast painted aluminium canopy, metallised polycarbonate reflector, polycarbonate protector, High Intensity Discharge (HDI) ballast, 50-Watt lamp, and various fasteners and moulded parts. Although the assessment shows that major impacts are focused on manufacturing of some components, usually the major impact on energy-using products is focused on its use phase. However this simplified assessment did not take into account this stage, so the manufacturing stage becomes the one with highest impact. Eco-design recommendations for this product were the following: 1) investigate ways of re-using the product main material (aluminium); 2) investigate ways to reduce the consume of non-renewable energy and encourage the use

of renewable energies; 3) virgin aluminium material should be minimized by: Replacing virgin with recycled aluminium, reducing the size of the canopy, Investigate replacing aluminium with plastic or steel; 4) replace aluminium with other material which does not need coating (i.e.: plastic); 5) avoid use of lead in components and welding; 6) reduce ballast size, or use electronic ballasts which are more efficient and smaller; 7) use as few different materials as possible; 8) sourcing of local materials and components.

Sustainable design specifications – design guidelines, checklists, rules of thumb

The fifth step is to inform the sustainable design spec. with sustainable design guidelines, checklists and rules of thumb. Usually, in eco-redesigns, the environmental profile is created from the environmental impact assessment carried out in reference products (Tischner, U., Schmincke, E., Rubik, F. and Prosler, M., 2000). However, when eco-design action is focused on creating new eco-innovations, the environmental profile of the product cannot be informed from a reference product (from own company/other companies catalogue), but from the "imaginary" profile created by the company, which will contain ideal/desired specifications to be embodied in the solution. This set of ideal/desired sustainable design features, will be defined/supported by sustainable design guidelines, rules of thumb and checklists (Chitale, A.K., and Gupta, R.C., 2007; Eco SMEs, 2010; Gn-Teknik, The Institute For Product Development (IPU) and Danish Toxicology Centre (DTC), 2005; IDSA, 2010; Jedlicka, W., 2009; Jedlicka, W., 2010; Meinders, H.-.P., 1997; Nordkil, T., 1998; Shedroff, N., 2009; SIEMENS, 2000-2004; Tischner, U., Dietz, B. and Mabelter, S., 2000; UNEP and Delft University of Technology, 2006; Vezzoli, C., and Manzini, E., 2008; Yarwood, J.M., and Eagan, P.D., 1998). Whilst using reference (existent) products for eco-redesign makes sense, as new re-designs need a reference in order to compare improvements of re-designed products. Using reference-products may not benefit the design of *new* eco-innovations; due to the influence these references may cause in the solution (similar solutions may appear). The possible similarity of new designed solutions may be influenced by the need to have similar features embodied in both designs for comparative purposes, which is necessary in order to measure the success of the eco-design action.

The main (summarized) sustainable design spec. informed from design guidelines, checklists and rules of thumb classified by product life-cycle stage were the following:

Raw material extraction and refinement stage: Use as few materials as possible; use recycled/recyclable materials; use one/few quantity/type of materials in the same product; avoid the use of banned/toxic materials; source local materials, use materials which have established recycling facilities, use materials which are fit for purpose; when choosing recycled materials select post-consumer recycled waste, avoid the use of adhesives (specially solvent-based); Use light materials (low density); if using more than one material, they should be compatible for recycling; use materials that are durable (depending on design purpose), choose materials that achieve aesthetical properties over time; choose materials that do not require energy-intensive processes to be shaped, avoid composites/other thermo stable plastics, avoid using scarce/limited materials; avoid use energy-intensive extraction/refinement materials.

Manufacturing (mechanization, finish, assembly) stage: Avoid energy-intensive processes; choose processes that do not waste material, or recycle the material wasted (pre-consumer waste); choose processes that do not create harming emissions, use processes that do not produce liquid and solid waste, choose processes that use water and energy efficiently (if at all); choose processes that use renewable energies; design components that are multifunctional, specify re-manufactured components, design component with minimum volume.

Packaging and storage stage: Avoid the use of packaging if possible; design packaging with minimum weight and volume, design packaging to be re-used/recycled; avoid solvent-based inks in printed areas, use the required packaging for protection (not over package), other criteria from previous stages already mentioned also applies here, as packaging is a product in itself.

Distribution, storage, sale and installation stage: Choose efficient transport means (ship), avoid air transport; design efficient distribution/logistic systems; use transport which avoid damage of goods; provide instructions for installation and use to extend the life of the product.

Use and maintenance stage: Design modular products so parts/components can be up dated/repaired; design easy to dismantle products to encourage upgrade/repair of parts; provide spare parts/components as

well as a list with the product's components and the commercial references; provide customer service; design product which are dirt-resistant and easy to clean; design products that require little maintenance; indicate on the product how it should be opened for cleaning or repair; use solar/motion sensors or timers, dimmers to reduce the amount of energy used at different times; use energy-efficient light sources; use energy-efficient drivers; standardize components; locate components that might wear out in accessible areas; design products with devices that allow to control the quantity/quality of light in order to use the exact quantity/quality needed for each purpose; specify best-in-class energy efficiency components; permit users to turn off systems in individuals units, or as a whole; eliminate unused or unnecessary product features; identify and eliminate possible weak points of the product; design products for safe/self-explanatory use; for energy-using products, this is usually the most relevant phase from an environmental point of view.

End of Life (disassembly, re-use, recycling, re-manufacture, energy recovery, composting, landfill): Design products that can be separated by material (if there is more than one); avoid adhesives to join components; use as few fasteners as possible; use the same type of fasteners; use fasteners which do not require tools, or require standard tools; avoid welding joints, only join permanently materials that can are compatible for recycling; design products so different parts with materials can be separated easily and re-use/remanufactures/recycled depending on the component; reduce disassembly number of steps; avoid the use of paints or other surface finishes; avoid the use of labels, use emboss to mark components; use one single material for all the components, if possible; minimize the number and length of wires; use one disassembly direction to avoid reorientation; design for multiple detachments with one operation; facilitate reuse/recycling by using standard codes for identification (labelling) of materials/components; design the product so it does not need to be dismantled to be recycled; minimize the use of energy-intensive process steps in disassembly; the cost of disassembly has to be less than the cost of the material recycled; make sure that joining points are easily accessible and there is enough space to allow disassembly with tools; include symbols or pictograms to inform about disassembly process; use detachable joints such as snap-fit, screw or bayonet joints instead of welded, glued or soldered connections; use joining systems that can be dismantled after long periods of use; include symbols/pictograms to inform about disassembly process; try to concentrate in one area all components that can be recycled; avoid use of joints that require energy-dependent tools for disassembly;

Solution

The sixth step was to produce solutions informed by specifications (company and sustainable design spec.) mentioned in previous points. The concept which matched higher number of criteria from the total spec. was selected and developed in more detailed sketches (Figs: 2 and 3). In the images below it is explained the rationale of design features selected, and how they contribute to the sustainability of the lighting product. The concept selected was a modular lamp made of extruded post-consumer recycled aluminum (majority of the lamp) with no coatings. The source of light were LEDs feed with energy-efficient electronic drivers, which could be chosen with/without dimmers, and for different LEDs wattages depending on lamp model, price and customer requirements. The housing dimensions were designed to contain a wide range of drivers and LEDs types in order to allow customization and upgrading of components over time. Lighting units can be rotated 360 degrees (x axis) individually, and the whole lamp 360 degrees (Y axis), this altogether with the possibility to use different LEDs power in each unit allows flexibility of light distribution and intensity by the user. All units (lighting + transformer units) use the same extrusion matrix, thus saving energy and costs. The extrusion profile also allowed building several functionalities in one single component, thus reducing the number of components. All electronic components are installed in one tray which can be easily repaired/upgraded or separated at the End of Life (EOL). The weight and volume was reduced by using LEDs (requires small volume) and aluminum (light material).

Environmental impact assessment of the solution

The eight step was to assess the environmental impact of the product with Sustainable Minds (Sustainable Minds, 2010), a Life Cycle Assessment (LCA) software-based tool which is adopts Okala methodology (IDSA, 2010). This tool has been designed to carry out streamlined/screening assessments, during/after the design process. Therefore is very suitable for the initial stages of the sustainable design process, when initial proposals have to be assessed and modified along the design process. This LCA tool does not carry out a full detailed analysis; and although it is more reliable than matrix-based LCA tools, which rely on qualitative-subjective assessments, still is not totally objective and results should only used to guide decision making and not as a rule. A serial of assessments were carried out and results showed that total impact of the product using aluminum was very high.

Although recycling of aluminum was not considered in the first assessments, as usually there are no collection points established, the last assessments carried out not only considered the use of secondary (recycled) aluminum but also the collection of this to be recycled, resulting also in high impact. After these considerations, an analysis was carried out using secondary High Density Polyethylene (HDPE) which was also recycled at the End of Life (EOL) to check if this material was more suitable. The second option using HDPE resulted in much lower impact (Fig. 4) 65 against 100 in the aluminum version. Furthermore it was observed that impact differences were not dependent on the material used (in trials with recycled versions) but in the manufacturing (extrusion) process (Fig. 5), being more energy-intensive in the case of using aluminum than using plastic. In addition to this, the highest impact phase, as expected in energy-using products, was the use phase, followed by manufacturing. It has to be noted that packaging and LEDs + drivers was not considered in the assessment. The assessments provided useful data to inform possible modifications (Re-design) of product's materials.

Approach framework

As it can be seen in the conceptual framework (Fig. 6), the sustainable lighting product design approach implemented begins with a life-cycle or systems perspective, which takes into account every stage of the life-cycle of the product, thus creating awareness of the impact that might be caused in every single process/activity along the lighting product's life. Once an overall perspective is understood, the scope of the eco-design action is decided. The present case was focused on eco-innovation, not eco-redesign, thus there was no "reference" product to assess and compare to create the briefing; Instead, an "ideal reference" product was created in the briefing (problem definition), which comprised: traditional spec. (typical in other product design processes) and sustainable lighting product spec., being the latter informed by legislation-directives, Life Cycle Assessment (LCA) case studies, eco-design guidelines, checklists and rules of thumb related with lighting products. Problem solutions were then created to match or approximate both types of design spec; Solutions closer to fulfilment of all specs. were then selected and described in a process-tree (where boundaries were set) in order to understand the quantity/quality of processes and materials used, which were required for the screening/streamlined preliminary LCA carried out by software-based tools. Results from this assessment not only informed total impact of the product, and where (in which stage) took place, but also assisted in trying "what if" scenarios by modifying materials and processes and observing the effect these changes have in the total impact. This stage informed (feedback) the creation/modification of improved solutions in a continuous loop.

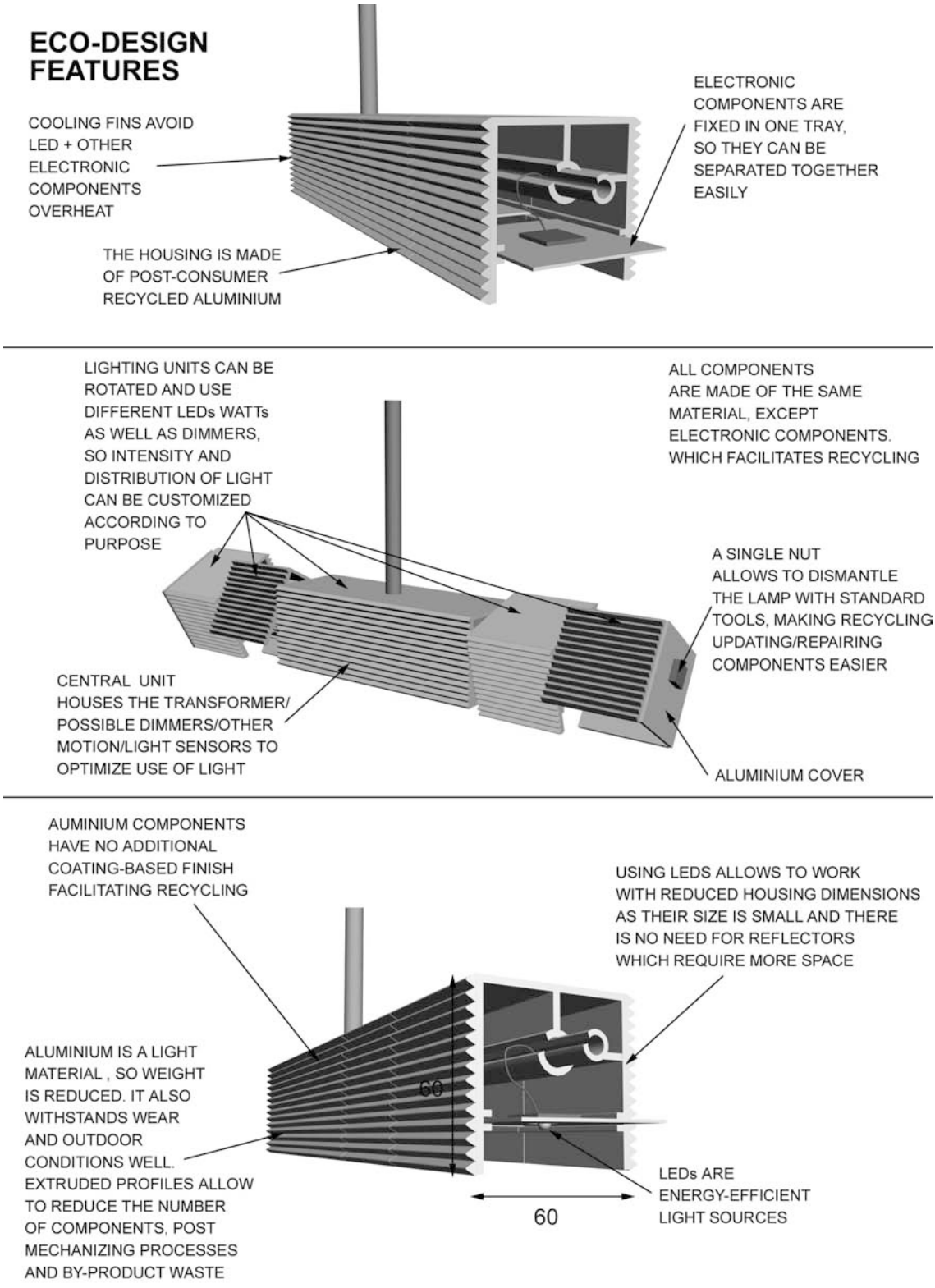

Figure 2: Lighting product eco-design features

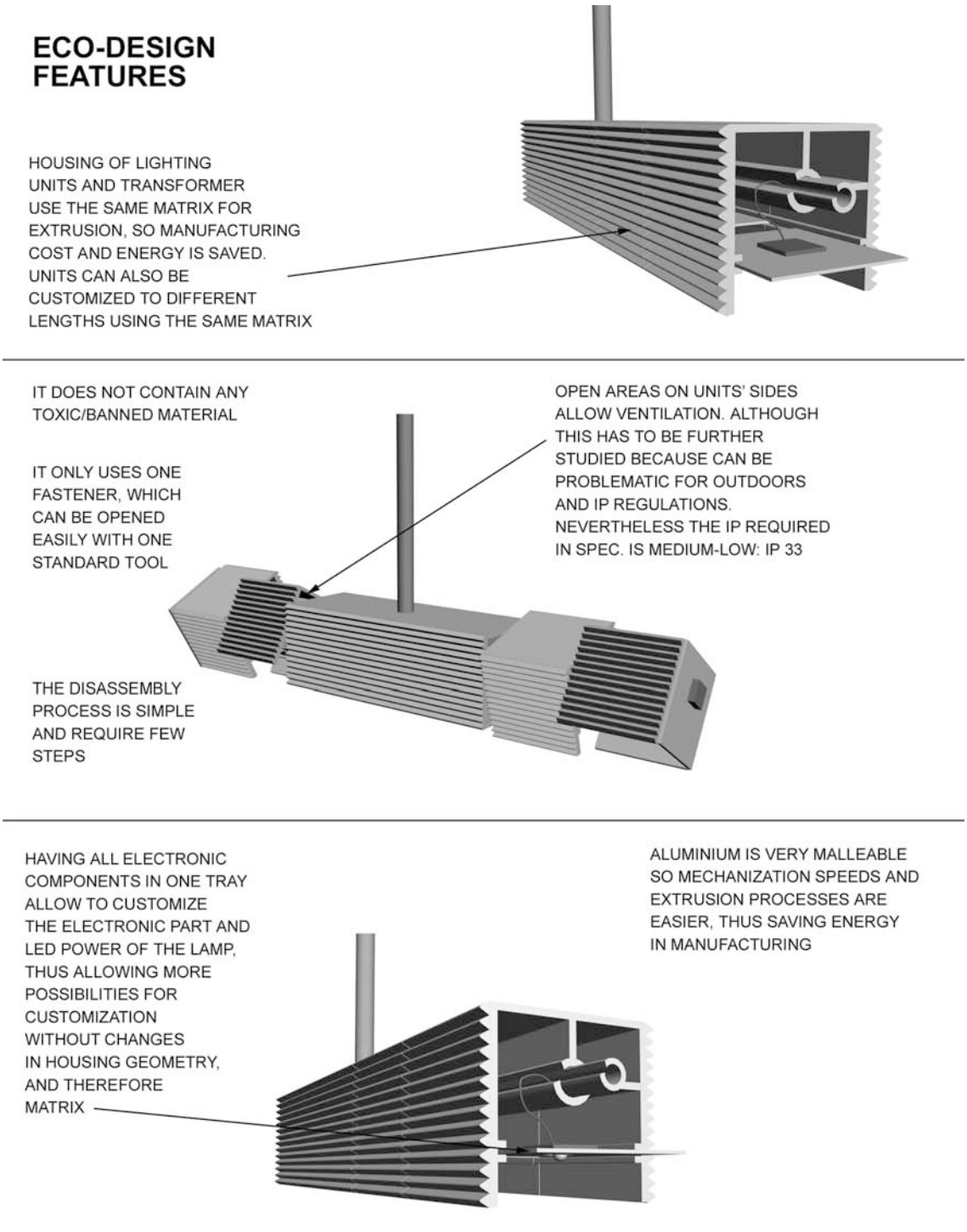

Figure 3: Lighting product eco-design features

System BOM | Results

Scorecard

Printable view

	Reference	
	Copy of SIN-1_aluminium recycled_EOL recycled	Copy of SIN-1 - recycled plastic EOL recycled
		
		36% impact reduction
Impacts per functional unit	**100** Okala mPts Per 7 hour of use	**65** Okala mPts Per 7 hour of use
Total amount of service delivered	**14 x 7 hour of use**	**14 x 7 hour of use**
Impacts of total service delivered	$1.4x10^3$ mPts	910 mPts
Assessment level	Estimate	Estimate
Greatest impacts		
SBOM input	Electricity, 120 V, EU	Electricity, 120 V, EU
Impact category	Ecotoxicity	Ecotoxicity
Life cycle phase	Use	Use
Total impacts by impact category		

Impact category	%	Impact category	%
Ecological damage		**Ecological damage**	
Acidification	0.07	Acidification	0.5
Ecotoxicity	55.15	Ecotoxicity	64.94
Global Warming	0.65	Global Warming	0.35
Ozone Depletion	0	Ozone Depletion	0
Water Eutrophication	0.03	Water Eutrophication	0.02
Resource depletion		**Resource depletion**	
Fossil Fuel	0.1	Fossil Fuel	0.02
Human health damage		**Human health damage**	
Human Respiratory	0.11	Human Respiratory	0.07
Human Carcinogens	21.23	Human Carcinogens	21.96
Human Toxicity	22.63	Human Toxicity	12.06
Smog	0.03	Smog	0.09

Figure 4: Environmental impact assessment and comparison of results using different materials (using impact category and total Okala score)

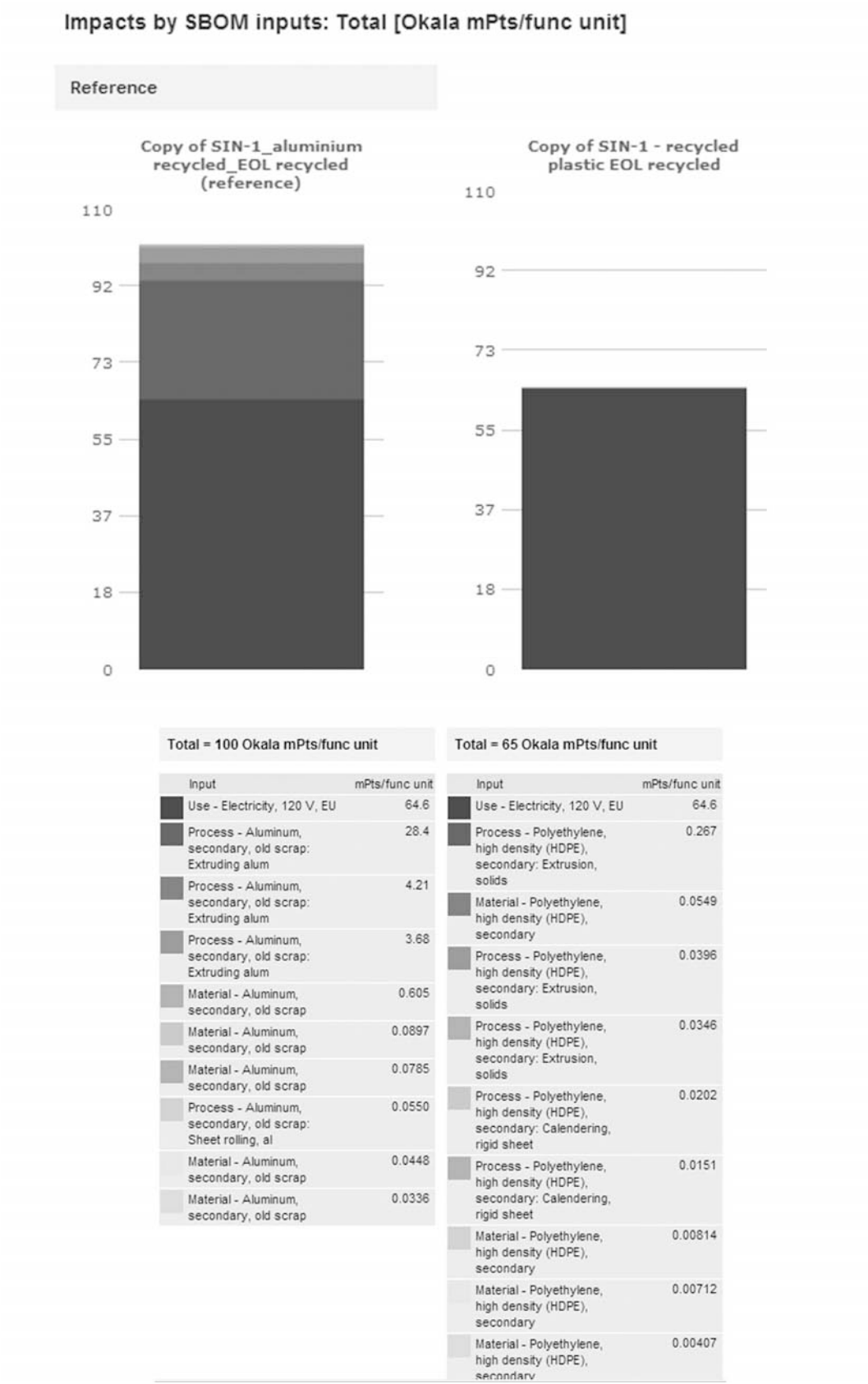

Figure 5: Environmental impact assessment and comparison of results using different materials (using part + process input)

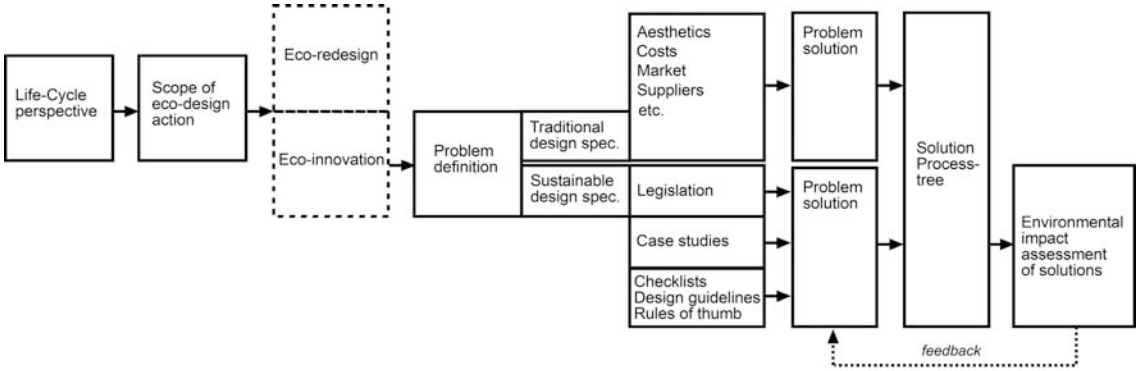

Figure 6. Approach framework.

Conclusion

This paper has shown through a case study the first stages of the development of a new approach for an on-going sustainable lighting product design. This approach has adopted a life-cycle perspective and has focused on eco-innovation where, unlike usual eco-design actions (eco-redesign), products are not taken as a reference to build the briefing or specifications. This fact creates the need to build an initial "ideal reference" with specifications from company's product strategy and sustainable lighting product design criteria; the latter being obtained from sustainable best practices, case studies, eco-design guidelines, checklist and rules of thumb. This methodology allows greater possibilities for eco-innovative lighting products, opening possibilities at the beginning of the design process, whilst keeping in mind sustainable design criteria. It also allows the possibility to "narrow down" or refine concepts through Life Cycle Assessment (LCA) screening/streamlined tools in order to find out quantitatively total impacts per product, and where (which phase) these take place, in order to make design modifications to reduce the total impact. This iterative loop of synthesis-analysis, aims to eliminate/reduce the impact of lighting products at the initial stages of the design process. However, this approach does not consider social impact, so it does not reflect a comprehensive sustainable assessment. In addition, although LCA screening/streamlined software-based tools suggested useful information having an effect in changes in the material used which were not detected after following design guidelines; these (because are simplified tools) may not offer reliable data and may provide quantitatively misleading data in an effort for simplifying a very complex assessment indeed. It remains a mystery to know how the scores of each material and process used in this software have been obtained and how these can be applied (generalised) to any context, when impacts are strongly dependent on context. Furthermore different software-based tools can provide different results?; confirming the problem of using simplified scores, and pointing out the core importance of databases and characterization and weighting methodologies. Nevertheless, they provide another aid to guide the complex sustainable design process.

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Design oriented mass customization for sustainability

A sustainable approach for product development in furniture sector

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In the modern society, sustainability is a theme that nobody can ignore and design is playing a remarkable role in this context; consequently, design for sustainability becomes a key concept in the process of product development.

Mass Customization (MC) is a well developed topic for couple of decades which is generally described as a positive strategy to improve marketing requirements in a large scale production. In order to satisfy the customers, companies are trying to provide larger product variety and more product differentiation that somehow results to over production and over inventory. In this context, "Mass customization equals sustainability: the amount of products which are not sold corresponds to such a huge batch of energy without any use at all (Sergio Dulio, 2009)" then became waste. Therefore, MC will possibly be an approach for sustainability, while design oriented customization will support sustainability from design perspective.

The research pays close attention on MC case studies in automobile and furniture sectors as best practices, and then investigated into furniture sector aiming to recommend design guidelines and tools as sustainable solutions for MC product development.

For future discussion, MC is potentially to reach "sustainable business (J.Pine, 2009)" and sustainable product development process.

The changing market and production environment

The UN World Commission of Environment and Development pointed out for the first time in the "Our Common future" report in 1987 that "a development that meets the needs of the present without compromising the ability of future generations to meet their own needs." In 1991, the World Conservation Alliance, United Nations Environment Programme and the World Wildlife Fund have jointly proposed the framework "Caring for the Earth: A Strategy for Sustainable Living ", (C.Vezzoli, 2007) which purpose is to promote a sustainable development between the ecological environment and human future generations.

Parallel, in the era of experience economy, customer satisfaction is playing a role more and more important than the industrial time, and has become the core status of what the enterprises desire, while they are facing an uninterrupted trend toward individualization in all areas of life. Individualized customization is becoming an effective way of meeting the customer's individual requirements (Y. Yang, X. Zhang, 2005), (J. Liu, F. Xu, 2006). Customer satisfaction has been the central to modern quality. Enterprises are struggling to improve customer satisfaction and loyalty, through improving the capacity of quick re-

sponse and technical innovation, and provide the best quality and excellent service of product with customer and market, and then they will be more competitive to win the final victory of fierce market competition (Jiang.X., Liang.S., Ding.W., Wang.W, 2007).

For purpose of improving the market strategy and focusing on customer satisfaction by providing more and more product varieties and variance, which will obviously result in over production and over inventory in a certain extent. This excess amount of products and stocking relevant matters will become wastes both to the manufacture companies and the environment.

Therefore, some companies are trying to meet the individual needs while not to burden manufacture production, which forwards to the direction Mass Customization (MC). It is a deeply investigated topic for couple of decades and devoted "…to offer individually tailored products and/or services on a large scale (Zipkin 2001)". In the Italian furniture industry, principles of MC started being applied in 1970's before the very concept was identified and described in the production and marketing literature (Pine, 1993).

Box 1: Furniture customization origin

Source: Renato De Fusco, 1985

> "From the mid seventies Italian furniture companies developed a new architectural concept based on a completely configurable structure."Another remark on the component 'production' of Italian furniture has given the fact that, in order to have a wide range of models in catalogue, few companies are equipped with machines with lots of monovalent rather than polyvalent, as befits other industries. Again, with regard to its reserves and storage, it mainly consists of parts and components rather than finished products, which results in the user the impression that the furniture industry commissioned works."

In his book "Mass customization, The New Frontier in Business Competition" (Pine, 1993), Joseph pine presented that MC is "process by which firms, in different industries, apply technology and management methods to provide product variety and customization through flexibility and quick responsiveness" building strategic advantage and economic value. Consequently said Frank Piller that "Mass customization is the practice of creating products and services linked specifically for individual customer" (Christoph, Pille, 2003)(Piller, 2003). MC presents a paradox by combining customization and mass production, offering unique products in a mass-produced, low cost, high volume production environment (Duray, 2002). For couple of decades, mass customization has been perceived as the future of industrial production, and for some ones it potentially will always be.

Most of the literature on customization were developed in production and management fields, as well as MC has been developed in the major industries that some remarkable cases of MC can be easily found in many products and service sectors, such as DELL, Mini cooper, NikeID, 121TIME, M&Ms. "Dress it up, Drive it out" is the 2007 customization program slogan by Toyota, communicating the possibility to customize the Corolla, one of the world's most popular cars since its launch in 1966: actually, the customization possibilities given to the customer are the result of the complex combined management of design, production and logistics principles (Qian, Deserti, 2009), and given to the environment are sustainable solutions by reducing tangible and intangible waste, such as to low consumption of raw material, and reducing the requirements of inventory and transportation.

What is design oriented mass customization?

A formal literature study was done concentrated on 78 historical milestone resources about mass customization research and development, with 92% (72/78) papers/books were written from 2000 to today. The areas interested in mass customization are:

- Marketing/management oriented Mass Customization,
- Production/engineering oriented Mass Customization,
- and Design oriented Mass Customization.

Table.1 indicated that 42.3% of the authors are from the background of marketing or management related, 51.3% are engineering or production related, and only 6.4% of them are directly or indirectly

design related. For an instance, the remarkable authors' background who are dealing with mass customization are as following:

- **Frank Piller,** Technology & Innovation Management Group of RWTH Aachen University, Germany
- **B. Joseph Pine**, Harvard Business School, Boston;
- **Thorsten Blecker**, Business administration; Technology, Institute of Business Logistics and General Management, Hamburg, Germany.
- **Mitchell M. Tseng**, Industrial Engineering and Logistics Management Department, The Hong Kong University Of Science And Technology.

Table 1: The areas interested in mass customization

Areas	Marketing/management oriented MC	Production/engineering oriented MC	Design oriented MC
Definition	It's a business strategy that aims at satisfying individual customers who are no longer accepting standard products; "it can be a suitable strategy to outpace competitors and achieve a competitive business advantage." [Thorsten Blecker, 2007]	It's a production/ manufacturing strategy to simplify production planning and scheduling, as well as lower safety stocks. [K. R. Baker, 1985].	It will be an integrated strategy to achieve customization product development from design perspective, so that to facilitate production process and marketing operation for customization, and to serve end-users satisfaction.
Mainly deals with	-to provide more variety Product configuration	-to release production stress -to maintain production with stable volume and quality -lower inventory	- design of customization products; - design of the interaction between products and end-users.
Proportion of the authors'	42.3%	51.3%	6.4%

On the other hand, key research arguments areas on customization in this literature study could be categorized as table 2, and again it indicates that the development of customization was concentrated in the areas of marketing and production, but the design role for customization is almost missing. Even *product platform and product architecture, modularity and commonality* which are logically design related but were discussed from production perspective.

Table 2: The areas interested in mass customization

Key research arguments areas	Proportion
Product platform and product architecture	17.95%
Agile production and logistics	16.67%
Modularity and commonality	33.33%
Co-design and shopping experience	10.26%
Web-based MC and product configuration	8.97%
E-commerce	3.85%
Others	8.97%

Therefore, design oriented customization will be an integrated strategy to achieve customization product development from design perspective, corresponding with production system and marketing operation. So that to facilitate production difficulty and better server market requirements for customization, as well as to provide end-users satisfaction. Compare with engineering oriented customization and marketing oriented customization, design oriented customization will concentrated on product design/development and design of the interaction between the end-users and producers.

Mass customization related sustainability

During the process of customization development, it was generally described as a positive strategy for manufacture companies to better satisfy their market and customers with the idea of the larger levels of customization, the better serving the market. But in many cases, “Burden of choices, excess variety may result in an external complexity (Piller 2006)”. Consequently, the excess mass production and excess products, modules and product components which are unsalable will definitely become waste. And this waste is related with all the functions of a company, from the supply of raw material, production organization, inventory stocking, logistics, etc, as well as to some intangible factors such as power and energy, management.

Box 2: Case study of Peugeot 307 wire harness

Source: Catherine da Cunha, Bruno Agard, and Andrew Kusiak, Member, IEEE, 2007

> In this section, an industrial case study is discussed that considering the example of a midrange car – Peugeot 307, one of many assembles used in this car to distribute power and information within the vehicle is a wire harness. Potentially, there are seven million different wire harnesses that could be ordered (Agard and Tollenaere, 2002).
>
> The annual sale volume for this car model is about 350,000, but actually 90% of the sales of this car model constitute 20% of the portfolio (Kocher and Rolland, 1995).

Case study of Citroen C3

Customization is deeply developed in automobile sector in the past 30 years. Car customization is developed in the areas of engineering and marketing, somehow as well as design but mostly only the painting and look of the car.

When Citroen C3 was launched, which is one of the best car sales till now, there were three fixed models presented into the market:

- IDEAL
- PERFECT
- EXCLUSIVE

As illustrated in Figure 1, actually, these three models were pre-defined according to the car engineering combination and cost. The IDEAL model is the basic Citroen C3 with a low price, well the PERFECT model is middle level and EXCLUSIVE model presents a very good combination with high price. Besides these three models, the customers could further customize their own options by adding, subtracting or changing some modules based on the three promoted models.

Figure 1: Citroen C3 customization models

These two cases demonstrate that the excess products or product components would not increase the satisfaction neither to the end-users nor to the company. On the contrary, the excess portion will burden the production organization, and make the customers confused by too many choices and it will be difficult to make buying decision. When there are fixed and clear options, it will be much easier to the customers to choose and make further customization.

Therefore, the benefit of sustainability linked with customization could be expressed in two ways:

1. To better serve the market, using customization as a strategy to reduce over production and over inventory, which means to reduce waste of all the manufacture process;
2. During the customization process, some pre-defined options will help the customers to make buying decision, and leave enough space of customization to customers for individually satisfaction.

Investigation of customization related sustainable product development into furniture sector

Furniture is a specific sector of the customization development considering some aspects related with the product features which approve the importance of customization of furniture:

Product characteristics related with the requirements of customization.

- the product must fit different environment
- the product must fulfil different and individual needs

Furniture characteristics linked with stock and delivery

- Product is generally in big dimension so that needs space to stock and deliver;
- Customers could not see all the physical product varieties when they want to buy furniture in a shop (or point of sale)

Furthermore, furniture characteristics linked with product design for customization;
Furniture MC is more complicated than the other industrial sectors (general MC is focusing on single product, while in furniture sector there are three levels of MC):

- Product customization based on single product;
- Product customization based on the coordination of groups of products;
- Product customization based on the coordination of products and the environment.

As previously saying, customization is an effective strategy for furniture companies to better serve the market and meanwhile to reduce the production difficulty for product variety. Customization is also an effective strategy for product development considering from sustainable perspective.

Going on this premise, and according to this principle and the previous research, we can classify home furniture companies into mainly three categories which are *Non-Customization, Mass Customization, and Full Customization by product Configuration.* (Table 3)

Table 3: Furniture companies mass customization degree models

Category	**Non Customization (Mass Production)**		**Mass Customization**		**Full Customization by configuration**
Products	Bundle of products	Single pieces of products	Combination of modules + finishing	Combination of modules + finishing + accessories	Variable products based on product platform
Production organization	Make To Stock (MTS)		Modular Make To Stock (MTS)		Make To Order (MTO)
Stocking model	**Simple Stocking: Produce and stock end-products**		**Complex Stocking: Product and stock modules, components, and accessories**		**JIT (Just In Time) Produce and sell by order, no stocking**
Product Architecture	No architecture		Modular architecture		Product Platform
Market segment	Early markets; Mid to Low-end level markets		Mid-developed markets; Mid to High level markets		Mature markets; High-end markets
Example	Developing countries Model		Scandinavian Model (E.g. BoConcept)		Italian Model (E.g. Poliform)

Concentrating on the stocking model of these three customization models, non-customization model is a forepart of the development process of furniture companies when they are exploring to the market and trying to provide as much variety as possible in order to fill the market space, with bundles of mass produced products or single product pieces. Products are simply produced and stoked in the warehouse or point of sale then put into the distribution channel to sell. The risk of over-stock is obvious and also other

associated problems. Companies staying in this stage have their specific market which is the low and low-end ones; well they are in a quite competitive and difficult situation especially when the competition is from raw material, energy, and recourse. So it means when the unsalable products became waste, that is the waste of raw material, manufacture process related labor, power and energy, space of stocking and transportation, as well as production organization.

In the middle developed markets to high furniture markets, hereon Scandinavian Model is typical demonstration, there are no end-products stocking but only product modules and components. Customers will configurate their favorite end-products from modules and coherent CFM (colors, finishing and material). Apparently, there is a further level of furniture customization from this basis that in some special cases such as beds, there is also the possibilities to combine some accessories such as bed sheets and cushions in order to better serve customer needs.

The typical Italian furniture company model is Full Customization by product configuration. There are no pre-produced products stocking because the production is Make to Order organization. Customers will have the possibility to fully customize their furniture with the help of salesperson in or make it online easily, and then the production system will produce by the order, with the industrial operation based on product platform. This fully customization model usually happens in the mature markets and high-end markets where products are required to be variable and unlimited number of varieties. Whereas, the risk is to serve a faraway market when the shipment delivery takes months to cross the ocean and the assembling in location makes the quality not reliable.

To some extent, the category differentiation is the process of customization in furniture companies, whereas Fully Customization by product configuration is not the ideal situation that all the furniture companies shall move forward to, but it is only one of the customization situations. In other words, a furniture company can stay in the situation of Non-Customization serving the specific market segment; or partly implement MC into some product lines and keep mass production for some other product lines at the same time; or implement fully customization.

As a matter of fact, these three models of customization demonstrated also the sustainable results from both the development of a company, and the impact to the environment. Most of the developing countries' furniture industry is under the Non customization model, which means it is a tough competition of raw material, labor and other resources. While in the other two customization models, the added value of products by customization, reduce over production and over inventory which brought less impact to the environment.

Recommendation design approaches to product customization for sustainability in furniture sector

From the prior research and analysis of furniture companies' categories based on MC situation, we can see that some furniture companies are in the Non-MC status but going forward to MC due to the development situation and some ones shall develop to a further level of MC.

To the furniture companies who intend to implement and develop MC from sustainable design point of view, we propose six different approaches, according to MC level of complexity, giving coherent recommendation and suggesting tools to each approach. As design guidelines, these approaches will provide more opportunities to furniture companies of implementing customization design, as well as to realize sustainability in a certain way.

(1) Customization based on CFM variety

CFM variety is to customize products by changing colors, finishing, and material which is the simplest way of customizing furniture and it is also the last step of customizing products in the other MC design principles. Usually, furniture companies will not produce or present many varieties of a product considering about the problem of stocking and limit space in showroom. Customers can order a piece of furniture, which they like from the point of sale or website, in a different color, finishing and/or material within the choice possibilities offered by the furniture company. Coherently, the furniture companies will present a panel of colors, finishing and materials as the possibilities that their customers can choose, and mostly

these choices will follow the design trend in order to feed the need of some customer looking for a popular or fashionable solution.

Figure 2: BoConcept Sofa *Milos* CFM variation

Image available at: http://www.boconcept.com/Default.aspx?ID=100924&ImageID=128&flashimageid=0

(2) Customization based on modular design

Modular design is an approach widely used in many product and service customization sectors, such as automotive, PC, fashion, financial service, as well as in furniture sector. “Customization is often achieved by changing, assembling, or modifying standard products according to customers’ desires” (Pine, 2003). The innovative methodology in MC is to design and produce product parts and components, or design in modules but not complete end products. Pre-design general structure or architecture base or a set of these, in another word is to disassemble product into parts and modular components to pre-design. So in this way, MC is based on limit number of industrial produced components and parts which could be easily combined into unlimited number of end-product varieties.

There are many ways to take advantage of modularized components that can be mixed and matched into customizable en products, such as illustrated in his book (Pine, 1993) Joseph Pine presented six types of modularity for the mass customization (see Fig.3) of general products and services which are suit also to furniture sector. These six modularity types are: component-sharing modularity, component-swapping modularity, cut-to-fit modularity, shelf modularity, mix modularity, and sectional modularity.

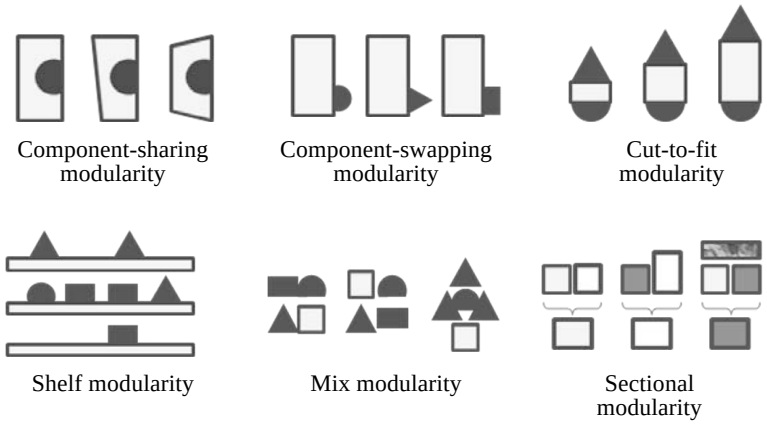

Figure 3: Six types of modularity for the mass customization of products and services

Source: Pine, 1993

(3) Customization based on product architecture

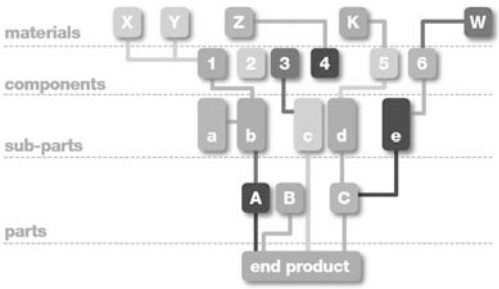

Figure 4: Product architecture disassemble

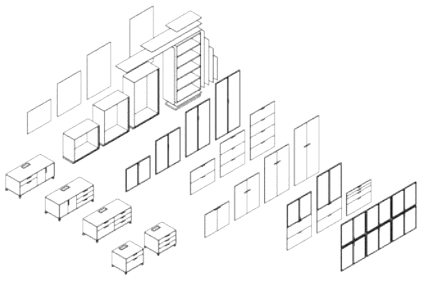

Figure 5: Cabinet and side table customization possibilities based on open product architecture

Customization based on product architecture is commonly in coherence with the idea of product platform, and the both factors are together integrated into general production, or applied to some individual product collection lines in production. The relation between products, from the MC point of view, is normally linked with the idea of product platform and product architecture (Yang, Beiter, Ishii, 2005). For the purpose to design furniture which is customizable with the idea of product architecture or platform, one solution is to simplify and standardize the product platform which is generally the technical or invisible part that is also difficult to improve evidently, and the aim is to keep the fixed base stable in order to release the burden of production operation.

Another possibility is to disassemble product design by product architecture (see Fig.4), and there is also the possibility to integrate the idea of product architecture into modularity design method, so that to leave more space and possibility to furniture customization by open product architecture (see Fig.5).

(4) Customization based on the relation between products and accessories

Customization based on the relation between product and accessories is more particular approach on furniture customization if compare with the former approaches. Furniture is a special home product with which people living together, so there is more emotion and feelings has been put into furniture, and something else to correspond or match the furniture is desired. Therefore, some design principles get along with the desires are:

- **Furniture can be "completed",** by some associated parts or accessories from functional point of view, such as containers or drawers to a wardrobe or shelves and boxes to a bookcase;
- **Furniture can be "associated",** from esthetic point of view with some free standing objects which are general go along with the furniture, such as vases to a bookshelf, candle stand, glasses and plates to a dining table;
- **Furniture can be "decorated",** by some associated parts or accessories from both functional and esthetic point of view, such as bed sheets and pillows to bed, or cushions to a sofa;

(5) Customization based on the relation between products in the portfolio

The total relevant factors of product collection identity are influencing the trade-off between commonality and variety in a product family design and development (Wonga, Wikner. and Naim, 2009). From functional and stylist point of view, reorganize product lines; cut off or re-classify some similar product collections to have clear product portfolio, which is easier both for brand identity building and production organization. For some similar design concepts of product collections, modify and reorganize from functional point of view to meet market segment needs variety. The product portfolio concept can be illustrated as (Fig.6)

Furniture is different from the general products because furniture is not staying or working alone as a PC or a car, but furniture is associated together with accessories and also other furniture at home. So the harmony and suitable relation between furniture leads to furniture customization principle of product portfolio strategies: **Flat, Deep, Skyline, Extensible strategy.**

- **Flat strategy:** means the product portfolio is wide (there are some different stylist collections) and high (there are some different functional product typologies), but not very deep variance of each single product, in another word, there are not many variants of CFM. The furniture company can better control the brand and product identity and provide some certain product styles with defined limited CFM variations.
- **Deep Strategy:** means the product portfolio is in deep variance of CFM, and it can be wide and high or not. In this solution, there will be less collections and short functional varieties is easier for production system, but with deep variance of CFM, customers will still have lot of possibilities to customize their favorite furniture and the furniture company keep a clear and identified product portfolio.
- **Skyline Strategy:** analogously, this is a mix of Flat and Deep strategy which means that there will be some different stylist collections, someone has high variety in product function, someone has deep variance of CFM, and someone has both high and deep variance depend on the requirement from customers.
- **Extensible strategy:** is also somehow similar to Skyline but less variance and variety, so the product portfolio is clear and well identified. The key point here is to leave the possibility of ex-

tensible variance and variety to stylist collections to be customizable. This solution is appropriate when a company started to build the product portfolio, and not putting much stress to production system at the beginning.

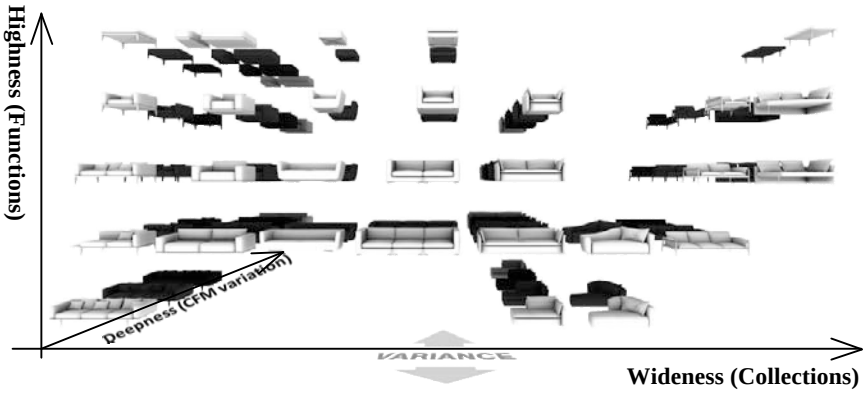

Figure 6: Product portfolio strategies

(6) Customization based on the relation between products and environment

As previously saying that furniture is a particular product sector which is always linked with other furniture, other associated products and decorations. Furthermore, furniture is also living in the home environment together with all the home stuff as we are; and furniture will present the taste and characteristics of the host. “Furniture companies such as Ethan Allen, Pottery Barn are successful not because they present a sofa, but because they create a look” (Tischler, 2003).

All the furniture and environment combination is a more complicated step of furniture customization. The relation with space is both a technical problem and a perception issue. For these reasons, buying a piece of furniture is a complex decision. Will it fit my room? Does it suit the rest of the furniture? (Qian, Deserti, 2009) From the overview that some pieces of furniture will be put into a specific space, to an entire space to be customized with furniture and the associated objects and decorations, furniture customization is much linked with interior design and environment depend on a particular lifestyle. As well as in the other customization approaches, CFM variance is diffusely used according to lifestyle.

Concerning space customization, which is becoming a trend in furniture sector, planer is a quite useful tool offered by many furniture companies on website or P.O.F to provide the customer a real-time overview in 3D perspective of the space which is a necessary contribution of furniture customization related with environment.

Conclusion and discussion

Furniture sector, as well as the others, is facing threats in the post-industrial era. Mass Customization is generally positive, but not omnipotent. It will be an effective strategy to improve the status if a furniture company is in the right condition to implement MC. Design can be seen as a key factor to reach the goal, not only for its traditionally strong role in the furniture sector, but also as an inter-functional link and as the most important factor in building an experiential relation with the customer.

Design oriented customization as a sustainable solution for product development is discussed in this paper. In order to reduce waste of material and energy for product development and end-products, customization promisingly is a positive solution considering about over production and over inventory. To improve and support customization from design perspective will help companies implement customization from the starting point of design, and reduce the possibility that products are unsalable, so that to reduce the waste of excess products and the related resources.

This research paid close attention into furniture sector which customization level is deeper than the other general industrial sectors. However, according to different sector features, the result of this research may be a little different.

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the Learning Network on Sustainability

Chromosustainability

Colour as an opportunity to define a new design and consumption model

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Politecnico di Milano, Italy

A need for change and a for a different approach to consumption is increasingly perceived in the fashion field. Such change should involve productive processes at a structural level, but above all, it should lead to a new definition of the value-dimension associated to the product.

As one of the fundamental elements in clothes, colour can but be part of this re-configuration process. Colour is at the heart of alternative routes to the conventional processes performed in the industrial field. Indeed, there is an increasing interest towards natural dyeing, viewed not only as an ecological process, but also as an opportunity to outline new design variables.

In this light, this paper aims at proposing scenarios in which colour can stimulate new identities and new project strategies, in which the nature/product relation would not only respond to technical and environmental needs, but it would also be the key to creating new product concepts. This can be done through the re-definition of the idea behind seasonal change, through the spread of a new aesthetics and through an increased level of perceived well-being.

In order to find out what companies do in this respect, and to understand what are the motivations that led to the choice of this kind of products, this paper take into consideration some case studies from different parts of the world. This analysis led to the definition of the geographical areas showing the highest degree of interest in this kind of products. It's also possible to identify the values which, on one hand, led these companies to the choice of working with natural dyes, and, on the other hand, motivated customers to chose this kind of products.

Through this analysis we are able to provide an international overview of the natural dyeing market, to identify the segment of reference, to define its emerging value and, therefore, the communicative aura these products could build around themselves.

Chromo*sustainability*. Sustainable Colour.

In the fashion field, there is a widely-felt perception that change is needed. Such change should involve the re-configuration of productive processes at a structural level, and above all, it should lead to a new definition of the value-dimension associated with the product. Today's political and economic situation leads to questioning the idea of the precocious ageing of the product (perceived rather than real), and to seek biological productive assets, in terms of the primary resources used and of the treatments performed in the later stages of production.

This 'green' approach was initially limited to the creation of products imitating the aesthetics of nature, which were not actually sustainable. Today, by contrast, such approach is intended as involving respect for the environment and for local human resources. It thus requires the re-structuring of the entire production chain, leading to products that both look new and have a new *ecological imprinting* (Manzini & Vezzoli, 2007).

Such approach has recently led to a significant increase in the demand for biologically-certified products[1], viewed not only as products with low environmental impact, but also as products that respect our body once they are turned into clothes.

As one of the fundamental elements in clothes, colour can but be part of this re-configuration process. Colour is at the heart of alternative routes to the conventional processes performed in the industrial field. Indeed, low-polluting dyes[2] have recently been introduced, and there is an increasing interest towards natural dyeing, viewed as a valuable alternative not only in terms of primary material (renewable and ecological)[3], but also as a traditional practice linked to local identity (both as resource and know-how).

We believe that in the fashion field, *sustainable* design can be pursued through a re-configuration of production processes and their technologies, but also, and more importantly, through a *cultural re-definition of the product*[4]. In other words, products must move beyond seasonal production and constant renewal, by looking at the value and identity of each individual product as elements embodying an evolving history, which nonetheless does not break with the past.

Between synthetic **and** natural

While open to new possibilities, today's consumption model is still based on mass consumption and consumerism. Therefore, the characteristics of synthetic dyeing are viewed as indispensable. This is why natural dyeing must comply to such dogmas, if it wants to play more than a marginal role in the textile market.

This is the direction research is moving to the development of production processes able to guarantee results comparable to those of synthetic dyes, both in terms of costs and in terms of performance on final products.

This paper will try to argue that an alternative route is possible, one that moves beyond conventional processes and starts from different assumptions to achieve different objectives.

We believe that the first step towards this aim is to identify what are the characteristics peculiar to synthetic and natural dyeing respectively, and what are their differences and common traits. The aim of this comparison is to understand if, and to what extent, the characteristics of natural dyeing, usually seen as limitations, can instead be viewed as strong points. It is precisely in these limitations (or qualities), that *design* must find the terms for a new approach and a different product concept.

From a productive point of view, synthetic dyeing offers all the characteristics typical of industrial products, namely potentially endless reproduction with the guarantee of foreseeable and reproducible results. Surfaces look even (unless uneven effects are deliberately sought), smooth and bright, and their colour-range is virtually unlimited. Its industrial processing and its easy-to-find primary materials guarantee low costs and reduced production time. On the other hand, the chemicals in the dyes are harmful, both for the environment during the manufacturing processes and for consumers, as synthetic dyes are aggressive and can lead to serious health conditions.

Dyes derived from natural elements, specifically plants, present very different behaviors. The characteristic perceived by the industrial world as being their greatest objective limitation is their sensitivity to light and time. In other words, fabrics dyed with natural processes tend to lose in colour intensity if exposed to sun rays for a given amount of time. This, in turn, means that clothes age more quickly, provided that there is an agreed parameter for the concept of 'ageing'.

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[1] According to ICEA (Istituto per la Certificazione Etica e Ambientale), in the last two years the demand for biological fibers has increased by 60%. Such trend is confirmed by the *Organic Cotton Farm and Fiber Report 2008*, which reports that in 2008|2009 the production of organic cotton was of 145,865 tons- 26 times more that in 1997|1998.

[2] For example, *azo free* dyes are increasingly used. These are synthetic dyes which do not release *aromatic amines*, which are toxic substances, often connected to cancer risk, generally released during synthetic dyeing processes.

[3] It is important to underline that natural dyeing is not necessarily a sustainable process. Indeed, when fabrics are prepared for dyeing, chemicals are often used to obtain a greater adherence of colour to fabrics. In addition, in order to obtain a wider range of colours from the same pigment, heavy metals are often used. This paper will only take into consideration processes that avoid such procedures and any other polluting procedure.

[4] Ezio Manzini envisions *«a social learning process [thanks to which it may be possible to share] new ideas on well-being, [by questioning] the cultural frame within which well-being expectations are shaped»*. Cfr. E. Manzini, *Idee di benessere (e idee sul benessere).*

A second weakness of natural dyeing is that it makes it more difficult to obtain even, smooth surfaces without imperfections. This is also due to the fact that dyeing processes are often hand-made; and even if such processes are transformed into industrial dyeing processes, they do not guarantee a perfect result because they have different needs and require different treatments. As dyeing materials come from plants, they, too, are subject to the variables of natural cycles. Weather conditions do not guarantee the same product quality every year; not all geographic areas are suitable for growing specific plants; not all colour shades one can think of can actually be obtained, but it is necessary to chose within the colour-range provided by the plants available. All these variables make it necessary for design to take into account the unforeseeable nature of the result. Even with reproducible processes, results can be, and very often are partially unexpected,.

In addition, higher costs are inevitable, because primary materials are more difficult to find and dyeing equipment needs greater storing space. Also contributing to higher costs is the hand-made quality of the dyeing process. It requires longer working times and, more importantly, specific and in-depth knowledge of all aspects of the production chain, from the growing of plants, harvest, drying, colour extraction, dyeing processes and the most appropriate procedures to best preserve the product.

If, on one hand, all the aspects taken into consideration above appear as limitations, on the other hand natural dyeing has a predisposition towards sustainable productive processes, and can provide an healthy relation with the body once naturally-dyed clothes are worn.

Selection of case studies and research methodology

In order to find out what is the response of the business world to these issues, and what are the motivations that led a number of small productive enterprises to chose natural dyeing and to re-construct a value system for this kind of products, a mapping was attempted of those international companies, with different backgrounds and objectives, which chose this particular market sector.

Essentially, the purpose of this research is to draw a picture of what different companies are doing in terms of natural dyeing. This is crucial in order to highlight the potential of natural dyeing and the urgencies of this emerging, yet still niche process within the fashion market.

In order to map these companies the following sources were used:

- specialised expositions:

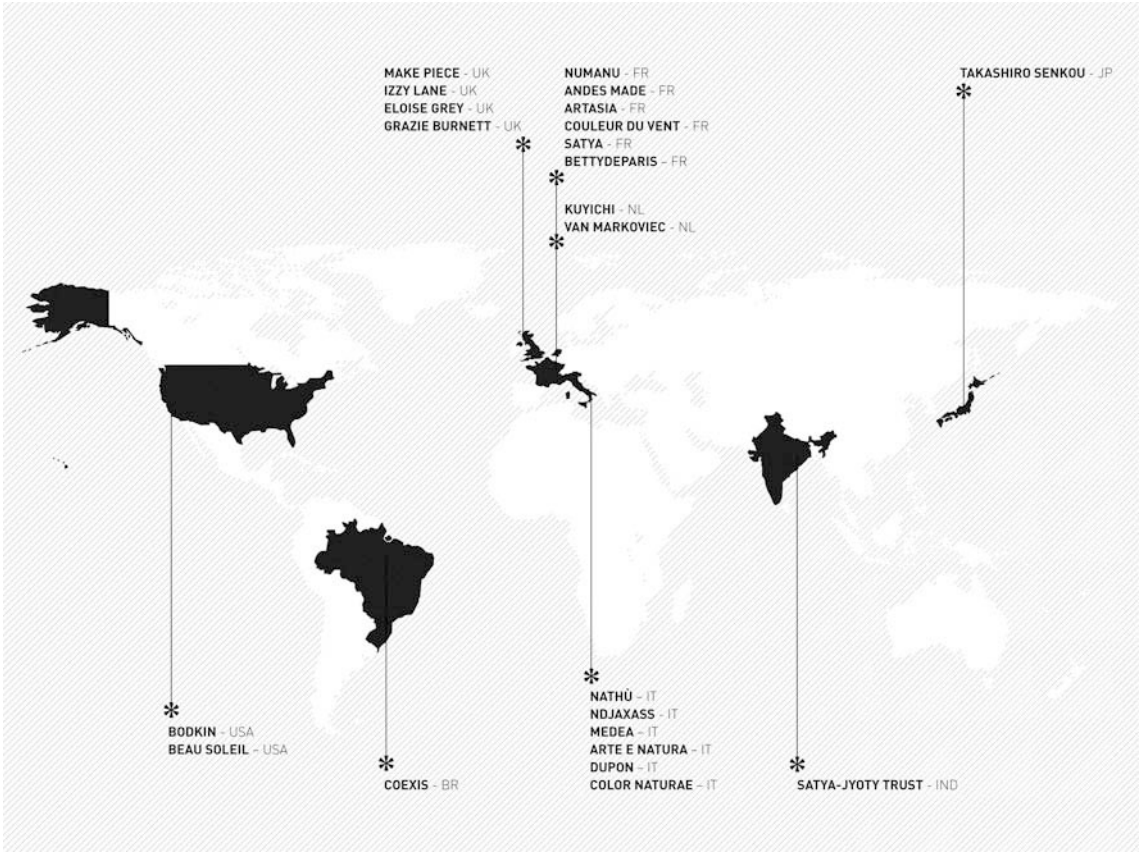
Ethical Fashion Show – Paris FR
Ethical Fashion Show – Milan IT
Ethical Fashion Show – Barcelona ES
Ethical Fashion Show – New York USA
Eco Fashion – Brazil BR
Estethica – London Fashion Week UK
Biofach – Nuremberg – Germania DE
Ethical Fashion Days – Genève SZ
Vivez Nature – Paris FR
Magic. Fiera Internazionale della Moda – Las Vegas USA
Pure – London UK
Pitti Bimbo (section *Ecoethic*) – Florence IT
Innatex – Germany DE
Ciff – Denmark DK

- direct contact with the following associations and groups:

Associazione Tintura Natura Maria Elda Salice – Milan IT
Natural Dyes International – El Prado MX
Ethical Fashion Forum – London UK

- web research[5]

[5] Research through the aforementioned sources allowed us to consider international companies, but it ruled out hyper-local small business with strong crafts identity. This was the result of the research methodology adopted, but



Picture 1: Map of selected case studies

Once the case studies were selected, three different levels of exploration were adopted:

- information was found through the internet and specialized magazines;
- companies were contacted and asked to fill out a questionnaire;
- in-depth, in person interviews were conducted.

Some companies, while proving to be very interested in the type of research proposed, were not available to offer comprehensive feedback. Thus, in these cases, web and magazine-based information was used. Other companies, however, proceeded with a qualitative survey, which revolved around seven areas of study:

- *ideology and company history*: the reasons that prompted the company to use natural dyeing;
- *the dyeing process*: types of dye used, strengths and weaknesses of natural dyes;
- *aesthetic features of the product*: peculiarities of this type of clothing, aesthetics, values, similarities and differences with artificial products;
- *product design*: the role of colour in the design process;
- *marketing and target*: identikit of *bio* consumers and sales channels;
- *communication of* p*roduct identity*: communication tools to describe the value of the product properly and effectively;
- *illustrations*: the last section aims at creating an iconographic database of products and processes.

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also of deliberate choice. This inquiry focuses on the potential of natural dying in more structured companies, which were able to win a specific market sector, thus confirming that a future in this direction is possible.

The *value* of natural dyeing

Picture 2: The value-dimension associated with the product.

The mapping and analysis of case studies has illuminated the value that the market attributes to natural dyeing, often part of a wider context of respect for natural and human resources. This is indeed the main point: through the choice of natural dyeing, it is possible to support a process that keeps the emission of pollutants to a minimum. Natural dyeing also fosters the cultivation of dyeing plants, which is often seen as an opportunity to encourage less intensive agriculture and allow for a more healthy planting rotation. Furthermore, a chemicals-free natural dyeing process improves the working conditions of employees/craftsmen- and aspect that is often underlined by the *humanitarian* characteristic of many of the projects analysed.

These considerations are connected to two other issues, as one can see in Picture 2[6]. The *promotion of local cultures* and the *consumer's well-being* have a rather prominent role.

Promotion of local cultures: in many cases the process of natural dyeing has its roots in the traditions of the remote locations where production takes place. Recalling these processes triggers a constructive relation between tradition and project, between a culture that preserves the traditional know-how and one that takes inspiration from it while continuously innovating.

Well-being: as suggested and confirmed by scientific analysis[7], natural dyeing inspires a positive exchange between body and clothes. It is a sort of well-being suggested not only by the colour composition but also by the natural, non-synthetic origin of the colour (plants), by the lack of chemical substances, and by the fact that natural dyeing implies working with non-synthetic fibres, which in themselves guarantee a greater respect for the human body.

But equally important is *natural aesthetics*, which contains all the choices made for pure love of natural colour. In this case, the values recognized so far are merely a pleasant consequence of the main choice: working with natural colours because we recognize that they have an entirely different aesthetic,

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6 The picture is based on Values of the case studies analysis.

7 Cfr. Harald Böhmer, *Koekboya. Natural Dyes and textiles. A Colour Journey from Turkey to India and Beyond* (Ganderkesee: Weppert Schweinfurt, 2002); S. Dhingra, «Textiles with a healing touch,» in *Fashion and well-being? – 11th Annual Conference for the International Foundation of Fashion Technology Institutes (IFFTI)* (London, 2009); Richard Gerber, *Vibrational medicine for the 21st century.* (London: Piatkus Publishers Ltd, 2000); Pamela Visconti, *Orientarsi nel colore. Per una dialettica cromatica degli oggetti*, PhD Thesis, Politecnico di Milano, Industrial design and multimedia communication, XXIInd cycle, Milan 2010.

which simply cannot be obtained with synthetic colours[8].

Another factor in choosing natural dyeing is represented by something one could call *poetics of the product*. Often, natural dyeing is part of the world of crafts processes and techniques, as the very process of natural dyeing is in itself largely hand-crafted. Colour is therefore part of this poetics, which sometimes evokes a return to the masters of *haute couture*, which makes final products *exclusive*, high-cost and elite.

Producing in a natural fashion means to see value in such process, to identify with this value and make it the purpose of one's activity. Similarly, *dressing in a natural way* means to understand the narrative of a natural product and decide to be part of that story. It is not only a matter of taste, but a *lifestyle* that becomes a message conveyed through one's clothes.

The sector's *urgencies*

The situation outlined above describes the values of natural colour, as perceived by the industry and by the market niche that chooses it. However, these values are often hidden and remain an unrealised potential, as this market sector is still undermined by factors that hinder its growth:

- *Crafts-design synergy*: products are still too often associated with folklore, therefore with old-fashioned aesthetics, or too characterised by an ethnic feel, thus confirming the preconception on their poor aesthetic value. Although a re-interpretation of local know how is often claimed and hoped for, design contents are often undermined by a sharp focus on technical aspects. An improved and more mature synergy between crafts and design is therefore needed, in order to create contemporary products whose appeal is not limited to those interested in the project's ethical value.
- *Sharing new aesthetic values*: once the aesthetics of nature has been re-interpreted and its value enhanced, it is necessary to share and to educate the public to a new consumption model, characterised by the awareness of the impact caused by one's choices, by renewed objectives and qualities attributed to fashion products and by sharing new aesthetic values.
- *Communication system*: manufacturers often rely on the idea that products can *speak for themselves*, without the support of an adequate communication system aimed at enhancing their value. On the contrary, it is necessary to convey and emphasise (without lying) the processes and history that turned these products into *re-invented* objects.

Design's answer

The inputs emerged from the mapping of companies working with natural dyes, and from the analysis of their performance, are a good starting point for design to provide answers by harmonizing the variables, issues and opportunities analysed so far.

According to the *LCD-Life Cycle Design* (Keoleian & Menerey, 1993; Manzini & Vezzoli, 1998) discipline and, more generally, according to environmentally-minded design, the qualities of natural dyeing do not apply only to the finished product, but they more or less directly influence the different stages of a product life-cycle (*pre*production, production, distribution, consumption, disposal).

[8] A difference between natural and synthetic colour is layering, that is, a process by which secondary nuances are obtained through additional colour baths; by changing the bath sequence, the outcome also changes. As a consequence of this procedure, natural dyeing allows for deep and virtually infinite colour nuances, which simply cannot be obtained through synthetic dyeing.

As far as natural dyeing is concerned, it means to take into account all the qualities considered so far, and to understand in what ways they may influence the entire cycle while finding the specific tools and objectives that can improve their importance.

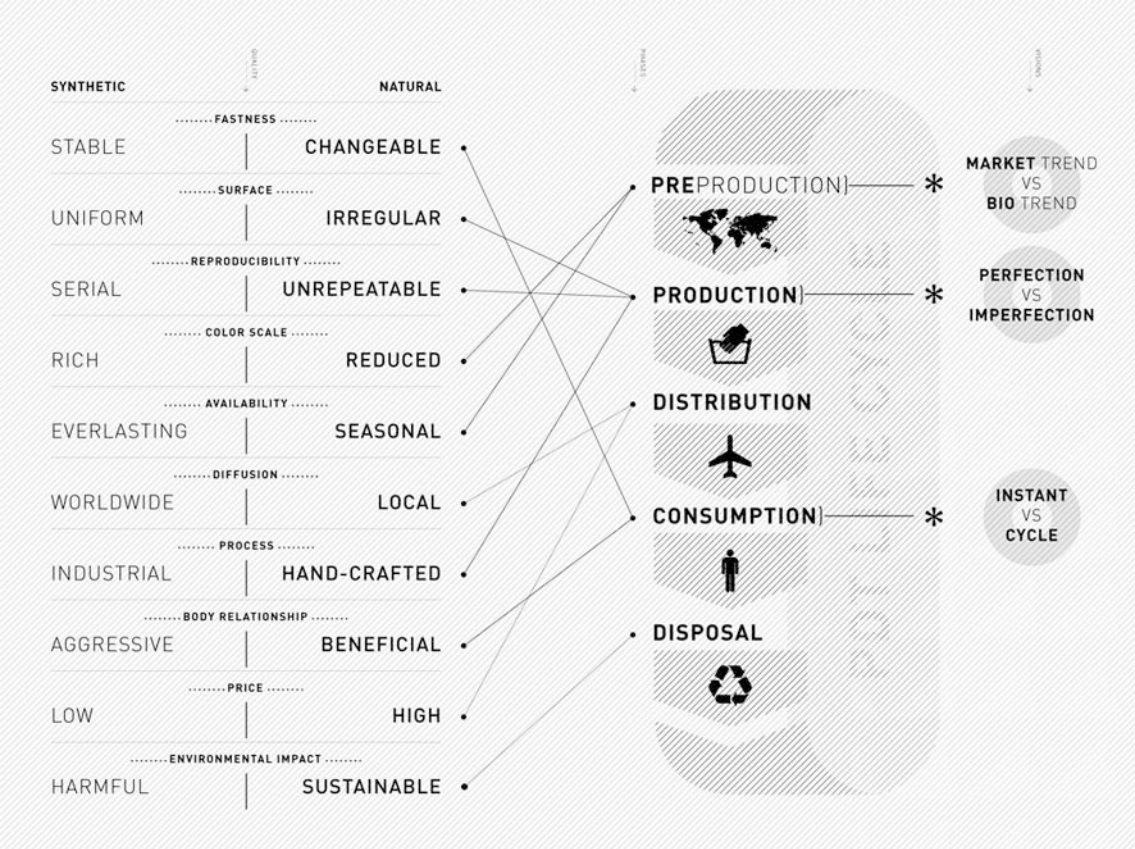

Figure 4: Influence of natural dyeing on the product life-cycle.

Preproduction: *Market*trend vs *Bio*trend

The organization of today's fashion industry is entirely based on a schedule imposed by the market. Colour follows seasonal trends which are often dominated by commercial needs, and which are only marginally the outcome of a critical interpretation of social and cultural contexts. The role of the *trend (o colour) forecaster* (Diane & Cassidy, 2005) is that of evoking, with chromatic *palettes*, the shapes and colours that will appeal to consumers in the near future. Seasonal trends are an advantage for the fashion industry, as the fast aging process of the value of products means a greater impulse towards sales. Trends are, therefore, the engine of today's market; but while they provide a reason for its dynamism, their consequences are not coherent with the aim of sustainability.

In contrast to these dynamics, deeply rooted in the production and consumption models typical of the fashion product, natural dyeing offers a different approach.

(Bio)colour diversity: a design based on natural dyes cannot start from a chromatic point of reference, with the aim of reproducing it and imitating its shade, intensity and brightness. This is something typical of synthetic dyeing -a different world. In natural dyeing, rules are made by nature, and it is according to nature that designers need to work. As with every system, the first rule is to know the rules of the game; in this case, it is necessary to know the behavior and qualities of the plants we work with. Dealing with plants means to deal with their ripening and harvest time, with drying processes and colour-extraction processes. The first variable designers have to face is biodiversity and the qualities of specific plants. Based on these assumptions, it would be possible to recognize new qualities in colour biodiversity: colours would not simply be colours, but they would be colours with a history, a life experience, and with characteristics that make it unique. Accordingly, for instance we can think of dyes as *vintage dyes*- a concept much closer to the wine world, and to the principles of the *Slow Food* movement, than to the world of fashion.

If colour is given new meanings that lead to new synergetic perceptions, the need arises for new systems of classification and communication (geographic and botanic origin, year, harvest season, transformation processes). In the design stage, new preconditions for the chromatic selections are also needed. Thus, dyeing substances are at the same time the result and the guarantee of biodiversity, as well as the vehicle of territorial characteristics. This model can only make sense if interpreted within the wider and more radical transition of today's society towards a sustainable lifestyle. As Manzini (2007) hopes for, this transition requires a social process of learning through which, step by step and after trials and mistakes, members of society will learn how to live better while consuming less and re-generating the quality of their habitat.

Seasons: the topic of seasons is to be seen is close relation with the issues discussed above. It goes without saying that plants are not available all year round. As we have already mentioned, each kind has its own period of top chromatic ripening. Such limitation can be avoided by drying the dyeing elements. However, the tie with plants' ripening periods can be viewed as a limitation but also as an opportunity to re-define seasonal change. *Fashion colour* is replaced by *season colour*, in which the *nuances* are not decided beforehand according to a *top-down* logic, but are derived from the opportunities provided by plant growing. This does not mean to undermine creativity; indeed, nature provides ingredients that need to be elaborated, mixed, interpreted according to the designer's taste and experience. With natural dyes, the aspiration is to create an idea, a concept, an evocation rather than a chromatic code.

The designer works as a *bricoleur* (Lévi-Strauss, 1964; Floch, 1997), o better as a *cuisinier*, by matching *«stable, given signs with an autonomous and creative new assembling, [and] by establishing a speaking subject which is other than the original project»* (Floch, 1997).

Production: Perfection vs Imperfection

The close relationship between raw material and territory involves the important issue of traditional know-how, which in turn is at the heart of processes and techniques. This issue pushes production systems to exploit the territorial identity of raw material.

Concerning natural dyeing, the territorial aspect is important for two related reasons. The territory generates and characterizes the raw material, which inevitably influences the final product.

Only a design that takes into account this relation and this history can build tools and methods that do not merely evoke a practice anchored in the past, but operate *with* and *through* it to build new objects. These objects would be different from traditional objects, but also different from those generated by contemporary supply chains. It is necessary to reset the production processes and review the planning goals, with due consideration for the emotional value of the object.

Besides the crafted nature of the dyeing process leads to potential errors, which are unpredictable and random.

Regarding the natural dyeing process unpredictable results are not caused by machines, or at least not only by machines. It is the essence of the matter that produced unpredictable results. This involves not only an adaptation of design tools, but also a redefinition of the parameters of product quality.

The designer has to allow room for the matter to be creative and then tweak the outcome, by enhancing it or hiding it as needed. One has to see added value in imperfection, both in the design phase and in terms of the finished product.

If in a traditional model, the designer operated upstream in the process, planning all the stages and having absolute control of the result: in this new model, a *non linear planning* (*fragmented and synergetic*) is needed. A planning that acts on the product in the final phase with embroidery techniques, printing, finishing – traced in local tradition – that strategically enhance or eliminate the error. The process should be flexible and adjust to fix different elements of unpredictability in order to achieve a new aesthetic and emotional model.

Consumption: Instant vs Cycle

During the "consumption phase" time has to be taken into account. Unlike the synthetic product, where the retention time of the original colour is perceived as a quality, or even as a necessity, the natural dyeing process introduces the concept of cyclic life of colour, which leads to the sedimentation of traces of time, light, water and experience. On the one hand, is a frozen kind of time, always identical to the point of undermining the perceived quality of the product; on the other hand is the vitality of colour, a colour

with a past (recognized by traceability), a present that does not give up empathy, and above all a future in which the product is bound to change, following a parable quite different from the synthetic product.

Traceability: In the case of the natural dyeing process, traceability should be intended not only as the different stages the product went through to reach its final look. One has also to consider the events and the instances that generated the pigment: those elements mentioned above including climate, territory, plant, growing time, processes, which inevitably influence the final product and make it unique.

Empathy: It represents the present, the time of the purchase, the moment when the product casts its history on the consumer, prompting him or her to identify with it. It is the irrational, compulsive moment that makes the subject and the object fall in love. The natural product therefore should not, and cannot, give up the aesthetic dimension that, albeit with its own vocabulary and syntax, is the instrument for establishing a shared experience. While acknowledging that the narrative sphere of these products plays a dominant role in the relationship with the consumer, a product should not be pure narrative.

Evolution: Once the subject and the object relate to each other, a shared story unfolds. A story in which they both invest their life experience. But unlike with conventionally synthetic products, in this case, the product continues to transform, bearing the traces of this shared experience.

This vocation of natural colour implies a redefinition of the value chain[9] (Porter, 1985) which recognizes a fundamental role to the intangible aspect of production: the cultural value that consumers attribute to products.

It is therefore possible to envision an *ever-changing* product, with a past, a present and a future during which it will develop aesthetic characteristics of its own. If, until now, clothes were asked to play the role of *Dorian Gray's mirror*, that is, of something that perpetuates intangible perfection through time, natural products find their value precisely in the passing of time, through their continuous transformation and sedimentation of experiences and visible traces.

Therefore, a new model of consumption is needed, based on a new concept of well-being. Well-being would not lie in quantity or in the vulnerable subject-object relationship, but in the construction of strong product identities able to convey positive narratives, and in an intimate, durable relationship. The life curve of a product, therefore, would be much wider than that of traditional products. In addition, such relationship would show a greater awareness of physiological, as well as environmental qualities.

The challenge is to identify the most suitable way to educate consumers to this new generation of products. Their appeal should lie not only in their rhetorical value, but also in the recognition of their added value, more seductive and *correct* compared to that of (apparently) similar synthetic products.

It is crucial, therefore, that products with added value are produced for a public that is *ready* to recognize their quality. A strong communication plan is therefore needed, in order to convey the values at the heart of this category of products and to transmit a renewed idea of well-being.

This is why it would be advisable to continue the study of these issues in the future, also with practical experiments aimed at the definition of codified processes and methods. In this light, educational activities were planned, which are going to implement the approaches theorised by research, in order to design products and systems that apply its principles.

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[9] Michael Eugene Porter identified the value chain of a company with the series of processes internal to the company itself which, when put together and supported by technological activities, can generate product value. This lies in the price consumers are prepared to spend to own the product.

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Sustainable children's product experience

University collaboration with Italian industry in Lombardy Region

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This paper presents a design research called Babylandia aimed at applying human and environmental sustainability principles to support co-design processes and appraise how different scientific data can efficiently be communicated for design purposes. To this aim, we have developed our own set of tools and experimented them in 4 workshops. Babylandia is a public cofounded project for the promotion of excellence in industrial districts of Lombardy region. The goal of the project is to prototype and evaluate children's products for home and collective spaces with the involvement of both university and local companies.

The project is done in collaboration with some companies expert in their fields such as; Fumagalli, Parà, Soliani, Caremi and Happychild. The research has been coordinated by Indaco Department of Politecnico di Milano.

Different stakeholders from research and practice community have collaborated in the project – such as experts in Life Cycle Design, ethnography, physical and cognitive ergonomics, independent designers, staff and managers from manufacturing companies and children care institutions – for sustainability analysis, user involvement and product development.

1. Introduction

The aim of the presented work is to experiment a multidisciplinary approach to design able to the answer to real user needs in an environmental sustainable way.
Preliminary analyses have been thus carried out in parallel concerning human and environmental issues.

The research on environmental sustainability has been performed in order to find out critical areas where opportunities for the decrease of environmental impact emerge. Moreover, it has been elaborated a series of strategies, guidelines and environmentally low level impact project indications for the products to be developed following the Life Cycle Design – LCD – criteria. Furthermore main environmental requirements have been defined for each company's product leading to the organization of a seminar for sustainable idea generation.

In the same time an analysis regarding human sustainability has been organized on social and individual level. The first one includes three phases: preliminary focus groups with parents and care givers, observations in users' own daily environment during their normal activities and direct children involvement through drawing sessions.

The latter, specifically focused on anthropometric parameters and sensorial requirements of children aged 3-10 years, has been carried out through literature reviews.

Consequently a system of toots summarizing the results of both the analysis has been developed to support co-design concept development workshops. These tools comprehend:

- A specific checklist for each workshop integrating environmental quality evaluation and improvement suggestions of the involved companies;
- A "visual notebook" aimed at synthesizing observed behaviours and needs in order to stimulate collective creativity (Leonard Burton, Swap, 1999);
- Tables containing physical and cognitive data of the target users divided in age classes.

The participants were combined in the 4 workshops in order to develop integrated products:

- An adjustable seat for disabled children with an ad hoc fabric;
- A cabinet for children rooms;
- An interactive floor with LED light;
- A product for children's protection from electromagnetic radiations and noise;

Prototypes have been produced and finally evaluated according to human and environmental sustainability requirement as previously defined.

1.1. The environmental dimension of sustainability: Life Cycle Design

The research has been coordinated by Indaco Department of Politecnico di Milano. Integrating environmental requirements into product design means having to manage greater complexity, a large amount of information and relations with partners from different disciplines. The logic behind this design approach – included in its definition – is that the design must adopt a systemic approach: the designer must shift its attention to all stages of product life cycle from extraction of materials necessary raw materials for product production and arrive at the disposal of these materials when the product is discontinued. The importance of a LCD is that it allows identifying and combining environmental benefits with economic and competitive – economic efficiency – benefits. Indeed, when it is considered the environmental requirements early stages of the design process, it is much more efficient than adopting solutions to remedy the damage and recovery (end-of-pipe solutions) stage.

For Babylandia project has been possible to apply the LCD approach from the beginning in order to:

1. Minimizing of resources through reduction of material and energy consumption
2. Choice of resources and processes with Low Environmental Impact for biocompatibility and durability or toxicity reduction.
3. Strengthening and extension of product and components life.
4. Material Life Extension: enhancing them with respect to landfill through recycling, energy recovery or composting.
5. Disassembly to facilitate separation of non recyclable materials.
6. To facilitate the product development processes have been developed a number of methods and tools to accomplish three specific goals in the process of decision support of the designer:
    - Set priorities for action planning,
    - Guide the design decisions towards a more sustainable solutions,
    - Evaluate the potential for improvement of a project developing.

1.2. The human dimension of sustainability: Ergonomics and Ethnography

Ergonomics was founded as an autonomous discipline in the late '40s when the setting of the physiology of work, which included the adaptation of man to machine, was reversed by placing man at the center. Later this approach took its name of User-centered design focus first on the concept of interaction – HMI – and then the experience – man-machine-context -. Ergonomics is playing then the consideration of anthropometric and physiological parameters to get the recognition of cognitive and social aspects. Ethnography is a methodology based on direct observation and gives priority to observation as its primary source of information (Gobo, 2008). This purpose is also served, in secondary and auxiliary manner, by other

sources of information used by the ethnographer in the field: informal conversations of the actors 'on stage', documents materials produced by the organization under study (diaries, letters, reports, house organs, photographs, and audiovisual aids), individual or group interviews. However, the overriding concern is always to observe actions as they are performed in concrete settings. Heritage (1984) stresses, if one is interested in action, the statements made by social actors during interviews cannot be treated "as an appropriate substitute for the observation of actual behaviour". Actually, there is an oft-documented gap between attitudes and behaviours (La Piere, 1934), between what people say and what they do (Gilbert & Mulkay, 1983). What most distinguishes ethnography from other methodologies is the role of 'protagonist' assigned to the cognitive modes of observing, watching, seeing, and looking at, gazing at and scrutinizing.

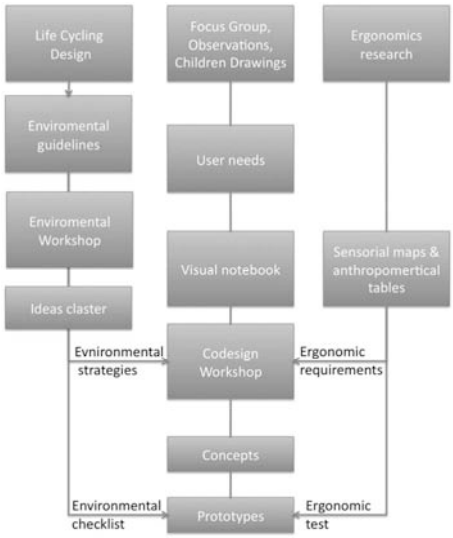
According to Salvador, Bell and Anderson (1999) ethnography is a way of understanding the particulars of daily life in such a way as to increase the success probability of a new product or service or, more appropriately, to reduce the probability of failure specifically due to a lack of understanding of the basic behaviours and frameworks of consumers.

2. Research Question

The general research question is "Is it possible to improve the sustainability of final products in a development process which take care of....?" to integrate environmental and human dimensions in the product development process and to find a way to communicate data collected by different experts to designers. Which is the best way to communicate to not specialist the complexity and importance of these three main topics? How influence the final result of design process the use of our tool kit? To this purpose we have developed a set of tools based on Life Cycle Design, ethnography and ergonomics theories, and experimented it in 4 workshops in the framework of a project called Babylandia.

Figure 1: Babylandia Research process

Source: Authors – Babylandia Project



2.1. Method for Product Design for environmental Sustainability

The Regarding Life Cycle Design, we have applied several tools of the Method for Product Design for environmental Sustainability – MPDS – in different phases of the process: product strategic analysis (brief), product concept development and communication. The aim of using this method is to integrate and support product development process with the sustainable environmental solutions. This method is a result of 15 years of research, didactic activities, business consulting, public institutions and associations.

The method is modular, flexible and organized in processes and sub-processes in order to answer designers' and companies' needs to specific needs by facilitating their applications in different context and various process of the project...
Particularly the modularity of the method concerns:

- The phases of the project: The method can be used entirely or partially along all its processes;
- The tools to use: The method is combined with series of tools such as ICS Toolkit and it is possible to select the ones in which to be used in design process;
- The integration of other tools and activities: The method is structured so as to enable the eventual integration of other design tools not specifically designed for this methodology and you can also modify existing activities or incorporate new ones, in relation to the need of a particular project.

ICS (Idea Concept Sustainability) toolkit is a digital tool developed by Research Unit DIS, which aims to guide the design process from the earliest stages of product development solutions to environmentally sustainable solutions. ICS Toolkit is consists of 4 sections related to each other: – Project Priorities, Table, Radar and Checklist -

1. Project Priorities: This section lists the priorities for action planning strategies for LCD products analyzed.

Methods and tools used in MPDS, related to the defined goals are described for each stage of product development.

A. Product Strategic Analysis – brief –

A1 Guidelines for Low Environmental Impact

For each company-specific manuals have been produced with the aim of facilitating the upgrading of entrepreneurial skills and product development, directing them towards new technical and strategic knowledge. The aim is to spread the necessary skills and tools to develop new proposals that integrate environmental requirements into practical design and production.

Guidelines are divided into two parts. The first section briefly introduces the concepts of sustainable development and Life Cycle Design – LCD -.

The second part includes strategies for designing a low environmental impact of specific products under consideration, with its comprehensive set of priority indicators, supplemented by diagrams, tables, and best practices.

In particular, the design strategies of LCDs have been sorted by relevance intervention project: IPSA – Strategic Priority Environmental Indicators – to define which aspects are most important focus during the design. That is, you are assigned a qualitative indicator of priority (high, medium, low, none) for each design strategy of LCD is defined as the potential improvement attainable through full application of a particular strategy. For the project Babylandia, it has not been done a proper LCA – Life Cycle Assessment. The evaluations are the result of the environmental workshop with experts based on:

Factors determining the major environmental impacts throughout the product life cycle, and the potential determinants of environmental improvement achieved through the specific strategy. Both factors assessed on the basis of knowledge gained (by such experts) and through in-formation found in the literature.

B. Product Concept Development

B.2. Environmental Sustainable Idea Generation Workshop

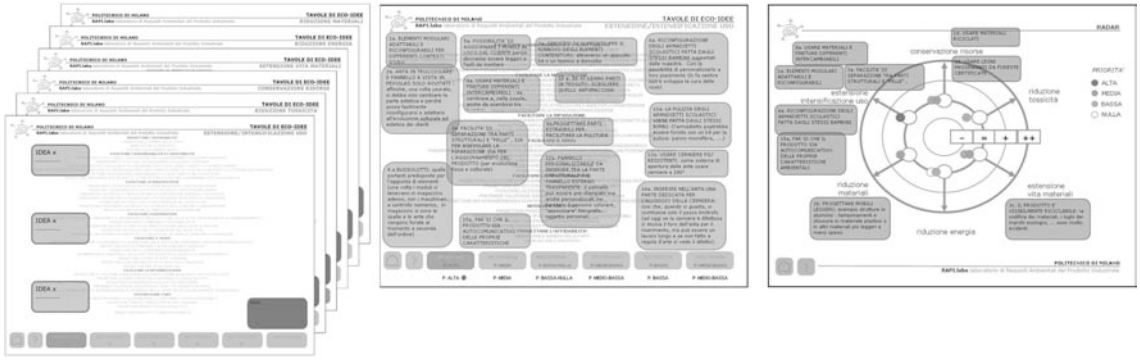
Workshops were organized for each company partner of the project Babylandia, these were composed of several brainstorming sessions, one for each environmental strategy. As a result, we obtained a set of environmentally friendly ideas / innovations used as input in the design development process. Babylandia project managers, anyone involved in business strategies, product development, research and development but also marketing, logistics etc. were invited to participate actively to the workshop. The main references for brainstorming ideas generation were the sustainable design guidelines contained in the Manual of guidelines for low environmental impact. ICS toolkit, and especially the "tables-generation eco ideas" and "radar multi-strategy" were used.

Tables of eco-ideas: contains the environmentally sustainable ideas generated during the workshop environment. Radar Multi-Strategy: Record environmentally low impact ideas emerged during the work-

shops broken down by environmental design strategies of relevance. In fact, the radar-multi strategy is used to show in an immediate way the priority level of each strategy and to select the most interesting generated ideas.

Figure 3: Tables of eco-generation ideas, post-it showing eco-generated ideas and radar multi-strategy

Source: Authors



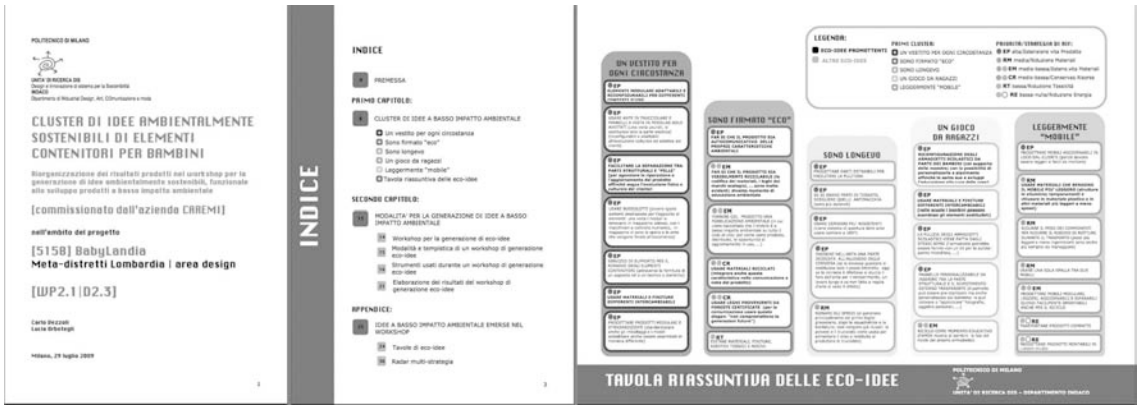
B.3. Cluster of environmentally sustainable ideas

Each company was provided with a summary of the environmental sustainable ideas generation Workshop with the aim to transfer the findings to the companies.

To encourage and stimulate the generation of low environmental impact concept, the ideas generated with low environmental impact – preceded by a coloured circle and an acronym that defines a priority and one that intends to pursue its strategy – have been refined and grouped in a document with respect to several possible cluster. In particular, it has produced a synthesis tool called Visual Summary Table of eco-ideas, used both as a support tool during the design workshop, is to refine the subsequent editing of the document checklist of environmental quality. In addition to this the terms and tools that are used during the workshop have been reported to ensure that companies in the future can develop independently eco-efficient design solutions.

Figure 4: Cluster of environmentally sustainable ideas

Source: Authors

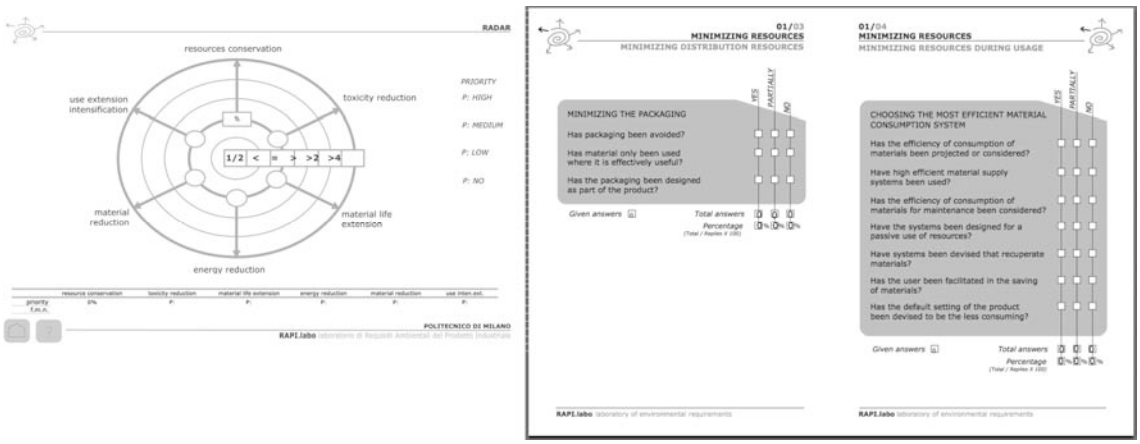


B.4. Environmental Quality Checklist

The objective of this phase is to obtain a verification tool for potential – improvement – of the concept of sustainability, and subsequently, the products that have emerged. For this phase are used all the functions of the ICS toolkit.

Figure 5: ICT Toolkit: Radar multi-strategy and Checklist example

Source: Authors



C. Communication

C.5. Communication of Environmental Characteristics

The final phase of work will be to communicate the environmental attributes of new products. In particular, is being prepared a document reporting on the strategy to strategy: the priority level identified, the main results that were obtained in the evaluation phase – check -, what are the guidelines adopted, the details of the solutions specifications drawn, illustrated by renderings, elevations, functional diagrams, photographs, ... highlighting the features of reducing environmental impact. Again in this case not having carried out comparative LCA between existing and new product, the evaluations related to development of environmental impact will be qualitative.

2.2. Mixed method approach

Different research methods have been integrated for user needs elicitation as Denzin (1978) noted, any single method ever adequately solves the problem of rival causal factors and each method reveals different aspects of empirical reality. Thus, it is important to approach the phenomenon under inquiry from diverse angles and to integrate diverse explanation resulting from diverse methods.

Regarding ethnography the question is to go beyond the rapid ethnography (Norman, 1998) approach in order to collect data in a more systematic way Prof. Gobo from Università degli studi di Milano together with Happy Child defined the typology of structures to be observed for the ethnographic research and designed a grid of observations to be applied in schools, and private homes.

The collection of data includes three phases: preliminary focus groups, free observation and structured observations. The observations are carried out in children' own daily environment during their normal practice. The research has produced many interesting results which are described in detail in text document. In this document the data are organized in 3 tables: observations, comments (including pictures) and proposals are classified in the columns and there is a row for each item. The tables are divided into thematic categories according to the observation sites: day care centres, nurseries, families and organizations for disabled children.

Table 1: Sample row from the ethnographic research

Items	Observations (and eventual photos)	Comments (theoretical reflections)	Proposals (theories and techniques)
Windows	Secondary function: Window handles Are used for hanging cloche, bags.		Rethink of the door handle design for this function (by reinforcing it)
	Secondary Function: Windowsill is used for keeping books or objects 	Problem: it is not possible to open the window	Design new windows with a fixed 30-40cm glass part at the bottom

The results of the ethnographic research are very precise and detailed but too large to be communicated to designers. Although there are already several existing tools – such as Scenarios[1] and Personas[2] – available to summarize analysis users' data, we decided to develop an own because of the high quantity of different variables we had to manage such as many users, many tasks and many products in different environments.

The new tool called "Visual notebooks" is composed of keywords, pictures and citations derived from different sources (observations, children's drawings, socio-cultural trend and sensorial interaction analysis) and are purposely designed for the actors involved in workshop sessions organized adapting O'Brien's (1981) methodology as developed by Wilsons (1991). Each "visual notebook" has a key concept such as personal, world, versatility, micro cosmos and aims at supporting product oriented concept generation.

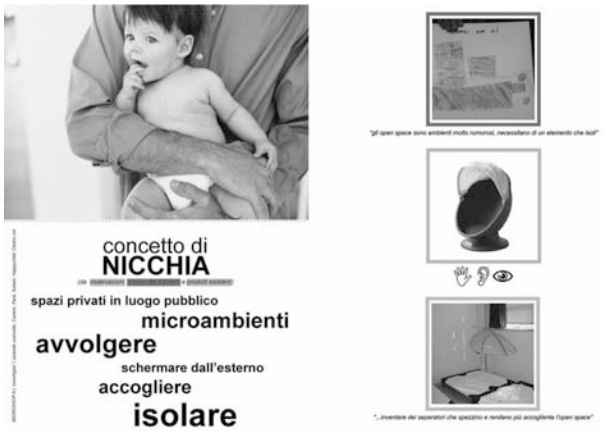
This method is based on visual tools since fast visualization stimulates new ideas by communicating them in a faster and easier way to make them understandable and keep the motivation in brainstorming session. The creative visualization method defines interactive and graphical presentation of data (Ronald, 1990) in order to visualize specific behaviours or events occurring user's life (Ware, 2004).

[1] Scenarios are stories about people and their activities (Carroll, 1999). Scenario-based design focuses on the description of the users and how the users perform the tasks (Carroll, 2002) in order to extract users' demands; and provides a tool to design products with high usability. This design approach helps developing ideas that involve interactions with multiple users over a period of time and is very useful when a service with a defined goal has to be achieved. In our case we had an undefined number of tasks that could not be organized in specific services.

[2] Personas (Cooper, 1999) are fictitious characters created to represent the different user types which are useful as a design tool in considering the goals, behaviours, desires of a group of real users. In our case we had a lot of different user categories including children and it would not be efficient to develop a persona for each of them. According to Pruitt and Adlin (2006) the use of personas offers several benefits in product development. They are synthesized from data collected from interviews in order to help to guide decisions about a product, such as features, interactions, and visual design. Such inference may assist with brainstorming, use case specification, and features definition. However in our study we had a lot of non explicit information collected through observations to communicate.

Figure 6: Front page and three sample pages of a Notebook

Source: Authors



2.3. Co-design Workshop

Those "Visual notebooks" were used in the 4 different workshops that have been developed starting from the characteristics of manufacturing firms. Purpose of the workshops was to create synergy between the companies bringing them to share the different experiences on a 'shared project idea together with the generation of product concepts. So 4 themes have been defined and, according to the themes the companies were grouped.

The workshops focuses were:

- A product for children's protection from electromagnetic radiations and rumours;
- An adjustable seat for disabled children;
- A cabinet for children rooms;
- An interactive floor with LED light

For each workshop, two "Visual notebooks" starting from two reference Keywords have been developed corresponding 2 groups of people; composing more than 12 people in brainstorming phase. All the workshops were shaped alternating parallel teamwork, presentation sessions and collective discussions.

Together with the "visual notebooks", other supports tools for the workshops have been environmental guidelines – as mentioned before – and hoc produced anthropometrical tables and sensorial maps.

After one hour of brainstorming the 2 groups have presented the results of the creative discussion session influenced by the Visual Notebook. The final results of the workshop were obtained from a general discussion which helped to integrate the comments obtained from the two groups.

The data collected after the workshop were processed by researchers and submitted to the companies with a report defining project concepts that allow the company to begin the design phase of a new product to be placed on the market after the closure of the research project; November 2010.

Figure 7: Environmental strategies

Source: Authors

2.4. Example of Tests Results: Cabinet for Children Rooms

Starting from the sustainability ideas cluster and ergonomics requirements Caremi has produced a prototype of a cabinet for children rooms that, in a second time, was tested with children in a kinder garden.
The evaluation goals were about the children behaviours in terms of sensorial interaction/ pleasure and usability. Tests showed a good level of acceptance of the object and in particular the ease of inducing tactile interaction as the moving parts of the cabinet, such as the wing, which proved that the case was easy to use and constructed of acceptable materials for children. For example to get a lightweight object and to maximize the use of eco-sustainable materials, the sustainability ideas clusters indicate the use of plastic as appropriate materials for the doors. The children were very interested in touch, open and move the sliding plastic have also used as a game taking advantage of the transparency of the polycarbonate.

Figure 8: The cabinet prototype before and during the test

Source: Authors

Conclusions

It is obvious to all that the present system of production and consumption of goods and services has exceeded the capacity of the biosphere and geosphere to absorb without irreversible damage all the generated changes.

It is an important moment because still there isn't a widespread awareness of those who are the right methods and tools to be applied for environmental sustainability. In the transition to a sustainable society, universities must take a prominent role through research to training. For design universities in particular where is an active ground to be able to generate and disseminate promising ideas.

In this specific sample positive results concerning both environmental and human sustainability have been demonstrated in the prototype evaluation phase. Our efforts in the future will be focused to integrate more deeply these two dimensions of sustainability.

We can also conclude that our method is fairly efficient for empowering discussion during the co-design workshop, putting participants in a high level of problem's knowledge and become a part of the proposed solutions. However we found some missing points in the synthesis phase, the method must be improved to manage the result of the discussions, since several inputs have been lost. The direct involvement of users in the co-design workshop could be experimented to elicit also tacit needs (Martin and Schmidt, 2001)

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Approaches, methods and tools for (Product-Service) System design for sustainability practice

the Learning Network on Sustainability

Designing sustainability into the urban context

Adital Ela
S-Sense Design | HIT – Holon Institute of Technology, Israel

This paper will share the results of a study that was done in preparation for an exhibition about sustainability in the urban context for the Tel Aviv City Museum. It will discuss five prisms that evolved from this study, enabling a wide scope outlook towards potential sustainable design interventions within the urban context.

Highlighted through the five prisms, the paper will present a variety of sustainability design strategies that were found in the study as having substantial sustainable potential within the city context.

The strategies will be demonstrated through a variety of design study cases, some from the author's work as a designer, some from the work of the students at the social-environmental design study program at the Department of Industrial Design at the HIT – Holon Institute of Technology, Israel, as well as projects and study cases of designers from around the world.

Introduction

No matter how you look at it, it is clear that we are becoming an urban society. Worldwide, 62% of the population lives in cities while in Israel, for example, 92% live an urban life.

It seems that urban life has the potential to form lifestyles that can sustain a relatively moderate ecological footprint along with social and communal gains.

In my perception, one of the important tasks of sustainable design is to envision, illustrate and enable the realization of new and inviting life habits that can thoroughly reform the encounter between man, object and environment. With the focus on the city, this reformation can become even more impactful.

From this point of view, designers of today have a role of mediation – to support the rehabilitation of the developed world inhabitants from the destructive lifestyles they have embraced for only a few decades.

This mediation process includes creating fresh and creative alternatives to this lifestyle which offer not only social and environmental benefits but also illustrate appealing, sensual, experiential and inspirational concepts, products, services and systems.

This paper will share the results of a study that was done in preparation for an exhibition about sustainability in the urban context for the Tel Aviv City Museum. It will discuss five prisms that evolved from this study, enabling a wide scope outlook towards potential sustainable design interventions within the urban context.

Highlighted through the five prisms, the paper will discuss a variety of sustainability design strategies that were found in the study as having substantial sustainable potential within the city context.

The paper will be designed according to the following five prisms:

> ***Elemental Dialogue*** | Projects and objects that illustrate a sustainable dialogue with the natural elements.
>
> ***Every-day Activism*** | Projects and initiatives that promote active participation of people in the private and public context.
>
> ***Closing Cycles*** | Projects that promote the re-design of products, services and processes into self-nourishing cyclical flows of organic or technical materials.

Preventive Consumerism | Projects and concepts that reform responsible consumption.

Open-Code Community | projects that present platforms for people to collaborate for a common goal or promote the ability of a community to address its own needs.

This paper will elaborate upon the different prisms through a variety of design examples from around the world. A *selected study cases* section will be dedicated in every prism to my own work as a designer, and some from the work of our students at the social-environmental design study program at the Department of Industrial Design at the HIT – Holon Institute of Technology, Israel.

1st Prism – Elemental Dialogue

Exploring sustainability design is about exploring a new form of communication, a new form of dialogue with the surrounding environment, with the natural elements, with animals and plants and, of course, with each other.

The way we will develop our skills in dialogue – listening and talking – will form the way humanity dwells on earth and our ability to define a much more participatory existence on this planet.

The following quote suggest one form of dialogue:

> *'We should go about in the manner of a bee collecting nectar from a flower: The bee harms neither the fragrance nor the beauty of the flower, but gathers nectar and turns it into sweet honey.'*
>
> *(Ahranat – a buddhidt saint)*

This anecdote about the bee encompasses a vision for the way humanity could dwell on earth – the bee is nourished by a flower – gathering nectar and turning it into sweet honey. In its feeding process not only does it harm neither the fragrance nor the beauty of the flower, it also supports the flower's reproduction process.

Various projects around the world have been exploring a new form of communication with the natural environment. In the field of architecture many examples can be found for buildings that are designed to function as water collectors, as wind or sun cultivators.

The work 'off the grid' by the Philips Design Probe Program illustrates beautifully a possible vision for buildings to become living membranes nourished from the natural environment by sending back into the environment nutritious outputs as a result of a well designed "digestive process". (http://live.philips.com/index.php/nl_nl/video/off-the-grid-habitat-2020-vision/16713202001)

Who listens to the light of the moon?

If we explore work that is done around the world we can find some guidance as to what designers can do in this field:

Luner-resonant streetlight by Civil Twilight sense and respond to ambient moonlight dimming and brightening according to the cycle of the moon. It supports saving energy and emphasizes a beautiful cycle of nature. (http://www.civiltwilightcollective.com/lunar1.htm)

The Parans sunlight transport system is designed to naturally light windowless rooms. It uses rooftop light capturing panels to collect sunlight and transport it via fibre optic cables to illuminate light-deprived rooms inside buildings. (http://www.parans.com).

GROW by SMIT is a hybrid energy delivery device that provides power via the sun and wind and is able to "grow" just like ivy on a façade of a building. (http://www.s-m-i-t.com)

New collaborations with plants and animals

'Elemental Dialogue' invites us to find different ways to collaborate with the various forms of life in our surroundings.

Many traditional societies were characterized by a profound and rich understanding of fauna and flora in their habitat. Nowadays, various projects attempt to re-establish such connection and utilize different plants for purifying water like GDC Whirlpool did in its 'Biologic' washing machine (http://www.project-f.whirlpool.co.uk).

Air purifying plants have been used in various systems, one of which is Andrea living air purifier by Mathieu Lehanneur which absorbs undesirable toxic components for indoor air. (http://www.mathieulehanneur.com)

Some fascinating projects are addressing production in collaboration with other life forms. An example is 'EcoCradle' which is a packaging material that is literally grown, not manufactured. In its production process a growing organism is used to transform agricultural by-products like cotton seed hulls into packaging material using a filamentous fungi (mushroom roots) to bond this material into almost any shape. (http://www.ecovativedesign.com/ecocradle)

Addressing Sustainability Design as an exploration towards a new form of participation within the natural environment can lead to an abundance of design projects and concepts that support fresh and nourishing interaction between man, object and environment. This new form of dialogue holds, when applied wisely, valuable potential in redesigning our footprint on earth.

Selected study cases

WindyLight by Adital Ela
WindyLight is a collection of self-sufficient outdoor lights operated by wind energy. It is created from a repetitive module which integrates wind collection and a LED light source into one element.
WindyLight creates a variety of lamps for the urban environment that operate on free, clean energy and require no connection to the city's electrical grid. In WindyLight, the capacity of wind is translated into light intensity, thus creating a unique light and sensual experience that is in tune with the natural flow of wind.
WindyLight illustrates a sustainable design vision in which products become a direct link between renewable resources and basic everyday human needs.

WaterFull by Adital Ela and Oded Davidovitch
WaterFull is an effective private upper-well that can be integrated in the home environment as a multi-season water collector as well as a shading element.
In the reality of global warming and evident lack of water in many areas around the world, WaterFull creates a self-sufficient platform that enables the home-user to collect dew and rain water for
Everyday needs. By doing so, one is able to make use of the natural abundance available in his surroundings.
WaterFull is 3 meters in diameter, and by using a unique dew-collecting fabric created by OPUR (International Organization for Dew Utilization), can collect up to 3.5 liters of water a day in the dry season. In the rainy season the water container allows the accumulation of up to 460 liters of water.


figure 1


figure 2

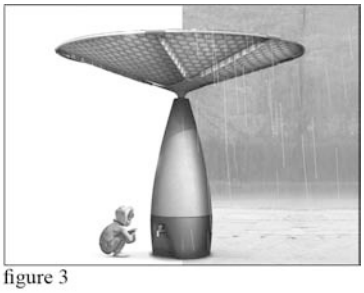
figure 3

Figure 1: WindyLight by Adital Ela

Figure 2: WindyLight ToGo by Adital Ela

Figure 3: WaterFull by Adital Ela and Oded Davidovitch

2nd Prism – Everyday Activism

While the first prism discussed our outward dialogue *'everyday activism'* questions our everyday actions and the extent to which we take an active role in our everyday life. In the modern setting passiveness became something to strive for – we got into the habit that things should be solved for us by products, machines or other people, leaving a form of activism only for special occasions such as political demonstrations or protest.

'Everyday activism' suggests that we can take back a much more active role and participate in answering our everyday needs, in designing our own environment and in nourishing our environment with our spontaneous everyday actions.

Reaping our everyday Watt production.

Around the world we can find many examples of projects that try to tune into simple everyday human actions such as walking, playing or dancing and transform this energy to various public functions. The 'Pavagen systems' (http://www.pavegensystems.com) collect the energy of by-passers in a busy pedestrian-street and convert the kinetic energy to electricity that is stored within the slab.

Other projects using the same strategy are 'Club4Climate' (http://www.club4climate.com) a dancing club operated by the energy stored from people's dancing movements. 'Play Pump' by Roundabout outdoor (http://www.roundabout.co.za/main_the_playpump.htm) uses the spinning play motion of children to pump underground water into a 2500 liter tank in sub Saharan Africa.

Growing our own fish

Design can play a central role in supporting people in answering their every day needs in a participatory way such as growing food, cultivating water or designing our own shelter to name a few.

In the last few years we can see various projects addressing the possibility of people growing their own food. 'Home Farming Unit' by Philips Design Probe Program is a self-contained farm with separate levels for growing plants and raising fish (http://designprobes.ning.com/video/home-farming-unit). Grow your own by Jochem Faudet is a greenhouse designed for urban dwellers, allowing them to grow their own food on a roof terrace. (http://www.jochemfaudet.com)

Can rain undo graffiti?

The need of people to express themselves in public space invites designers to come-up with creative solutions inviting this spontaneous expression without creating permanent marks in public domain. Projects such as mud or moss graffiti and public furniture that invite people's interaction illustrate a starting point for these possibilities.

Selected study cases

Knaan 3 by Yaniv Brafman @ HIT, Israel
Knaan 3 is a human powered earth strainer for communities building their mud homes with their bare hands. Applying the concept of pedalling makes the straining process (one of the most difficult and time consuming phases in the building process) four times more efficient than in conventional ways. Knaan 3 is designed for disassembly and can be easily shared between the targeted communities.

Girls Mud Grafitti by Liran Elbaz, Nurit Shlonsky and Daniella Kaufman
A sand and local earth graffiti kit. The kit features the tools and recipe to create graffiti figures from sand and local mud. It also includes templates of various mythological women figures.


figure 4


figure 5


figure 6

Figure 4: Knaan 3 by Yaniv Brafman | design tutor: Adital Ela

Figure 5: Knaan 3 in use

Figure 6: Girls Mud Graffiti by Liran Elbaz, Nurit Shlonsky and Daniella Kaufman

3rd Prism – Closing Cycles

The professional discourse regarding projects that promote the re-design of products, services and processes into self-nourishing cyclical flows of organic or technical materials has become common and

prevalent. In the last years it has been dominant by the concept of Cradle to Cradle (McDonough, Braungart, 2002) which became a synonym to sustainability design.

The search for additional views and possibilities to close consumption and production loops can prove to be a rich platform for developing new possibilities for design to support sustainability.

Can beer grow bread?

Great inspiration can be found in various projects asking these questions in different levels:
In Kalundborg Denmark an industrial area is operated by the concept of Industrial Symbiosis. The Industrial Symbiosis network in formed from companies in the region that collaborate to use each other's by-products and otherwise share resources. (http://www.symbiosis.dk/)

The Zeri Foundation investigated this idea on a small scale in beer production as a study case. They found that 20 liters of water and spent grains are the by-product per liter of brewed beer. Exploring the possibilities for additional end products they discovered that this waste can be a great substitute for bread flower and also a valuable ingredient in the substrate for the growing mushrooms. (http://www.zeri.org/case_studies_beer.htm).

Can a homeless person produce compost?

'Closing cycles' can also manifest itself in local neighbourhoods and home settings.

The project 'FoodLoop' by Seed Foundation is a design-led social enterprise that addresses the issues of biodegradable waste and homelessness. It offers local authorities a blueprint system for localised composting of biodegradable waste on housing estates. A specially designed community composting machine is installed and managed by formerly homeless residents who handle waste collection and management and use the compost to cultivate fruit and vegetable plants on communal areas of the estate. (http://www.seedfoundation.org.uk/enterprises/foodloop/)

Encompassing a sensitive designer's eye towards *'Closing Cycles'* by wise design intervention can result in various fascinating solutions. This strategy can be applied to system-scale projects and also to the home environment where various cyclical concepts can support users in adopting more sustainable life habits.

Selected study cases

Slow Water by Adital Ela
Slow Water is a simple in-door system that can be integrated into an existing bathroom, supporting the user in collecting water from a wash basin and re-using it for toilet flushing and other needs.
Slow water illustrates the potential of design to become a mediation tool that supports people in adopting more sustainable life habits.

Compost Toilet Bucket by Dafna Noam @ HIT, Israel
Compost toilet bucket is a simple plastic bucket designed to be placed into a standard toilet enabling the home uses to collect human bodily waste for home-composting.

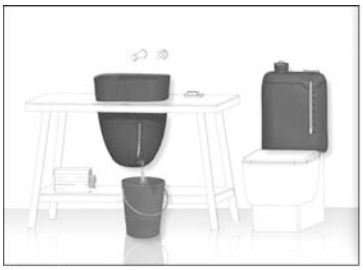
figure 7

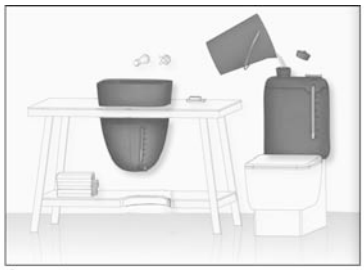
figure 8


figure 9

Figure 7: Slow Water (phase 1) by Adital Ela

Figure 8: Slow Water (phase 2)

Figure 9: Compost Toilet Bucket by Dafna Noam | design tutor: Erez Steinberg

4th Prism – Preventive Consumerism

The choices that we make in every moment every day have a fundamental influence on the actual footprint that each of us places on earth.

Designers have an important and potentially influential role in creating solutions that enable people to adopt alternative consumption patterns through designing projects, concepts services and systems that reform responsible consumption.

Can we design a home production line?

Design can empower people to regain their capacity and participate in designing their own environment and using their unique creative skills to create the artefacts they need.

This notion can be explored by creating designs that mediate between an individual and the materials or resources he might find in his environment, thus enabling him to locate and use the existing potential.
On another level a design can create ways for the user to participate in a product's creation process by introducing creative kits that support users in producing their own daily objects.

How tall did your chair grow this year?

One of the accepted but not commonly explored strategies in our field is the notion of designing objects that change through the years to fit the changing needs of a person.

Architect Gary Chang managed to take this concept to new heights when he designed sliding wall units and fold-away furniture that transform a 32 square meter apartment into a versatile 24 room home. (http://www.youtube.com/watch?v=Lg9qnWg9kak)

In his project Corb 2.0 Architect Andrew Maynard applies this strategy on a community level. Using existing industrial infrastructure- shipping containers and stackers, Maynard suggests a new form of housing which is responsive and egalitarian. This dynamic structure allows people to change their view or neighbors according to the seasons, change in family dynamics or space requirements.
(http://www.maynardarchitects.com/Site/houses/Pages/Corb_V2.0.html)

In the field of product design we can find examples such as 'The high chair' by Maartje Steenkamp in which the legs are shortened as the child grows, or 'Grow Bike' that changes in form to fit the changing needs of the growing child.

Selected study cases

TWO GO by Yael Livneh @ HIT, Israel
TWO GO is a DIY designed project that supports the user in creating his own 2 in 1 bicycle seat and storage.
The design is based on the re-use of a plastic milk crate. It includes an instruction form and a kit of appliances that enables the user to create his own extra bike seat using a re-used plastic crate and seven standard joints.

4 in 1 by Bonnie Manor @ HIT, Israel
The project '4 in 1' was designed with the aim of creating 4 different toys from the same kit addressing the different needs and motor capabilities of a growing child. Parents can easily create the relevant toy for their child from a set of wooden pieces and joints.

Bacbucon by Johana Kiss and Shlomi Friedman @ HIT, Israel
Bacbucon gives children free play opportunities utilizing "clean garbage" to create a personal outdoor play space. Bacbucon consists of a set of connectors that enable the re-use of empty plastic bottles to create an endless spectrum of open-ended structures.
Bacbucon was created as part of an academic project at the social-environmental program at HIT with the aim of designing play objects for nursery schools of the foreign worker's community in Israel. These facilities are characterized by very poor conditions and severe lack of educational stimulation and toys.


figure 10


figure 11


figure 12

Figure 9: TwoGo by Yael Livneh | design tutuer: Prof. Gad Charny

Figure 10: 4 in 1 by Bonnie Manor | design tutuers: Prof. Gad Charny and Tal Kamil

Figure 11: Bacbucon by Johanna Kiss and Shlomi Friedman | design tutor: Adital Ela

5th Prism – Open-Code Community

'Open code community' addresses various aspects and themes regarding the interdependent collaboration of a community to address it own needs and wishes. It strives for the strengthening of community ties and, on a larger scale, strengthening the local social fabric.

'Open code community' touches upon aspects such as Design for Social Innovation and Sustainability (www.desis-network.org), socially driven service design, projects that promote the ability of a community to address its own needs and various grass root communal initiatives.

This paper will focus only on design projects that create platforms for people to collaborate for a common goal. This area of search is explored by creating experiences that would initiate shared common moments in which people are playing or working together to address common goals that are either long term outcomes or spontaneous moments of joy.

The project 'table tennis fence' by Next Architects acts as a beautiful anecdote of this design challenge. The fence that may also be used as a Ping-Pong table is part of a study exploring new types of contacts that exceed physical boundaries (http://www.nextarchitects.com/projects).

The 'Public library for non-public' in Tel Aviv addresses this issue from a different angle.
A small group of interdisciplinary artists initiated a public library in the heart of Neve Sha'anan catered to the population of migrant workers, a growing social group which tends to live an isolated life disconnected from other social groups.

The library features two bookcases, one for adults and one for children, designed to be closed when not in use. A list of desired books was produced with the help of members of the local community, and today the library contains more than 2,500 books in Nepalese, Thai, Hindi, Mandarin Chinese, Tagalog, Arabic, French, Romanian, Spanish and Hebrew. The library's open configuration and its setting, grants it an unconcealed presence and provides unmediated access. (http://m--a--p.net/thegardenlibrary/eng.html)

How can we as designers support new interactions, contact points and sharing platforms in the city remains a vast and fascinating field to search. Exploring the way we can design into public space moments of contact and sharing can open up new ways for people to share objects, talents, materials, knowledge, skills, a smile or any other valuable resource.

Selected study cases

Nomad Urban Furniture by Omri Revesz
NOMAD presents a system of mobile urban chairs that fits into the main characteristics of the city: intensity, variety, coincidence, interests. This project underlines the urban square as a platform for human activity. The mobility allows choosing position according to social and weather conditions. The single mobile chair appears in high numbers according to the need and disappears when there is no activity in the square.

Clothing exchange platform by Gilad Mashiah @ HIT, Israel
This clothing exchange platform was designed to be located in various places in a city creating a playful and appealing platform for people to donate objects and clothes they no longer need as well as having a chance to get a new treasure that was another person's waste.

Interactive bus stop by Rony Tamir @ HIT, Israel
An interactive game board designed to be placed at bus stands and other public locations, thus encouraging dialogue and playful interaction between passers-by in public space.


figure 13

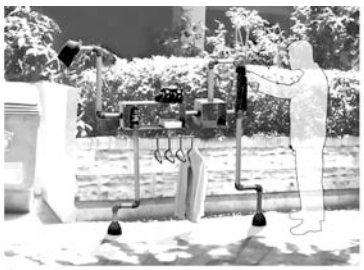
figure 14


figure 15

Figure 12: Nomad Urban Furniture by Omri Revesz

Figure 13: Clothing exchange platform by Gilad Mashiah | design tutor: Dr. Victor Frostig

Figure 14: Interactive bus stop by Rony Tamir | design tutor: Prof. Gad Charny

Conclusions

In the field of sustainability design it is not always easy to determine what type of projects, objects, services or systems deserve the title "sustainable".

The prevalent discourse in our field often puts the focus on end results neglecting the essential question of context.

Asking wider questions such as "what would it mean to design sustainability into the urban context" invites us to deal with substantial and wider questions of lifestyles and habit, of supportive systems and services and, above all, basic questions regarding our dialogue with the natural environment, the dialogues and collaborations between people and to explore the way we participate in the world.

The city, which became the taken for granted way of life around the world, is a wonderful example of the potential of focusing on context in a way that enables the definition of applicative strategies that can enable designers to support designing sustainability into this context.

This paper, the five prisms and the various strategies were all a result of an attempt to share one study that aimed to apply this methodology. They are indeed a starting point and, at the same time, an invitation to continue and explore.

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the Learning Network on Sustainability

Case study of the design of Eco-Efficient Product-Service-System for KONE Corporation, using the MSDS method and tools

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The paper describes and evaluates the method and the tools used for the elaboration of an eco-efficient design orienting scenario and the design of an eco-efficient product-service system (PSS) concept for KONE Corporation, one of the global leaders in the elevator and escalator industry.

The method used is called Method for System Design for Sustainability (MSDS) and it's the elaboration of a method developed in 2005 as the main result of an EU funded research named Methodology for Product-Service System Innovation (MEPSS).

The paper describes and evaluates all the activities that involved, in a participatory design process, both DIS research unit and KONE company staff. The paper describes and evaluates as well the various used tools, the achieved results and their impact on the company.

Even if the results of the project are protected by a confidentiality agreement, a critical evaluation of them is presented, together with possible improvements.

Product-Service System: the background

It is a shared opinion that the transition towards sustainability will require radical changes on multiple levels: social, cultural, institutional and technological. It is also shared that, given the nature and the dimension of such changes, a system discontinuity is needed, and therefore it is necessary to act on a system innovation level.

In this sense, on a company level (and especially for large companies) it is crucial not only to design, produce and sell low environmental impact products, but also to adopt a *system design approach* (Vezzoli, 2010), i.e. to design and offer so-called sustainable Product-Service Systems (PSS). The United Nations Environment Programme (UNEP, 2002) defines a PSS innovation as:

> "the result of an innovative strategy that shifts the centre of business from the design and sale of (physical) products alone, to the offer of a set of products and services that are together able to satisfy a specific demand of satisfaction".

In other words, it is a shared opinion that PSS are sustainable opportunities for companies (Goedkoop et al., 1999; Mont, 2004), i.e. they are win-win strategies because with this business approach it is in the company's (or companies') economic and competitive interest to reduce the environmental impact of the offered PSS.

A consequence of this approach is that innovation (and design) should work at both the level of stakeholder interactions and partnerships and that of customer/final user, being part of a specific value production chain that includes all actors in one way or another linked to the system, with the aim of fulfilling specific demands of satisfaction. In other words the approach focuses on designing the system of actors and the related interactions and partnerships in order to make the delivered offer eco-efficient. In this sense the aim is to reach system eco-efficiency through the stakeholders' strategic convergence of interests, defining a system as eco-efficient if the economic interest of each stakeholder (part of the system) converges with an interest in the resources optimisation (on a system level).

Since, as already said, system innovations require changes on multiple levels (social, cultural, institutional and technological), they can be considered radical innovations. For this reason, when talking about (product-service) system innovation, there could be some barriers in the application and introduction of such innovations: for companies the resistance in changing the traditional business concept, the lack of knowledge and experience in design methods and tools and service management systems, and the difficulties in evaluating the environmental and social features of a (product-service) system innovation.

Being radical, these innovations should not be imagined as static outcomes of a design and development process, but they have to be considered as the result of co-evolution processes involving several socio-economical actors. In this sense, to support the introduction and subsequent branching of such innovations, it is effective to adopt a strategic approach, designing and managing a system innovation transition path, i.e. designing the proper conditions to foster and speed-up the experimentation, niche introduction and branching of such innovations, through the design of innovative stakeholders' interactions, and their evolution in time.

In this framework, the MSDS method (Method for System Design for Sustainability) and the related tools to design sustainable PSS were developed. They are presented in this paper, through their use in a project for a large company. The activities are presented in relation to the two main phases of the project. In the first phase an *eco-efficient design orienting scenario*, aiming at exploring all the potential opportunities, was elaborated, comprising a set of visions, clusters of eco-efficient PSS ideas and single PSS ideas, generated with the support of the *Sustainability Design Orienting* toolkit. In the second phase, two eco-efficient Product-Service System concepts were designed, aiming at defining the possibilities for a further implementation of a pilot project. Each concept is composed of a main offer and different sub-offers, describing products, services and stakeholders' interactions using different tools, such as the *offering diagram*, the *system map*, the *interaction table*, the *interaction story board* and the *win-win potentials tables*. Feedback from the company as well as a critical evaluation of the process are presented.

MSDS: Method for System Design for Sustainability

The MSDS method was developed within the Learning Network on Sustainability (LeNS) EU funded project[1], under the coordination of the *Design and system Innovation for Sustainability* (DIS) research unit of the INDACO department of the Politecnico di Milano university (Italy). The Method is an adaptation of the MEPSS methodology[2], able to support and orient the design and development of Sustainable Product-Service Systems (PSS), in a multi-stakeholder visioning process.

The general structure of the MSDS method is made up of five main phases:

- Strategic analysis
- Exploring opportunities

[1] LeNS is an Asian-European multi-polar network for curricula development on system design for sustainability focused on Product-Service System. It is a 3 years project (December 2007 – December 2010) funded by the European Commission (Asia Link Programme, EuropAid), involving 7 design schools in Europe and Asia: Politecnico di Milano (Milan, Italy), Technology University Delft (Delft, the Netherlands), Aalto University (Helsinki, Finland), Tsinghua University (Beijing, China), Indian Institute of Technology (New Delhi, India), Srishti School of Art, Design and Technology (Bangalore, India), King Mongkut Institute of Technology Ladkrabang (Bangkok, Thailand).

[2] MEPSS, Methodology for Product Service System development, research funded by the European Commission under the 5th Framework Programme, coordinated by the Price-Waterhouse-Coopers and DIS-Politecnico di Milano being the partner responsible for the design area. The results of the research are available at www.mepss.nl or on Van Halen, C., Vezzoli C. and Wimmer R., edit. 2005. Methodology for Product Service System. How to develop clean, clever and competitive strategies in companies. Assen 2005: Van Gorcum.

- System concept design
- System design (and engineering)
- Communication.

Each phase is supported by a set of specific tools, developed together with the method or adapted to/integrated with it, which can be applied by either a small team of experts or in a more participatory planning process. Within each phase, processes and sub-processes are defined. The general structure of the method is presented in Table 1.

Table 1: Stages, aims and processes of MSDS method

Source: Vezzoli, 2010

MSDS Method		
Stage	**Aim**	**Processes**
Strategic analysis	To obtain the information necessary to facilitate the generation of sustainable ideas	Analyse project proposers and outline the intervention context
		Analyse the context of reference
		Analyse the carrying structure of the system
		Analyse cases of excellence
		Determine priorities for the design intervention in view of sustainability
Exploring opportunities	To make a “catalogue” of promising strategic possibilities available, or in other words, a sustainability design-orienting scenario	Generate ideas orientated towards sustainability
		Outline a sustainability oriented design scenario (visions, clusters and individual ideas orientated towards sustainability)
Eco-efficient system concepts design	To determine one or more system concepts oriented towards sustainability	Select clusters and single ideas
		Develop system concepts (consisting of: one or more product and service mixes that characterise the offer; the relative interaction systems between the actors involved; potential environmental, socio-ethic and economic improvements)
		Environmental, socio-ethic and economic appraisal
Designing (and engineering) a system	To develop the most promising system concept(s) into the detailed version necessary for its/their implementation	Detailed system design
		Environmental, socio-ethical and economic assessment
Communication	Draw up reports to communicate the general, and above all sustainable characteristics of the system designed	Draw up the documentation

Scenario elaboration and eco-efficient Product-Service System concept development: the project

The research project "Scenario elaboration and eco-efficient Product-Service System concept development" was launched at the end of 2008, commissioned by the Eco-efficiency Team in KONE Corporation, one of the global leaders in the elevator and escalator industry, and carried out by DIS research unit.

The goal of the research was to provide KONE with a contribution for a know-how upgrading on the design and implementation of eco-efficient Product-Service Systems, capable of facing the transition towards environmental sustainability, in an highly evolving market and regulatory context. The final aim was to set the basis for an articulated skills' development capable to make KONE autonomous in the development of eco-efficient Product-Service Systems. In particular the objectives of the research project were:

- To elaborate an innovative scenario in order to support and orient the development of eco-efficient Product-Service System concepts
- To develop an eco-efficient concept in terms of the stakeholders involved and their interactions and the system of products and services.

Strategic analysis

During the first stage of the project, the aim for DIS staff was to collect and elaborate information in order to facilitate the generation of an Eco-efficient Design Orienting Scenario. First of all a kick-off meeting was organised (Italy, 28th of November 2008), involving both DIS and KONE, in order to fix the modalities and timeline of the project, to identify the involved company's staff and to present KONE with a first set of requests for documents and information.

Afterwards, four steps were carried out, whose characteristics are detailed in the following paragraphs:

- Understanding the company characteristics
- Understanding the reference system
- Understanding the reference structure
- Defining the sustainability priorities of the design intervention.

Understanding the company characteristics, the reference system and the reference structure

A first goal was to understand the main characteristics of KONE: what are the core competences of the company? what are the main strengths and weaknesses? how is the supply chain structured (who are the key stakeholders and the other involved actors)? what are the main business models and what offer typologies are delivered (in relation to the different customers)? what values are delivered to the customers/users? etc.

Moreover, the objective was to acquire and elaborate information on the contexts of reference (set of products, services and actors), information on KONE's competitors and on the set of macro-trends that represents the background against which KONE has to operate (economic, regulatory, social and cultural dynamics), in order to recognize and understand emerging opportunities for the future.

To gather the necessary information, few more meetings were organised and KONE provided a set of confidential and public documents.

A field activity was performed as well, in the form of an exploratory survey (Italy, 13th of January 2009), asking the potential users about the products and services they would like to have near the elevator, about their elevator experience and about how they'd define an eco-efficient elevator. The answers from 50 surveys were collected and used to prepare the first workshop, in order to help the participants to better understand both the company's and users' point of view.

Defining the sustainability priorities of the design intervention

The objective was then to define the priorities, in terms of environmental sustainability design criteria, to support and orient the scenario generation phase.

The criteria that were considered are:

- System life optimisation, i.e. design for (system stakeholders' interactions leading to) extending the total life span of products and intensifying the use of all products
- Transport/distribution reduction, i.e. design for (system stakeholders' interactions leading to) reducing transportation and packaging
- Resources reduction, i.e. design for (system stakeholders' interactions leading to) reducing the total resources used by all products and services of the system
- Waste minimisation/valorisation, i.e. design for (system stakeholders' interactions leading to) improving system recycling, energy recovery and composting, and reducing waste
- Conservation/bio-compatibility, i.e. design for (system stakeholders' interactions leading to) improving the total conservation/renewability of the system's resources
- Toxicity reduction, i.e. design for, (system stakeholders' interactions leading to), reducing/ avoiding toxicity and harmfulness in the system.

This part benefitted from a previously developed project named SEED[3], in which one of the outcome was the definition of such priorities.

Exploring opportunities

The aim of the *Exploring opportunities* stage was to use all the information collected and elaborated in the previous stage to define a "catalogue" of strategic intervention possibilities that could lead to significantly more eco-efficient PSS models of the elevator flows offer. A promising eco-efficient design orienting scenario was then generated and elaborated.

Two main steps have been carried out:

- Eco-efficient ideas generation
- Eco-efficient Design Orienting Scenario elaboration.

Eco-efficient ideas generation

Two ideas generation workshops were organised to generate a set of eco-efficient Product-Service System ideas, i.e. ideas for innovative offers to the customers and for partnerships with other stakeholders in the flow satisfaction system.

The aim of the first workshop (Italy, 30th of January 2009), involving DIS staff, was to generate explorative and promising ideas on products, services and stakeholders interactions that might lead to the design of a draft sustainability design orienting scenario, composed of eco-efficient (Product-Service) Systems ideas, clusters of eco-efficient ideas and 4 eco-efficient visions. The visions are represented by the combination of 2 polarity axes (i.e. a polarities diagram) identified as meaningful for the design context: one of them is usually related to the offer system (horizontal axis) and the other related to the level of customer level of participation (vertical axis). Each vision is a schematic narration of promising evolutions of a specific context in relation to sustainability aspects.

The main activities are:

1. The presentation of the main results of the strategic analysis, of the identified priorities and of a set of potential contexts with the related satisfaction unit (i.e. for what purpose is the elevator used or could be used in a specific context?)
2. The generation of eco-efficient system ideas targeting the 6 aforementioned environmental criteria

[3] The SEED (Sustainable Elevator Eco-Design) project was commissioned by KONE and carried out by DIS research unit in 2007. The main goal of the project was to facilitate KONE in the development of products, orientating them towards new technical and strategic knowledge, which are able to promote a new generation of highly eco-efficient elevators (low environmental impact together with high economic and competitive value). One of the main output of the project is a set of guidelines and checklists for the design of high eco-efficient elevators, now integrated in KONE design process.

3. The polarization (re-generation) of ideas using two polarities that highlight PSS modalities.

The main tools and supportive documents used during the workshop are:

- Sustainability Design-Orienting toolkit[4] (environmental PSS idea tables and guidelines)
- Outcomes of strategic analysis (environmental priorities, best practices, …)
- SEED handbook (guidelines for low impact elevator design)[5].

The second workshop (Italy, Finland, USA, 10th of February 2009) involved both KONE and DIS staffs. The aim of the workshop was to get an expert (KONE) take on the draft ideas and visions generated during the first workshop, to identify those worth exploring further, to improve them and to generate new eco-efficient ideas. The main steps are:

1. The presentation of the draft eco-efficient system ideas and visions to KONE staff
2. The evaluation, improvement, re-generation and new generation of single ideas
3. The evaluation, improvement and new generation of visions and clusters of ideas.

Feedback from the company was collected during the discussion and later on by e-mail in a set slide-show format, asking, for each idea and each vision, if it was worth exploring/considering and what could be its possible improvement and spin-off ideas.

Eco-efficient Design Orienting Scenario elaboration

The collected feedback was discussed internally by DIS and the re-generated ideas were clustered using a revised polarities diagram. This process led also to the definition of a revised set of visions.

The first design result of the MSDS method, reached after the *Strategic analysis* and the *Exploring opportunities* phases, is called the Sustainability Design-Orienting Scenario (SDOS). A SDOS is a picture of some possible and promising configurations of a particular demand-offer system, in which socio-cultural, organisational and technological factors are combined to fulfil a particular demand of satisfaction, with a low environmental impact, a high socio-ethical quality and high economical and competitive value. In other terms the design process leading to the SDOS aims at exploring sustainable PSS opportunities, at proposing an organic set of possible company strategy re-orientations, all potentially sustainable (economically, environmentally and socio-ethically winning).

A SDOS is called Eco-Efficient Design-Orienting Scenario (and not Sustainable) when its brief is targeting the environmental and economical dimension, but not the socio-ethical one, as in the case of the KONE project. The Eco-Efficient Design-Orienting Scenario elaborated for KONE is composed of:

- 4 eco-efficient visions
- 17 eco-efficient clusters of ideas, grouped under the vision they belong to
- 49 eco-efficient single ideas, grouped under the clusters they belong to (i.e. under the vision the heading cluster belongs to) and with the indication of the sustainability criterion according to which they could potentially generate an improvement.

So forth, sustainable visions and ideas and their clusters are intended as “tools” to suggest, orient and support the subsequent development and implementation of an eco-efficient Product-Service System.

Eco-efficient system concept design

The results of the first two stages (i.e. *Strategic analysis* and *Exploring opportunities*) formed the base for *Eco-efficient system concept design*, where two steps can be identified:

- Promising scenario options selection
- Eco-efficient system concept development.

[4] The Sustainability Design-Orienting (SDO) toolkit was developed by Carlo Vezzoli and Ursula Tischner and included in the MEPSS EU 5th Framework Programme, Growth projects. Its objective is to orientate the design process towards sustainable system solutions by helping the user in setting sustainability priorities, analyzing best practices, using sustainable design orienting guidelines, checking and visualizing the potential improvements in relation to an existing reference system. It is open-source, copy-left software that can be used on-line (www.sdo-lens.polimi.it) or downloaded (from www.lens.polimi.it, “tools” section) and installed for use on Local Area Network (LAN).

[5] One of the main output of SEED project, see previous footnotes for details.

Promising scenario options selection

In a participated process involving KONE staff, the most promising (in terms of economical and environmental sustainability) visions, ideas and clusters of ideas were selected.

KONE staff also gave indications about the market segments, contexts and time scope that were regarded as the most promising for the company. In particular, what emerged was that:

- The PSS concept was to be seen as an offer for the business to business segment, considering the tenant or facility manager as the referential decision maker
- When a new installation was being considered, the PSS concept was to be designed as for the green building/eco-cities context
- When considering modernization, it was to be designed in terms of the public residential buildings context
- The time scope to be considered was the short term, focusing on present time and possible integration with existing KONE proposals.

System concept development

On the base of KONE indications, comments and selection, DIS begun the concept development.

A third workshop (Italy, Finland, 4th of May 2009), involving KONE and DIS staffs, was organised during the development phase, in order to present a set of draft elaborated concepts to KONE and to collect feedback and suggestions, both during the meeting and later on by e-mail.

The final result initially set for the project was to design one eco-efficient PSS concept for KONE Corporation. Nevertheless, taking in consideration the outcome of the strategic analysis and the following scenario elaboration, two contexts with substantially different characteristics (namely, new installation in green building/eco-cities contexts and modernization in public residential building contexts), were considered equally potentially interesting.

Thus, in constant and fruitful collaboration with KONE staff, DIS designed two concepts, one complete and one draft. Each concept is described by:

- An offering diagram: a graphical representation of the offer provided by the system, illustrating the core function and the added value functions delivered to the customer and/or end-user (see Fig. 1)
- An interaction table (and an interaction story-board, an abstract of the complete table)[6]: a graphical representation of the stakeholders' roles and interactions (see Fig. 2)
- A system map: a graphical representation of the structure of the system, describing the potential stakeholders and their interactions (physical, informational, financial and labour performance) (see Fig. 3)
- The eco-efficiency win-win potentials: a textual description showing the relation between the most important actions of the main stakeholders, the (economic) benefits for the stakeholders themselves and the benefits for the environment, along with the main criteria for environmental impact reduction.

[6] A complete table, both in digital and printed version, was made only for the complete concept, which is already fully designed. A digital abstract of the interaction table was prepared for the draft concept.

Figure 1: An example of a generic offering diagram (due to confidential content, the offering diagram designed for KONE is not publicly available)

Source: Vezzoli, 2010

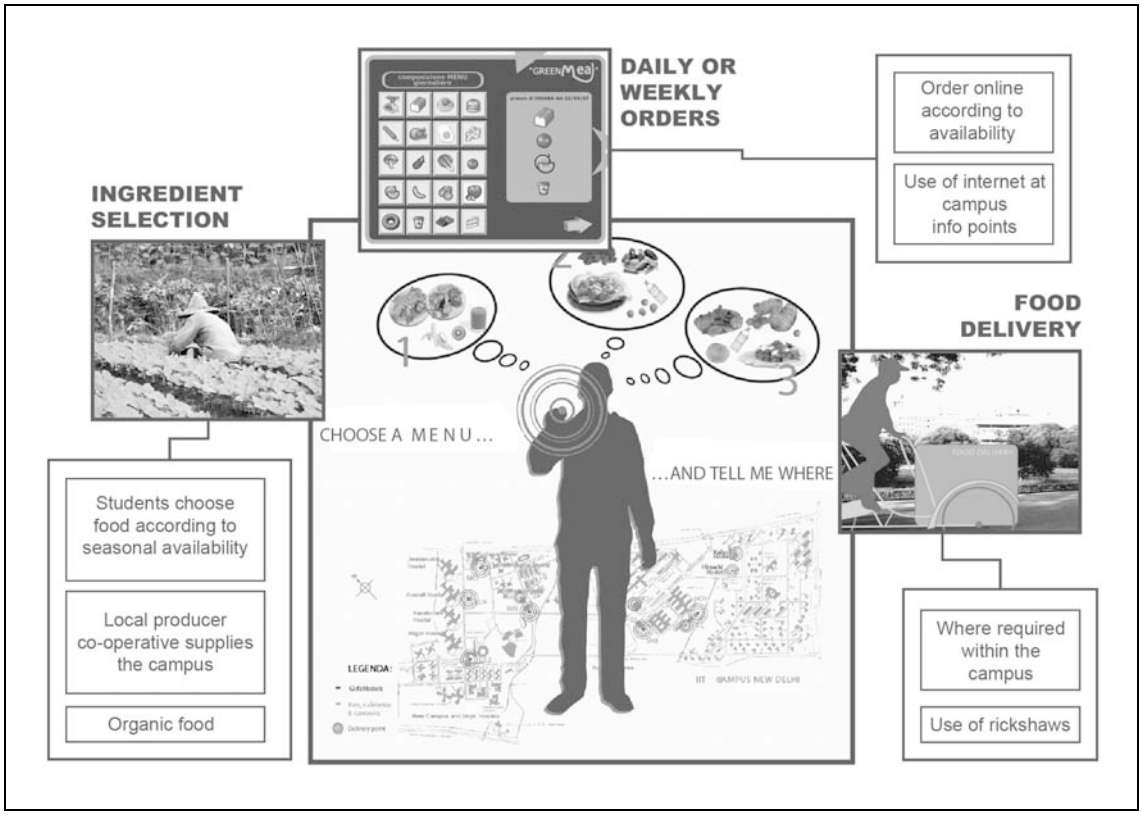


Figure 2: A detail of a generic interaction storyboard (due to confidential content, the interaction storyboard designed for KONE is not publicly available)

Source: Vezzoli, 2010

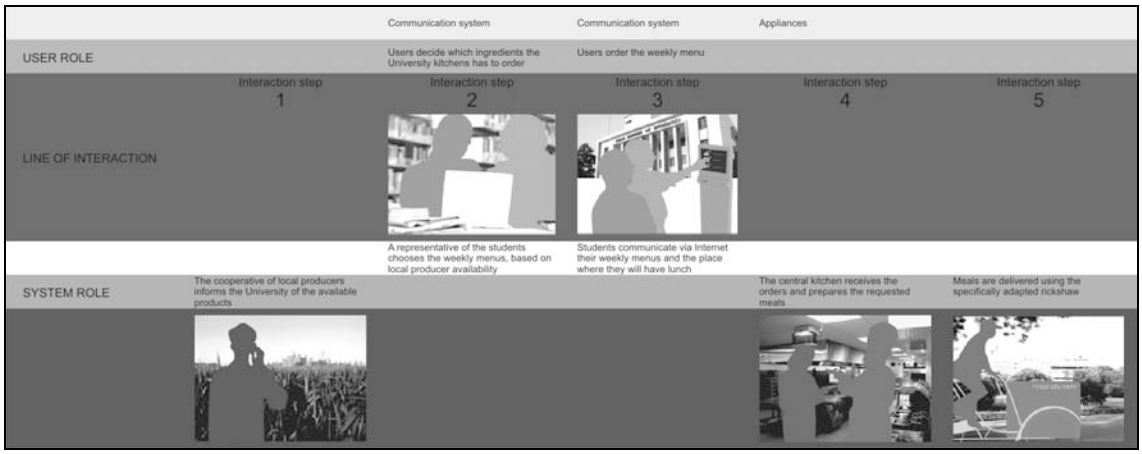
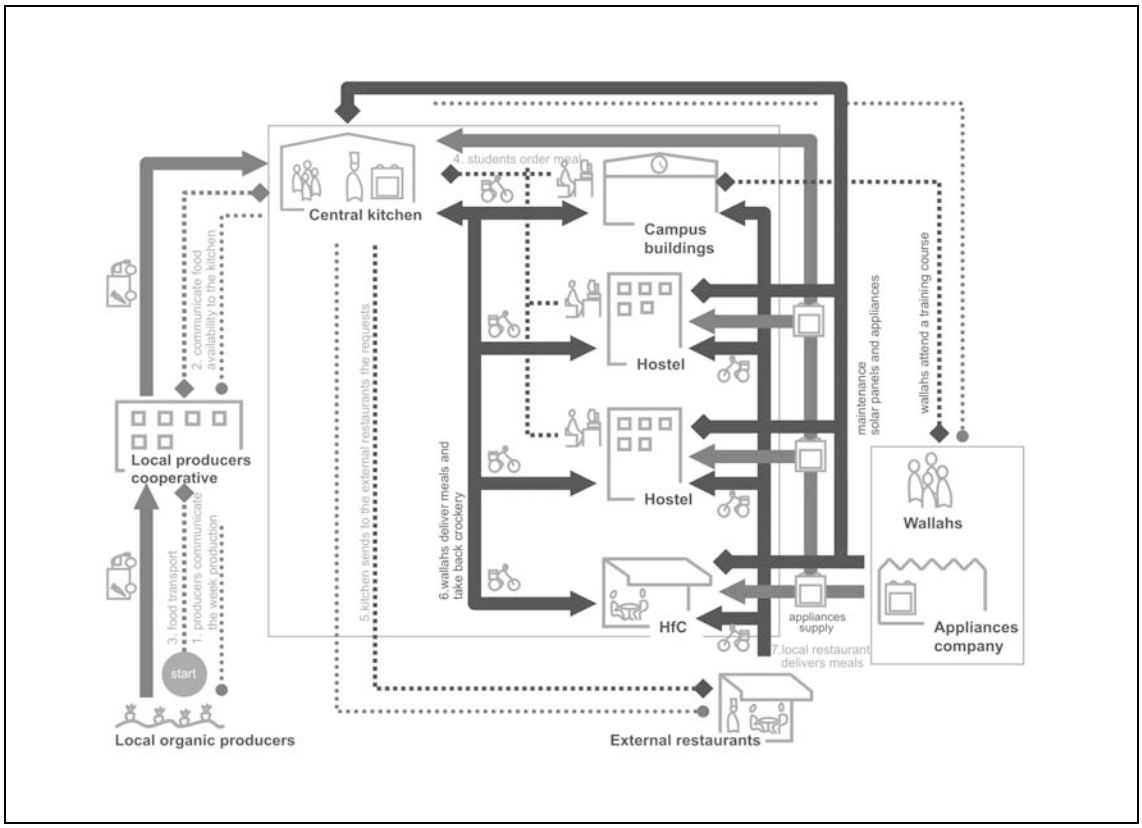


Figure 3: An example of a generic system map (due to confidential content, the system map designed for KONE is not publicly available)

Source: Vezzoli, 2010



System design (and engineering)

Even if not performed yet, the *System design (and engineering)* stage has been already though out, the first defined activities being:

1. The detailed design of an eco-efficient system, starting from the most promising PSS concept, to be developed in close interaction with KONE, and resulting in the following:
    - Detailed offering diagram, stakeholder system map and interaction table
    - Detailed interaction story-spot on sustainability: a clipping from an interaction story-board, meant to visualise key interaction in relation to a specific aim, i.e. how certain concepts would help to achieve a given sustainability goal
2. An abridged Life Cycle Assessment (LCA), highlighting the environmental improvements of the new PSS as compared to the outgoing situation
3. The design of a strategic transition path for the implementation and diffusion of the PSS, i.e. the design of the proper context and conditions to foster and speed-up the experimentation (a pilot project) and the niche introduction and branching of such innovations, through the design of innovative stakeholders' interactions, and their evolution in time.

Communication

The results of the project were presented to KONE staff during a closing meeting (Italy – Finland, 17th of November 2009) and are described in two documents, prepared by DIS both in printed and digital version, in order to facilitate their diffusion within the different departments as well as, at the discretion of the company, to a public audience:

- *Report 1 – Eco-Efficient Design-Orienting Scenario*, presenting the first two stages of the project and the Eco-Efficient Design Orienting Scenario (consisting of a set of visions, clusters of ideas and single ideas)
- *Report 2 – Eco-Efficient Product-Service System Concepts*, presenting the *System Concept Design* stage and the two eco-efficient PSS concepts (one of which only drafted), through offering diagram, stakeholders system map, interaction table and win-win potentials.

KONE feedback on the design process and the achieved results

KONE Corporation is committed to pioneer the development of energy-efficient products that maximize eco-efficiency over their lifetime. Eco-efficiency is one of the key drivers of product and solution development and it has been integrated into all technology roadmaps. To investigate innovative and promising paths towards the sustainability KONE decided to look at eco-efficient product and service systems.

KONE feedback on the design process is positive, in particular due to its comprehensive and fact-based approach. The achieved results in terms of potential business scenarios are important for further development of the company towards the environmental excellence. However an improvement area is to increase the focus on the cost competitive applicability of product service systems to enable their implementation as win-win strategies.

Conclusions

The project was a productive and instructive experience for both DIS research unit and KONE Corporation. For DIS it has been a further opportunity to test the MSDS method and tools, in relation to the practices and culture of a real company, leading to some improvements.

The good reception that KONE gave to the project and its outcome and the fact that DIS is now working with another large company from a different industry sector on a similar project, show that the companies are more and more interested in this kind of design approach and that they recognize the win-win potentials of Product-Service Systems and its value.

The design research community dealing with environmental sustainability has to be aware of the role it could play in offering its competencies for the development of such projects. Its active role is crucial if they wish to accelerate the diffusion of sustainable PSS innovations and approach in design practices, in order to consistently reduce the overall environmental impact of satisfying the users' needs while producing an added value to all the stakeholders of a given value production system.

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the Learning Network on Sustainability

Large-scale retail and the behaviour of people and firms towards sustainability

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The large-scale retail trade has been providing its contribution towards environmental sustainability through different means, principally on the basis of consumer demand. However, there are still large gaps in this area, as the best practices that can be found are sporadic cases, as opposed to standard practice.

The analysis of case studies reveals several environmental problem areas: the geographical location of dealers, the adjustment of the retail trade to current consumer trends, environmental certification, packaging, transport, waste, energy expenditure and the limited success of sustainable solutions/products among the public. As part of this research we wanted to pursue the latter aspect, identifying specific lines of development, because it is essential to work on the choices and behaviour of costumers, who in turn affect those of large-scale retail.

The aim is to induce consumers to enter the system of values proposed by the product and then create a link of loyalty.

Overview

The trade history follows the evolution of the life-style of modern society. For example, in the Fifties women started to work more and more outside their own houses, so it was helpful the presence of large-scale retail where they can buy everything they want just in one place, saving time and money.

The first supermarket was born in 1930, with the opening of *King Kullen Grocery Company* in New York. The big change, that was brought with this sell system, is the self-service mode instead of client-shop assistant (often the owner) mode. That was because, after the 1929 crisis, on one hand, the entrepreneurs looked for new way to save money and gain the best profit possible, and on the other the costumers were looking for products cheaper and cheaper, so the "everything under the same roof" formula satisfied everyone. Those are the historical reasons because the large-scale retail is so successful, but the trend from small-scale to large-scale operation of retail distributive enterprises has been sharply accelerated during the last twenty years and the two major types of such institutions are department stores and chain stores. At the beginning the chartered places to open new large-scale retails were big building already existing in the city centre and simply converted to new needs, but from Sixties, they changed in new building built outside the downtown, where it was possible to have larger area (for shopping and parking).

This kind of sale influenced also the products themselves, and in particular their packaging, because they cannot be sold unpacked anymore, like in small shop. This change was expedited also by a new material, invented in 1855: the plastic. This material is easily formed in different shape, so it can generate

many different boxes that are suitable to many other products. Then, it is lighter than other traditional material (like the glass), so it can facilitate the transportation. Furthermore, it is clean and hygienic.

However, all those aspects generate many environmental problems: big buildings are selling/consuming huge amount of products, but also they are using many energy, heat, generating traffic and waste; and billions of products are increasing plastic waste.

The main environmental impacts of building with large surface are the energy consumption for lighting and more for air conditioning and much more for fridges and refrigerators and the heat dispersion.

Since the 1950s, one billion tons of plastic has been discarded and may persist for hundreds or even thousands of years (Weisman, 2007). Furthermore, burning plastic can release toxic fumes, like the dioxin from the polyvinyl chloride (PVC) burned. Also, the manufacturing of plastics often creates large quantities of chemical pollutants.

Method of the research

The research has a very strong method: from a very clear definition of the retail state of art it was analysed the problems related to that field, in particular the environmental impacts. In that complex scenario, some problems related to the limited success of sustainable solutions and products among costumers resulted more crucial to have broader results. To understand better the reason and to verify how is possible to go further, some best practises were analysed. These show that the successful realities are based mainly on senses and interaction with costumers.

The results of this research were a definition of guidelines to stimulate the development of green products trough large-scale retails, that should be sustainable themselves.

Environmental problems in large-scale retail

The large-scale retail analysis give a complex scenario and, in particular, some crucial criticalities: layout, display, trolley and products. Those are taken in consideration from the point of view of the costumer and of the enterprise.

Layout problems

Costumer side

The layout of a store is usually more oriented to achieve maximum possible profitability rather than customer satisfaction: that will highlight several issues during shopping. First, the location of units does not coincide with the logic of filling trucks: the delicate products such as fruits, vegetables and eggs are placed at the beginning while heavy and bulky staff, as water and detergents, are at the end. On the division of departments, it is noted that some (such as those relating to food) are overcrowded while others have little traffic. Along the route, costumers face other problems such as lane width limited, especially in the outlets of small areas do not allow the passage of multiple people with the trolley: the shelf is positioned as close as possible together to increase display area. Moreover, again for reasons of space, several shelves are positioned near the doors of the warehouse, causing overcrowding due to the presence of both clients and committed as well as equipment for the movement of goods, rather bulky. Often desks are installed for temporary special promotions not being provided special area these are located along the lanes going so impede the flow of customers and creating a sort of obstacle. Not for trolleys and baskets is a dedicated area designed to let them temporarily when you need to find a product and this causes the give up of these objects close to the shelves or even in the middle lane, preventing other customers to move comfortably. Finally, the path does not require the presence of litter bins with the exception of fruit and vegetable department but these are only used for the collection of plastic gloves (in these baskets are thrown but also other types of waste are not compatible with the collection of plastic). Analyzing the fence funds other difficulties arise: just ended spending must choose a box and wait your turn. But the gap between the cash and the shelves behind them are not suitable for the size of trucks it to the amount of customers who are forced to continue along the lane line also hinder other customers. The enclosures themselves are located very close by defining a minimum space for the passage of the cart only create complications for the client who has to fill the bags, place them in the cart and pay. If a customer buys products may leave the store without buying it from the past, however, since one is located just at the

beginning or at the end of the barrier cases, forcing the customer to make a path more (much more if it is a large store surface). The orientation between the lanes should be facilitated by the presence of billboards above the shelves (for example, hung from the ceiling) with indications of the products included in each of these: but often overlap to view and read them you need to go almost at the beginning of the same lane. There are other ways to help customers find products. Moreover, the placement of a product is changed periodically, so the customer who is used to find the product preferences in a certain position, finds herself having to search through the lane, losing time.

Enterprise side

The biggest problems concern the store management are related to order the exact quantities of products to avoid both the sell out and the unsold. Just for the products are needed refueling operations involving the use of shelf resources like the roller pallet or container being large for the transportation of large quantities simultaneously, could cause disruption to customers. Also just the moment of restocking the shelves implies an obstacle both for the customer who does not see certain products and is an obstacle to its passage, both for the worker who must carry out their work as fast as possible than to try to create minimal discomfort to customers. Finally it can result in broken packages of products which then reversed: the intervention of the cleaners must be timely and quick and cause the least possible impediment to customers.

Display problems

Costumer side

The problems can be divided into three areas: on the shelves, products and labels. Regarding the first area the biggest drawback is given by the height of shelves. Foods placed in the last shelf is not accessible to most customers (especially women and older) due to the high altitude and depth of the shelf. Furthermore, in many cases using the same type of shelf for several references: this does not help the customer in the place of storage products to understand and prevent the kind of product content. The second area is characterized by the main problem of identifying the product brand desired when in fact there are many brands for the same reference is difficult to identify the one chosen on the fly. Another drawback is the difficulty to move products as particularly heavy packs off the ground. Regarding to labels instead of reading difficulties exist for that position too high or too low, being also written with a limited character, not of immediate reading. Often the allocation of a label to a product is difficult as they can be moved and therefore not clear which of the products on the shelf are reported. Another exception is made for environmental labels that are placed on product packaging but are not reported on the shelf (in some stores has recently adopted this method, but the cases are still very rare). So do not evident that at first sight, especially since products with eco-labels are placed on shelves where the rate of sales is less, not encourage the purchase by the customer.

Enterprise side

The shelves are too high an obstacle for the employees to be as fast as possible to fulfil them. In some cases involving the use of ladders to facilitate the operations. Another task of the clerks is to identify and fix the products out of place in the right wards. Customers often leave it on a shelf any product that decide not to purchase more before arriving at the checkout, not willing to return to where they had taken. Proper label placement is a task, which the company should take care, in order to help our customers to read them. Labels should be checked regularly and replaced in the right place if you move, sometimes inadvertently, by the customer. A concern is also in the risk of theft products on the shelves and they must be willing to avoid creating hidden areas to facilitate the theft and each area should be controlled by surveillance cameras.

Trolley problems

Costumer side

When you decide to take a cart is necessary to insert a coin to release the frame with the previous one. Often, however, this joint you cannot open easily. Also not uncommon to find waste as plastic gloves and flyers left by the user before. Inside the store management of the basket is quite difficult given the size, more if the truck is full and heavy to move. Despite its size it can happen to buy a few large products and fill quickly. The trucks are lacking a method for supporting a shopping list that instead must be hand held

by the customer, making the operation more difficult to ride the trolley. The same applies to the possibility of supporting the bag or jacket.

Enterprise side

The main issue appears to be similar to that of the baskets with the difference that the blocks have a special housing. The difficulty is the fact that customers use the truck to transport spending to the parking lot to load it easily by car, then depositing it into the slots located at the parking lots. Workers must continually move into positions near the entrance of the store for subsequent customers who otherwise would not have provided.

Products problems

Costumer side

There are various problems related to packaging: first of all packs of proportion with the content (designed to bring attention) that deceive the customer on the amount of product. Also represent an environmental problem since it increases the amount of material used: this occurs mainly in packaging doubles, where the outer function takes the image and communication while the internal security and storage. Some packages may be damaged during transport, in all its phases. These damaged items are discarded immediately. Are there any packages that protect fragile during the trip, however, may be broken or damaged by the customer when they take in hand to choose when or places them in the cart / basket or put them in bags to take home with them. The problem is in fact due to the disposal of the products, often do not pay much attention and is likely to deposit a brittle under a heavy product. There are also packages whose structure is not perfectly linear, it causes instability: the customer, picking up products for evaluation or read labels, often in danger of dropping it. In the selection of products is important to read the expiration date is often difficult to detect. The same applies to environmental certifications that are often placed in the back or lower and therefore hardly visible. Furthermore, the choice may fall on the customer's products aim to promote saving: in fact doing so is likely to buy more than necessary and if it is fresh that he could not consume them before they decay. Finally you have a problem even to the case: certain products are placed on display located behind or beneath the boxes, so it is difficult to achieve as well as detect them. Furthermore, by depositing the products on the tape, it can happen to confuse them with those of previous client or later: the same can happen to the cashier.

Enterprise side

The staff has the task of unpacking: this is not always easy and quick: to open the cartons sealed with tape or plastic film as it is necessary to use the knife. Opening of the pack comes a problem for environment: large amounts of waste (waste material from the biggest selling point is the cardboard). Another problem is that the packaging thin and fragile, often used for fruit and vegetables, can be pierce easily. For heavy products you have issues of transportation and moving inside the store, mainly from the warehouse to the shelves.

Limited success of eco-friendly products

The problem of reference of this analysis concerns the consumption pattern of people and the willingness or not to take on new behaviours that are more sustainable. The causes behind the lack of interest in adopting sustainable behaviour can be grouped into three main areas: product selection, the choice of how shopping and alternative ways of purchasing.

Product selection

The products introduced recently in the local references of retail customers are often not chosen because of failure to read the labels on which shows the place of origin. In fact to save time you choose the product that is usually used to purchase without stopping to read the labels of various products to compare and choose instead the path that has fewer miles. Since the range of local products constituent is lower than the traditionally this: consumers are accustomed rather to find any type of product, from exotic foreign ones, and difficult to give up to buy what they want. The same applies to organic products, but what often leads to not choose the higher price to other products, we add the distrust of certain persons in relation to actual farming methods adopted. For products marked with certification ecological problem, be-

sides the higher cost, is the misinformation on the meaning of the certificates themselves. Such products are not exploited but rather are placed in positions where the rate of sales is minimal, apart from the fact that the logos are placed on the sides of certifications that are hidden in the time of exposure of the product on the shelf or not emerge in other packages. The products on tap, introduced so far only a few outlets have reported initial success but few consumers. In fact, a customer needs is the time savings: buy in bulk means a waste of their time greater than the range of packaged products. Moreover, despite the economic savings, spread a sense of distrust of novelty, also linked to the fact that you do not know the quality of the bulk and the operation of the dispenser. Finally a responsible choice would also aim at products that use less relevant material for their packaging: instead of the current trend is to buy single product because the increasingly hectic lifestyle that requires fast and easy consumes. Furthermore, the individually packaged product is perceived as of greater value or quality (such as boxes of chocolates: the larger the pack size and the smaller the number of chocolates content, the higher the perceived quality).

The choice of how shopping

The first choice to make when you decide to go shopping is the mode of transport: public transport or cycling or walking are often unused because of the convenience of transportation by car to which it is difficult for the waiver is 'habit for comfort, especially when the distances are large and difficult climatic conditions. There are also no incentives to encourage the first mode, besides the fact that the car can save you time. Another option is responsible for spending online causes of low use in Italy, are the added cost of delivery that not everyone is willing to pay, the fear that mistakes may occur or delays in deliveries, especially the lack of a direct contact with the product is particularly important in the vegetable-fruit products, while for products that easily wither important is chosen based on the expiration date. In some case, sacrificing quality for cost savings but also the distrust on the actual product quality. Also trademark does not allow misinformation to choose the most responsible way, supporting those products to be marketed require large amounts of energy or exploit the workforce. Fall in consumption patterns aware also buy only what you need and no more, for the simple desire to possess. This however is not favoured by large quantities of such products in a shop characterized by impulse but also the propensity to take advantage of offers or promotions to save the conviction and the ability to earn loyalty points with special purchases. Finally also the choice of bags recorded in this field: as consumers declare that responsible use reusable bags, many do not take this behaviour because they forget to carry the bag from home played a role in this important habit. Often the choice of paper or reusable bags is also constrained by the higher initial cost than a polyethylene bag (although this is repaid over time).

Alternative ways of purchasing

Shopping at a farmers market is disadvantageous from the standpoint of a consumer because it involves a waste of time because these markets are not products for the home or personal care. The formula for everything under one roof is no longer valid and forces the consumer to go to another place to meet all its needs. As for local products among the desks of the large-scale retail, the selection of a farmers market is less than that of fruit and vegetable department of a store. Being a new formula in the market, the farmers market are not present in many cities, so if you live in a city where there are no clear beneficial move. This then is a general misinformation on this subject: not everyone is aware of farmers' markets and who knows what consist not always know how to find them. In fact, besides being present in a few locations, are not open every day: The customer must then inquire about opening times and they coincide with their commitments. An alternative solution is the buying group but also in this case knowledge on these associations is relatively low, those who do not know, who does not know how to join and how they work. But often plays a role imported the desire for independence: indeed, adhering to a buying group, it enters into a relationship with other people and, despite orders from the farmer products can be made individually, the time of supply is in communion with the second internal logic predetermined group. Both for the farmers market for the buying group then enters the game of usually problem: if the expenditure is made at the large-scale retail long hard a person is willing to change. Finally, the phenomenon of city gardens, still in its infancy, is difficult to spread primarily to the unwillingness of people to use their time to cultivate and to assume a commitment durable. Many aware of these initiatives are not aware of the growing techniques and are not willing to learn the field.

Best practices

This research field has been analyzed taking into consideration a number of best practices and highlighting the problems relating to layout, display, baskets, trolleys, products and shoppers, from the perspective both of the client and of the company, and lastly also the problems related to logistics, buildings, storage and packaging. These solutions come from the experience of some foreign countries, where popular consent is already steady. An important factor that comes from the cases is how the application of eco-guidelines in this field can reduce costs, facilitate purchasing and increase customer loyalty.

Conclusions

To understand in what direction the large-scale retail can move to achieve the goals of a greater empowerment of consumers, not only in buying but also in consuming, environmental guidance by manufacturing companies is required.

This research has defined six lines of development, divided into two main categories: those based on specific factors of experiential design (the 5 senses, environment and interactivity), and those representing new solutions (social relations, simulation situations, product knowledge).

To make an object more rich in experiential terms the simplest approach is to add elements that intensify the sensations experienced by the user. However, such stimulation may be unrelated to a particular object and should be expanded to an entire environment. As you can see from the current solution, stimulation of the senses is more focused on vision and hearing. Touch, taste and smell but are often overlooked. Within the retail distribution and in particular in the food sector, is fundamental for choosing one product over another, just the stimulation of these three ways, as well as the visual. To encourage more environmentally friendly products to choose should emphasize their ability to stimulate these senses in a way more intense than others. Regarding the view, often taking the treated products look better and thus more reassuring but are more harmful to health. You must make it clear to consumers that a pleasant visual perception is not always the goodness of the product. Even the taste of natural products is more intense: we can envisage samples: in fact the consumer is more convinced if he has the chance to personally try out the sensation.

Based on the confidence given by the subject to the product, future purchasing opportunities arise. To encourage responsible consumption, we can try to engage the consumer emotionally; through the association of intangible property to sustainable behaviour, the individual internalizes the values given by the products. Modern consumers require intangible aspects such as space, time, air, welfare and social development.

Currently society is characterized by a lack of quality of emotions related to human relations and solidarity. Our convintion is that the attitude should change to include others, and not just ourselves.

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the Learning Network on Sustainability

Shared use

Cultural aspects and user satisfaction in doing the laundry together

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This paper discusses the shared use of washing machines in residential buildings, considering the relationship between cultural diversity and user satisfaction. Although shared use of artefacts has gained notoriety in several countries as an alternative to reduce consumption, there is still a certain level of resistance in some social groups, regarding sharing, partly because it involves relationships, individualism, collective rules and mandatory interaction between individuals, as well as a weak sense of ownership over the artefact, amongst other factors. In the collective use of washing machines, these concerns become more evident in relation to hygiene and privacy. Based on a research on user satisfaction in sharing washing machines and its relation with cultural factors, conducted in residential buildings of Curitiba city, in Southeast Brazil, this paper emphasizes the need of a deeper understanding about the cultural motivations that underlie the shared use, both in terms of ways of using and designing artefacts, as well as about their implications in the user satisfaction. Furthermore, it proposes some design strategies, which aim at promoting the sharing of washing machines, as well as some strategies for improving the development of products and services focused on shared use.

As one of the environmental strategies for sustainability, Manzini and Vezzoli (2005) propose the intensification of the use of artefacts through their sharing, in order to reduce the quantity of units produced and the number of discharges generated by aesthetic or technological obsolescence.

Tukker (2004), in turn, indicates that the use of systems for shared use can lead to a reduction of approximately 20-50% of the environmental impact, compared with those for individual use. An example of this strategy is the collective laundry system of residential buildings, where few washing machines can be used by all residents.

Studies based on life cycle analysis conducted in Sweden indicate that there is a positive environmental impact of washing clothes in a communal laundry in comparison with washing at home, if the drying is not included, since people tend to use the clothes dryer while using laundry services, and the clothesline while doing the laundry at home (Mont, 2004).

Another study about eco-efficiency factor that was determined by the amount of energy, water and detergent consumed per kilogram of laundry, made by the Netherlands Government on Sustainable Technology Development Programme, also indicates a better environmental performance of doing laundry in community centers and commercial laundries than individually at home. While gaining a better performance than the collective laundry and the residential use – according to the washing of clothes in scale and the availability of qualified operators –, the commercial laundry requires the use of high temperatures in the process of washing clothes and greater energy expenditure with transportation to these locations. The collective laundries, in turn, perform better than individual use, since few washing machines are purchased (Roy, 2000).

Despite the environmental advantages described by these studies, the question of satisfaction seems to be a key point regarding the collective laundry use, since, even in countries where shared use is relatively well accepted, there is a reduction in using these services in substitution to the ownership of washing ma-

chines. In Germany, for example, where the collective laundries were the main place to wash clothes after World War II, currently about 90% of families own their own washing machine (Schrader, 1999; Mont, 2004).

According to Mont (2004), in Sweden, a survey realized by SIFO[1] (2000), indicated that 76% of households using communal washing centers were satisfied with the quality of equipment in such spaces, but in contrast, only 40 % of households were satisfied with the cleanliness and hygiene of equipment and place where the clothes were washed.

In Brazil, data from the Union of Laundries and Similar (SINDILAV, 2010) indicate that only 2.8% of the economically active population use services of commercial laundry. Besides, the main reason for this option is the need to wash more delicate clothes and heavy items, which are harder to wash at home.

Furthermore, some resistance to the widespread use of services or collective laundries in residential buildings can be observed in the Brazilian context, reinforcing the inexpressive use of commercial laundries.

According to an exploratory research conducted by Vasques, Lourenço and Padovani (2009), in Curitiba – Brazil, few buildings that offer this service for over ten years have been identified. This research highlights some difficulties in the use of washing machines in a collective laundry, both in terms of interacting with other people and with the artefacts.

The wait for using the washing machine, the lack of community sense, and possibility of contamination are some of the problems often mentioned by the research participants. On the other hand, some advantages of using this system have been identified, such as: it is easy to use; less storage space in the apartments; and the apportionment of costs of acquisition and maintenance. However, only few people of the research group prefer the shared system, which highlights some dissatisfaction with this way of use (Vasques, Lourenço, & Padovani, 2009).

Other studies developed in Curitiba city (Ono; Sampaio, 2007; Santos; Schäfer, 2009) mention certain refusal to the sharing of artefacts, motivated by possessiveness, for fear that other people do not have the same care with the artefacts in order to avoid damage, the unavailability of the artefact when someone wants to use it, or the possibility of not having a loaned artefact returned. A great concern about the possibility of lacking hygiene and harming health was identified as a relevant barrier to the sharing of washing machines, according to Ono and Sampaio (2007). Moreover, anyone of the respondents consider that it is more advantageous to wash clothes away from home, because they think that by doing that they might lose comfort, convenience and time.

These studies show that many of the justifications that have been given for the preference of individual use against the shared use of washing machines are based on cultural issues. Therefore, it is necessary to more deeply investigate the influence of culture on shared use of artefacts .

Thus, the research reported in this paper seeks to promote a discussion about cultural factors that are related to (dis)satisfaction of users of collective residential laundries, and, from that, it delineate some recommendations for products and services design that are focused on clothing care, more specifically on sharing of artefacts, respecting the cultural diversity.

The relevance of the reported study for design research and practice focused on sustainability is emphasized by the fact that there is still a lack of studies and researches about the relationship between cultural factors and alternatives of more sustainable consumption (Ono, 2008). Moreover, Mont (2004) calls attention to the fact that alternative ways of living that could lead to more sustainable consumption based on values and standards of one culture may conflict with those of others, which limits the potential for transferring them. Therefore, it is necessary to take into account the characteristics and particularities of each culture, in order to develop viable alternatives for sustainable use and consumption.

This paper initially presents some studies about examples of shared use of washing machines in collective laundries in the Brazilian context and abroad, showing some of the cultural reasons for their acceptance or rejection, in the first two sections. Then it reports the research method and the main findings from a pilot study. Finally, it presents some considerations about the research and recommendations for future work.

[1] SIFO. *Om Tvättstuga i Flerfamiljshus*. Sifo Research and Consulting. Stockholm: 2000, p. 24.

Collective laundry in different contexts: some examples of cultural reasons for doing the laundry together

According to Mont (2004), there are communal laundries centers in Sweden since the 1920's and, still nowadays, this is the most common alternative to wash clothes in this country.

Rosén (2008) indicates that collective laundries was encouraged by the Swedish government even in the 1930s, with the approval of several grants for the construction of collective laundries in rural areas, taking into account the requests of women's groups to become easier the housework, since doing laundry was considered one of the most arduous female tasks. The so-called "laundry issue" was seen by local authorities as a housing problem, and after Second World War, they have increased the investments for the construction of various types of collective laundries in the cities.

In the 1960s, people living in rural areas began to acquire their own washing machines, while the number of collective laundries increased considerably in the cities at the expenses of commercial laundries. As a result, there were subsequently raising recommendations on the location of collective laundries and basic equipment for installation by the Swedish organization for owners and tenants of apartments. In Germany, by the same time, the communal laundries were also the most trivial place to doing the laundry. This scenario, however, has not been maintained, and, currently, the vast majority of the population has its own washing machine, accomplishing the task at home (Mont, 2004).

Thus, Mont (2004) attributes the persistence of collective laundries in Sweden to the institutionalization and standardization of these services, unlike other countries of Western Europe, where most of the clothes are washed in commercial laundries.

On the other hand, Lanz (2008) argues that, concerning to Architecture, the sharing of spaces and services (such as rooms, laundries, offices, etc.) is one of the most common proposals in European countries today, as a possible response to changes in the family structure and the consequent sprouting of new needs for housing.

According to Busch (2006), it is common to find collective laundries in residential buildings in the United States. For this author, the share of washing machines and use of commercial laundries are popular in this country, because in its population's structure there are many people with a under-average income, who cannot afford an own washing machine, as well as due to the lack of space in apartments in cities.

Such variety of manifestations emphasizes the importance of considering the social dynamics and the cultural diversity (Geertz, 1989; Geertz, 1996) in the development of services and products systems (Ono, 2006).

Collective laundry in Brazil: cultural aspects

In the Brazilian context, even nowadays there is some resistance to the widespread use of collective laundries, despite the washing machines are present in only 39.5% of the Brazilian households on average, according to data from the Brazilian Institute of Geography and Statistics (IBGE, 2008).

Based on a research on the configuration of buildings from the 1930's and 1940's, Pinheiro (2008) reports that only some of them are designed with collective areas in São Paulo city. She asserts that there was no success in this type of buildings, and suggests that some associations with tanks, latrines and collective kitchens existents in slums from the early twentieth century partly explain the resistance to collective laundries.

Guimarães (2007), in turn, argues that the fact of finding external spaces for clothing care only in very specific situations and in small areas of housing, still today, leads to the "intimacy" issue involved in cleaning clothes, which means that most people do not feel comfortable having their lives exposed in collective places.

On the other hand, a number of builders currently begin to realize the economic advantages of reducing the individual areas of apartments, offering, in exchange, common areas, such as toy room, office, collective laundry, amongst others. Thus, many of them have invested in buildings with such infrastructure. The collective laundry, specifically, reduces total cost for builders, because it requires less materials,

electrical and hydraulic installations than if it was installed a laundry in each residential unit (Brum, 2008).

Nowadays, buildings that offer laundry services in Curitiba are generally composed by a large number of apartments, with maximum internal area of 60m^2, and they are intended for one or two people (Brum, 2008), indicating that this type of service has been better accepted by a very specific audience, usually composed by people who seek a place to live for a short period of time, as suggested by Guimarães (2007).

There are basically two types of collective laundries available in residential buildings in Brazil: *self-service*, in which the residents are responsible for putting the clothes for washing, follow the process, remove the clothing of the machines, and put them to dry in a dryer or in clotheslines; and *express with care*, which is similar to a commercial laundry service, in which the residents only deliver their clothes and get them after, ready to use.

Nevertheless, the choice for professional washing machines represents a high cost for buildings in general, because they have higher prices than residential washing machines, which can become a hindrance in the implementation of a collective laundry (Brum, 2008). As an alternative, however, some residential buildings have been opting for residential models of washing machines, aiming at making possible the acquisition of these artefacts, such as the Denver Hill Building (Fig. 1) and the Central Place Building, both located in Curitiba, for instance.

Figure 1: Collective laundry of the Denver Hill Building (Curitiba), equipped with residential models of washing machines

Source: Photo by Rosana A. Vasques (2009)

Brum (2008) points out that, besides the high cost of professional equipments, other factors may hinder the acceptance of the collective laundry in residential buildings, as the fear of having relationship problems between residents in its use. These factors are related to the ways of sharing space, scheduling time to use the machines, and the maximum quota of usage. For this author, another relevant issue is the lack of community sense, evidenced by the Central Place's building manager's words: "There are a lot of residents who do not respect the rules and put even dog clothes and dirty shoes within the machine, forgetting that other people will also wash their clothes there."

Guimarães (2007), on the other hand, identifies, in the speech of one of her interviewees, the development of a greater socialization among neighbours, because of the existence of a collective laundry in the building where the interviewee lives. This author also emphasizes the development of values aimed at sharing among residents, like the fact that some people use to collect and fold the dry clothes for others.

Research Method

The research follows a predominantly qualitative and interpretive approach, considering that its main objective is to investigate cultural factors that might influence satisfaction in the shared use of washing machines, and not to quantify or measure data. It emphasizes the report and interpretation of social meanings related to the use of collective laundries, and the social interaction resulting from this experience.

Research tools include semi-structured interviews and questionnaires, both designed to assess the user satisfaction in his/her interaction with collective laundries of residential buildings, as well as to investigate cultural factors that influence satisfaction in sharing washing machines, and to identify barriers and opportunities for shared use.

The interviews consist of five main topics, namely:

- Participants' profile.
- Cultural habits related to the use of the collective laundries of buildings.
- Interaction factors between the user and the washing machine.
- Factors of social interaction related to the use of the collective laundry.
- Interviewee's opinion about shared use (besides collective laundries).

The questionnaire consists of options to be placed in order of preference on types of use (ownership, rent or share), and a list of advantages and disadvantages of using a collective laundry, whose options are based on Schrader (1999) and Vasques et al. (2009). There are also issues about characteristics of washing machines, habits of use and sharing, with the option of single or multiple choice.

Other forms of gathering information are participant and structured observation, for the triangulation analysis of data obtained from the interviews and questionnaires, and analysis of washing machines of the investigated collective laundries, as a way to verify the presence of design strategies aimed at sharing these laundry artefacts and systems.

Participants

The sample of this research consists of collective laundry users from residential buildings of Curitiba city, without gender restriction, nor age or income limitations. A priori, these limitations do not allow to broadly investigate about the residents' profile, although some authors suggest some specificity, such as as singles or couples without children (Brum, 2008), people without fixed residence (Guimarães, 2007), or the "typical innovators" represented by young people with educational level above average (Schrader, 1999), for instance.

In the pilot study described in this paper we adopted the strategy of maximum variation among the participants, trying to capture differences in the sample, which, according to Moreira and Caleffe (2006), can produce results that highlight the uniqueness between them and shared standards between cases that derive from the heterogeneity. The following table (Table 1) provides some information about those participants.

Table 1: Description of research participants

Participant	Age	Occupation	Lives with	How long has been living in the building?
Flavia	20	Student and Trainee	Husband and a pet cat	3 years
Sirlei	41	Housewife	Husband and a daughter	8 years
Maria da Aparecida	78	Retired	Lives alone "by her choice"	11 years
Robson	37	Systems Analyst	Lives alone	12 years

Results and analysis

As reported by the participants, the presence of a collective laundry is usually not a deciding factor for choosing an apartment. However, it has been a relevant factor. Maria Aparecida, for instance, found in-

teresting the presence of a collective laundry, because her apartment is small [0], which confirms that the release of space inside the apartment constitutes a facilitator in the shared use (Schrader, 1999; Kazazian, 2005).

Regarding the confirmation or not of a positive or a negative expectation, a factor that Demir, Desmet and Hekkert (2009) point out as an indicator of satisfaction, Maria da Aparecida and Sirlei reported that the existence of a collective laundry generated good expectation and their expectation has not changed over the years, whereas Flavia and Robson had negative expectations at the beginning, which were not confirmed during use.

In relation to cultural habits, Maria da Aparecida and Sirlei follow the classification system of pollution, identified by Barbosa[3] (2006), whereas Flavia mix various types of clothing, and Robson "puts everything together", including mixing colours.

Maria da Aparecida uses the washing machines in the collective laundry just for bed and bath clothes and few personal clothes. Suit and blankets are washed in a commercial laundry. And the other clothes are washed in the bathroom by herself, especially underwear and dish clothes (separately). The main reasons for it are the need of privacy; concern about hygiene, "because everything is washed up there", and for health reasons, "to prevent diseases", according to her. She also reported that, during the summer, she likes to wear very light clothes, which are washed at night, when bathing, and can be used in the next morning, because it is already dry. Because of that, she installed a clothesline in her bathroom (Figure 2) for drying those clothes that are not washed in the collective laundry.

Figure 2: Clothesline installed in Maria da Aparecida's bathroom for drying clothes that are washed there, and not in the collective laundry

Source: Photo by Rosana A. Vasques (2010)

The "intimacy" issue – pointed by Guimarães (2007) as a barrier to the use of collective laundries – was identified during the observation period, when it was noticed that some residents attempt to hide their underwear, putting them in the center lines of the internal clothesline, among other clothes, while others do not care about exposing this "intimacy", leaving the pieces anywhere in the clothesline, even outside.

Furthermore, concerning the habits related to the use of the collective laundry, Flavia emphasizes that she activates the pre-washing system of clothes while the machine is fulfilled with water, and she uses to make "reservation" of a laundry machine, as soon as she arrives from her job, leaving it turned on while picking up the clothes in her apartment. This behaviour highlights the need for synchronization between the availability of the artefact and laundry system and the users' schedule, as mentioned by Warnke and Luiten (2008) and by Manzini and Jégou (2008), since neither the washing machines nor the laundry use

[2] Every apartment in the building where the pilot study was performed has only one bedroom and living room and kitchen combined with the internal area of approximately 36m^2.

[3] Barbosa (2006), based on structural theory of pollution proposed by Mary Douglas (1966) defines that in complex modern societies, the concept of pollution is not related only to the sacred / profane, as discussed in the literature of traditional anthropology, but it is a key criterion in the organization of everyday life, since this concept "structure a complex classification system, which guides the practices of cleanliness and hygiene of houses, clothes, and also the bodies of men, women and children in Brazil" (p. 112). In relation to clothing care, the principle of what is pollutant, that is, capable of get dirty what other things materializes out under the "rule of prevent that clothes which has contact with certain types of people or things considered different in nature come into contact with each other" (p. 133).

to have any information system for users to check their availability from their apartments, which requires that the user goes to the laundry to see if there is one machine available or not.

About the interaction with the artefacts, all participants consider that residential models of washing machines are quite suitable for collective use, mainly because they are easier to use than the semi-industrial or professional ones, since the use of commercial laundry is not widespread in Brazil and few people have prior experience with these artefacts.

In relation to the issue about social interaction, Flavia mentions that: “People here [in Curitiba] are introspective. But I’ve made friends in the laundry”. Sirlei affirms that she knows people who live in a certain building just because of the existence of a collective laundry, because one can meet people there and talk with them. Maria da Aparecida reports that she has a good relationship with her neighbours, but some of them are closer and others less. Robson, in turn, considers that many conflicts can occur in the laundry, especially when there is a selfish attitude from someone.

In the last part of the interview, Maria Aparecida affirms that she does not rely on the hygiene of the washing machines in the collective laundry, “because of all kind of things that are washed there. There are people who wash sneakers in the machine [...]. And a germ is a germ. At my age, I try to avoid it”, confirming the results found by Ono and Sampaio (2007).

Flavia and Maria da Aparecida consider that shared-use is like borrowing something from other people, and they do not feel co-owners, because, by doing that, they tend to be more careful with the machine than if it belonged to them.

Finally, Robson emphasizes the implications in time saving. He is looking for an apartment where he can have his own washing machine. He argues that sharing a washing machine reduces his spare time in the weekends. Furthermore, he described other experiences on sharing, some negative (sharing an apartment) and positive (sharing a car, a drill) for him.

Conclusions

The ways of usage, habits and feelings about the collective laundry and sharing washing machines are directly interrelated with cultural factors. This is reinforced by the reported experiences and opinions of the research participants, which, associated with the general analysis of satisfaction with this way of use, might be helpful in the development of strategies for designing products and services aimed at the shared use, especially insofar as more data are added to the survey, thus affording deeper analysis.

Although they have not been developed for this purpose, residential models of washing machines used in collective laundries do not seem to cause big problems, as indicated by the interviewed participants. However, the absence of bactericidal sterilization systems in such equipments is one of the potential cultural barriers to sharing, as identified in the interviews, and previously described in studies by Ono and Sampaio (2007) and Barbosa (2006).

Unlike the image of the majority of Brazilians, Curitiba’s inhabitants are known in general as introspective people. However, the existence of a collective laundry was identified by the research participants as a possibility to regenerate the social fabric, and able to create stronger connections than the banal and superficial “good morning” that occasional meetings in the elevator allow. Thus, this space is configured as an opportunity to “activate” relationship between people (Cipolla & Manzini, 2009), and the artefacts and systems might become “meeting points” (Jordan, 2000), able to develop and expand social integration among residents.

It is worth mentioning that the mentioned research is still in progress, and the development of new interviews and questionnaires will expand the data obtained, so that we can get more detailed results, and propose recommendations for designing products and services systems, aimed at shared use in collective laundries.

However, the implications of cultural diversity (Geertz, 1989; Geertz 1996; Ono, 2006) and social changes require appropriate research and development approaches, to be conducted in a continuous process (Leur et al., 2005), and taking into account the complexity and dynamics of society and culture.

Thus, the information and proposals presented in this paper do not seek a single, definitive truth. Moreover, limitations of the research are also recognized, and, especially, the influence of the interpretation of the researchers in the adopted approach (Flick, 2004; Caleffe & Moreira, 2006).

As previously observed by Mont (2004), the understanding of consumption practices from the perspective of their socio-cultural impact and from the historical context in which they occur can help the understanding of how alternative and more eco-efficient consumption as shared systems are merged.

Thus, it is recommended that future works investigate barriers and facilitators in shared use on doing laundry and other types of services in different cultures, since the sharing of systems of artefacts, as well as the provision of services instead of the individual ownership can configure as a possible scenario for a sustainable consumption, since they can afford respect for cultural diversity and be part of the social construction of meanings in the relationship between different individuals and between people and the shared systems of artefacts.

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the Learning Network on Sustainability

Overcoming barriers to adopt Product-Service Systems (PSS)

A case study from Turkey

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The notion of Product Service Systems (PSS) is being investigated by many scholars as an innovative way of achieving dematerialization towards sustainability. Beside successful PSS examples, barriers for shifting towards PPS are also identified in the literature. However, adoption of a successful PSS model might need a transition phase to overcome the pitfalls.

The objective of this research is to identify and to discuss the possible strategies to overcome business and technology related barriers to adopt a PSS in a developing country. The paper further examines the recognized drivers and barriers for shifting towards service oriented business models from the literature. An exploratory case study about a Turkish company is also presented to make a comparison with a successful Italian case. The paper concludes with a set of lessons learned from the case study and critical business factors that companies and entrepreneurs should be aware of when designing strategies for service oriented business solutions.

Introduction

Sustainability is one of the core themes of many disciplines and presents a truly global challenge for product developers regarding with material consumption and resource utilization. Towards the transition to sustainable production and consumption, state business models need to be reviewed in order to realize a radical system innovation.

Product Service Systems (PSS) provides an opportunity for potential dematerialization of consumption. In this manner, many successful PSS models are discussed in details in the literature. Possible drivers and barriers for adoption of PSS models are also discussed by many scholars. Besides analyzing drivers and barriers of different PSS cases individually, comparing business models which provide same kind of product and / or service would support the literature with an understanding about the impact of different circumstances on the success of a PSS model. This paper aims to identify the impact of country related economic, legal and social circumstances on evaluation of a PSS model.

A brief literature review has been done about the possible drivers and barriers for shifting towards more service oriented businesses. To provide more insight about the critical factors that contribute to the companies' decisions to shift, and to understand the situation that supports or blocks the adoption of PSS in a developing country, an exploratory case study on a Turkish company is conducted. An existent and simple example, the Italian business case on textile floorings for trade fairs, is chosen to make the comparison. It was expected that same model could be adopted in Turkey as a best practice. Stakeholders of the system and the material flow were identified in a system map. Interviews with open ended questions were conducted to understand stakeholders' expectations about products. Drivers and barriers from the literature are used to analyze the business case. Finally, opportunities of improvements in the actual PSS and a complete new PSS model are discussed.

Background

Sustainability can be defined as a dynamic process that enables improving the quality of life while simultaneously protecting and enhancing the earth's life support systems (Sherwin, 2004). From this perspective; sustainable design considers that environmental, economic and social impacts occur throughout the product lifecycle (Lilley, 2009). Economical, environmental and social domains are the three pillars or triple bottom line of sustainability. Defining solutions for those three domains requires system thinking while designing and developing products. In theory there are many studies concerned with the economical and social domains of sustainability however in practicality, it is more about eco-design which includes improving existent products for less harming effects to the environment (Sherwin, 2004). There are several methods and concepts for more sustainable product development and manufacturing (Kaebernick, 2003). However it does not help to create big positive impact on the environmental effects of products, that's why there is a need for a systematic change (Morelli, 2002; Nuij, 2001).

As a result of the nature consumption pattern, customers are becoming more and more demanding than they used to be; they consume products faster and ask for newer versions. Thus, companies need to shorten their innovation cycles and build strong relationships with customers and other stakeholders. Increased demand of customers is met in a material and energy intensive way. As consequences of this situation, in near future resources will not be enough to provide wealth for the same amount of people with the same life standard they have now. Mont (2002a) stresses two strategies for altering this chaos; increasing resource productivity to cover consumption trend or reducing resource consumption. It is obvious that the first option cannot be achieved. However the second option is much more possible, which is a promise of dematerialization (Mont, 2002a).

In sustainability literature, much has been written about the concepts of eco-design, sustainable design, eco-innovation, eco-efficient products or eco-effective design and sustainable innovation. Sherwin (2004) discusses how the ideas behind these concepts range from changing the nature of the product to reduce impacts to rethinking an entire system that may contain a new product or service. At this point, PSS aims a system innovation through selling end result instead of products (Mont, 2002a). This kind of dematerialization promises positive impulse for both environmental and business related progress. In this manner PSS is being discussed widely from late 80's as the economy is also changing from being supply driven to being demand driven (Baines et al., 2007; Mont & Lindhqvist, 2003). PSS framework describes new types of stakeholder relationships, new convergence of economic interests and potential systematic resource optimization. Baines, et al. (2007) defines PSS as an integrated product and service offering that delivers value in use. (Manzini, 2003) classify PSS in three categories:

- Providing value added to product life cycle
- Providing final result to customer
- Enabling platforms to the customer

While in theory PSS has the potential to bring improvements on sustainability, it is not always a part of the system. 'PSS equals to sustainability' is just a myth for many cases (Tukker & Tischner, 2006). Providing service with the product is not the way of gaining sustainability but increasing material consumption many times. Thus, developing sustainable PSS models needs system innovation where dematerialization occurs. Mont (2002b) underlines that existing PSS examples are not always more environmentally benign and successful in gaining economic sustainability. This win-win situation occurs in some business models while for some others it is expected not that realistic (Tukker & Tischner, 2006). To gain the environmental benefit of service oriented business, economically successful and environmentally sustainable PSS examples should be transferred into different fields in different markets. Mont (2002b) discusses that in order to develop PSS scenarios for different circumstances, it is necessary to know what kind of pitfalls exist and what can be supported for those companies to overcome those barriers.

Drivers and barriers

In PSS literature many scholars mention the presence of drivers and barriers for shifting to PSS or gaining success with PSS. Cooperation between educational institutions, governments and NGOs towards more service oriented product-service system development (Brown, Vergragt, Green, and Berchicci, 2003) increased relationship between customers and producers, availability of demand for recycled or recovered

products in the market (Besch, 2005), availability of reverse logistics in the market (Rahimifard, Coates, Staikos, Edwards, and Abu-Bakar, 2009) are proposed as drivers for service oriented business development. As one of the most systematically presented one, the classification done by Mont, (2002b) which organizes drivers and barriers in two large categories, was used as a basis to produce Table 1. Other contributions from the scholar were added in the table.

Table 1: Drivers and barriers identified in the literature

Derived from Mont, 2002b

	Drivers	**Barriers**
External	Coercive: • Public concern (Mont, 2002; Mont & Lindhqvist, 2003) • Cooperation between universities, NGO's research institutions (Besch, 2005) • Legislation (Mont, 2002b) Market drivers: • New possibilities for growth (Mont, 2002b) • Service demand of customer (Mont, 2002b) • Increased relationship between customers and producers (Besch, 2005) • Demand for recycled – recovered product in the market (Besch, 2005)	Relationship between actors: • Conflict of interest between actors (Mont, 2002b) • Lack of demand from customer (Mont, 2002b) • Lack of customer's knowledge (Mont, 2002b) • Lack of customer acceptance (Mont, 2002b; Tukker and Tischner, 2006) Regulatory barriers: • Lack of public procurement (Mont 2002b) Context-related barriers: • Relatively low price of resources (Mont, 2002b) • High labor price (Mont, 2002b)
Internal	Resource drivers: • Cost reduction opportunities (Mont, 2002b) Management decision: • Top management's will towards service oriented business (Mont, 2002b) Environmental performance: • Company's proactive role on environmental concerns (Mont, 2002b)	Cost-related barriers: • Use related costs (Mont, 2002b) • Uncertainty of cash flow (Mont, 2002b) • Lengthen time to market because of increased product development time (Mont, 2002b) Concept design barriers: • Uncertainty about the return flow of products – reverse logistic (Besch, 2005; Mont, 2002b; Rahimifard et al., 2009) • Conflict in customer priorities and environmental performances of the product-service (Mont, 2002b) • Product related limitations –fashionable products (Mont, 2002; Besch 2005) Organizational barriers: • Conflict between organizational functions (Mont, 2002b)

Research method

In this exploratory case study, the challenges were to analyze the existent system in Turkey with its actors and business model, and to compare the same business case with a successful PSS application in a developed country. The goal was to identify possible barriers and drivers that are faced while adopting a suc-

cessful PSS model from a developed country into a developing one. Moreover, outcomes of the research were expected to be useful in similar adoption projects in similar circumstances.

The Italian case study mentioned by Manzini (2003) is used as the basis for the case study research in Turkey. Manzini (2003), in their paper, point out the environment friendliness award winner Italian carpet company called Diddi&Gori S.P.A. that produces textile floorings for trade fairs. Diddi&Gori S.P.A. provides carpets to trade fairs and recycles used carpets to produce new carpets. This cycle is quite effective both economically and environmentally. This is a successful PSS case that also achieved sustainability with a closed material loop.

This case was chosen as the basis for comparison because same customers (trade fairs) and producers (carpet manufacturers) exist in the Turkish market, and the product (carpet) fulfills same functions in Turkish trade fairs. Since it is a B2B market, less cultural barriers and more relationships between companies were expected compared to a B2C market. Thus, exploring this case would bring a possible comparison with a successful example and understanding about the PSS application in Turkey.
Main research questions that shaped the case study interviews were:

- How does the business work in Turkey?
- What kind of drivers and barriers are existent to adopt the Italian case?
- What are the possible opportunities for improvements?

For the case study following steps were used:

- The system and its stakeholders were defined.
- Actors in the value chain were identified. Interviews with open-ended questions were conducted to understand their expectations and priorities in the market.
- Actual status of the system was analyzed in terms of sustainability. Drivers and barriers were analyzed and compared with the ones identified in the literature.

Interviews were conducted with two visitors and two contributors of the trade fair, procurement manager from the trade fair organization, an engineer from a carpet manufacturing company's production department and with the owner of the carpet provider company.

There are many trade fair halls all around Turkey. However Istanbul is the biggest fair centre of Turkey while Izmir and Antalya follow after. Largest and busiest trade fairs are CNR and TUYAP from Istanbul. Procurement manager from CNR was interviewed to analyze the system.

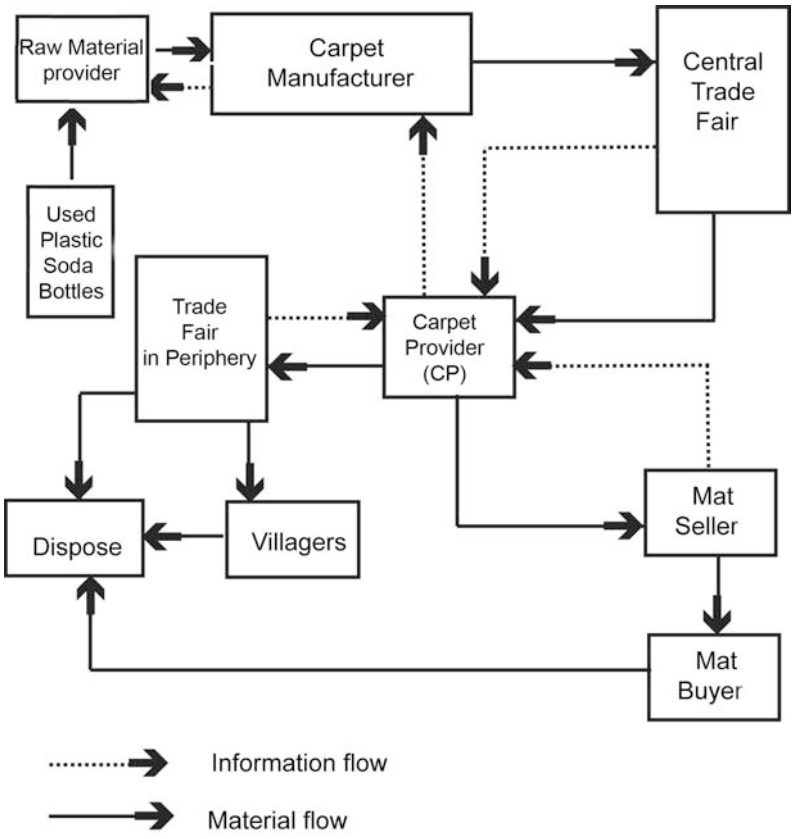
There are only a few carpet providers in the market. Thus, only one of these companies, which provides service to those important trade fairs, was chosen. Trade fair visitors and contributors were chosen randomly during the same fair organization. The carpet manufacturer company was chosen according to its location and proximity to Istanbul, which would make it easy to organize an interview.

Case study

Stakeholders of the system

Seven main stakeholders were defined in the lifecycle of the trade fair carpets. They are presented in the Figure 1. Trade fair visitors and contributors were not included in the value map since they are not really included in the material flow.

Figure 1: The system map



Trade fairs

CNR EXPO has the biggest trade fair facility of Eurasia. It has around 150.000m2 closed area where 8 halls are located. Each fair is held for around five days. Carpets are mostly used in the walking area and sometimes at the pavilions. According to the procurement manager, in CNR approximately 450 000 m2/year of carpet is used and it is not possible to use a flooring solution for the next fair because layout of the trade fair changes for each organization.

The product

Trade fair carpets used in CNR are produced by using PET (polyethylene) material. Even though there are pure PP (polypropylene) carpets and PP – PET mixed carpets in the market, CNR prefers the PET because of low cost. PET carpets are produced by using recycled plastic soda bottles mixed with virgin PET granules in the manufacturing company. PP carpets are able to recycle however PET carpets are not. There are different colors and two different types of thickness of trade fair carpets.

The carpet provider (CP)

CP is an Istanbul based carpet provider for trade fairs in Turkey and abroad. CP does not produce carpets but buys from different manufacturers all around Turkey. Company has a workshop equipped with a machine for rolling and one for cutting used carpets to produce mats out of them. The company is in close relationship with almost all trade fair procurement managers and carpet manufacturers that produce PET basis carpets. Thus, market is a kind of monopoly.

Company provides full service of installing, maintenance and removing carpets for trade fairs. Carpets are glued to ground during the installation. Used carpets from central trade fairs are reused in smaller fairs in periphery if the carpets are not damaged. If carpets are not good enough to use for another fair organization or in case there is no fair in near future, then company produces mats to sell in national and foreign market. Reused carpets in the periphery are most of the time given away to people in small villages to be used on the ground of their barns.

The carpet manufacturer

Most of the carpet manufacturers are located in western regions of Turkey. Interviewed carpet Manufacturer company located in Bursa which is in the same geographical region of Istanbul. Manufacturer produce different kinds of synthetic carpets for offices or residencies in general and they produce trade fair carpets if there is a demand. The company produces trade fair carpets out of PET, PP and mixed materials. However, they don't have recycling facilities for PET or PP and they purchase raw material from other companies.

Analysis

Barriers for the manufacturer company

Different than the Italian case, here the producer company is not involved in providing service to the customer. There are several barriers for manufacturing company to enter this market. Firstly, the manufacturing company actually is not equipped with recycling machines. This requires an investment cost. As the production engineer also mentioned during the interview; providing carpets for the fairs around their region would supply only a small increase in their profit. Cost of new machines, hiring new team for service and logistics of recovered products are use related costs and create a barrier for the company.

Even though PP carpets are produced by the manufacturer company and also there are companies that recycle PP carpets, because of the high price compared to PET, they are not appreciated by the customer. There is a conflict between customer priorities and the environmental performance of the product.

Drivers for the CP

Customer's demand for service is a valuable driver for this business model. As the owner of the carpet provider company also mentioned that they would never identify such a business unless his friend in trade fair organization had pointed out. For trade fairs, especially for busy ones, service is necessary as the procurement manager also underlined. On the other hand relationship and mutual trust is important for both sides to run the business. This is something hard to gain for the manufacturing company since it is not their main business and it creates an opportunity for the carpet provider company. However it is an easy top management decision for the carpet provider company since it is much smaller and flexible.

Even though offering service was related to the customer demand, lengthening the product's lifecycle is done because of the cost related drivers. Used carpets are still valuable in the market as flooring textile for another customer profile which expects less quality, or as another type product. This indicates the demand for recovered products as a driver for this business. On the other hand, giving away the used carpets in trade fairs far from center, is not only related to social philanthropy but also a cost related decision since it is much more expensive to transport them back than to benefit from them in mat production.

Trade fair carpets are used same as it was in Italian case, the product service that customer gets is almost same. However, there is a mediator company which uses the opportunity in the market. The main concern of carpet the provider company is profitability, not environmental concerns. Even though the lifespan of trade fair carpets are lengthened by secondary use in different ways, the material loop is not closed as it is proposed in the Italian case. To close the material loop, carpets have to be recycled fully by the end of its lifespan. As the production engineer of carpet manufacturer-company also pointed out, main problem about recycling is the heterogeneous structure of the PET carpet. All PET carpets have soles that create problems during the recycling processes. Changing the structure of the carpet with a new product design could be an opportunity for closing the material loop. However the only way to close the material loop is to produce PP carpets.

Demand from a few trade-fair is not good enough compared to the profit that could be gained from offices and residences with much more expensive products. Thus, investing in this service oriented market is not profitable for the manufacturers with these circumstances while they are producing and selling carpets anyway. Another barrier to invest in PP carpet business by the carpet manufacturers is the lack of demand from customer.

Neither the manufacturer nor the provider thinks that there is a support of public policy for investing in more environmentally friendly production. Thus, it is not possible to mention legalization as a driver as

it was in the Italian case, where the company got funds from EU for this project (Walsh, n.d.,) and awards (Manzini, 2003).

Since entering the market as a mediator is not that difficult, to reduce the risks the carpet provider company tries to strengthen its position in the market by increasing relationships with manufacturers and the customers. This network brings possibilities for innovation in product and service.

Conclusion

This is an interesting example compared to other PSS cases. Difference is that the company is not producing anything in fact. This company is extending product life span while a final result is presented to the client. CP could be an example for situations where clients ask for more service instead of product and manufacturers are not willing to enter service oriented business, whether because of low profit or high risk. Mediator companies can create solutions for more sustainable systems when it is not easy to reach fully closed material loop solutions. In such a case, the mediator company takes on the responsibility of the product and the risk of business. This situation can be identified as a transition phase to sustainable PSS.

Obviously, it is not profitable for any company to produce carpets fully recycled with conditions in Turkey. Mont (2002b) gives the sustainable PSS example of Interface, the American carpet company, and points out that they are not really profiting from this part of their business. It is more about the company's proactive role about environment. In a developing country, it is not easy to expect such a proactive strategy. However, support of public policies, availability of proper technology and legislation could be important drivers for companies to act towards more service oriented business (Mont & Lindhqvist, 2003).

This paper has presented a PSS case from Turkey with a comparison of a similar Italian PSS case that was described before. Difference between situations and company strategies give insights about how PSS can be adopted in different conditions and how a transition phase could be developed for situations where manufacturer companies find it risky to move towards more service oriented business.

Much more interviews with carpet manufacturers and trade fair organizations are necessary to describe a better picture. Also recycling facilities should be involved in the system where they play an important role in transition. Another missing part is the evaluations of sustainability status of the business case where only a broad analysis was presented here. Producing PP carpets and PET carpets might create different impacts on environment. They all should have been included in the analysis.

For further research about this issue, new scenarios could be built and compared with the actual situation by evaluation tools. Focusing on the homogeneity of the product structure and eliminating other chemicals for fixing it to the ground could be a starting point for development. Analyzing customer expectations would result in a new understanding about the function that clients demand. Such information is useful for designing a better product-service mix.

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the Learning Network on Sustainability

Think, Make, Evaluate, (Evolve)

Designing participatory tools to better understand how to help physicians communicate with families about obesity. A case study in sustainable co-design

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Over the past four decades the number of obese children increased dramatically, yet obesity prevention still challenges physicians and families. Physicians struggle to discuss obesity prevention with nine to twelve year-old patients and their families during well-child visits. Barriers include limited time, physician discomfort, and patient confrontation. Physicians lack resources to have effective obesity prevention conversations. Previously, we described Fitwits MD™, a successful obesity prevention intervention. In this paper, we describe with a case study the sustainable co-design strategy used to create, disseminate, and evolve the Fitwits MD intervention. *Sustainable co-design*, refers to the practice through which collective creativity unfolds and is maintained at a certain level over the span of design emergence, dissemination, and evolution. We use the socio-ecological model and stages of change model to explain the varied involvement of physicians with Fitwits MD during emergence, dissemination, and evolution phases.

Childhood obesity is a growing epidemic in the United States and it is the most common medical condition primary care doctors face. Obesity prevention challenges physicians and families during well-child visits for several reasons. Physicians have limited time, they perceive such talks to be ineffective, and some parents and children perceive such discussions as confrontational.

Previously, we developed Fitwits MD to help physicians and parents (Hughes, Fidler, McGaffey, & Audenried, 2009). Preliminary results suggest that our intervention significantly increased physician confidence and comfort discussing childhood obesity. Patients reported our intervention was helpful and informative, better than just talking to the physician, and they thought they would use the Fitwits games and activities at home. We attribute part of our success to the sustainable co-design process used.

Co-design entails collective creativity across the whole span of a design process (Sanders & Stappers, 2008). *Sustainable co-design* involves ongoing collective creativity applied to three stages: the design emergence, dissemination and evolution linked to a product, service, or process. In high paced domains, such as healthcare delivery, products, services, and processes are appropriated, adapted and modified by the community of use (Nardi & O'Day, 1996). Designers may work with the community of use to ensure that products, services, and processes are useful, usable, and desirable (Buchanan, 2001).

Designing products and services for clinical medical practice requires both the participation of designers and medical professionals. Co-design is challenging because both designers and medical professionals are called to work outside of their area of expertise. Designers must acquire medical domain knowledge (e.g., related medical research, clinical practice). Physicians are asked to participate in making products, conceiving services, iteratively beta testing them, and, then, finally integrating the new products and services into their practice.

In this paper, we describe three phases of the Fitwits MD intervention that support sustainable co-design: emergence phase, dissemination phase and innovation phase. First, we describe the challenge of

childhood obesity, second, we describe sustainable co-design, third, we discuss our results and future work, and finally summarize our findings.

The challenge of childhood obesity

The number of obese children has increased dramatically. Recent statistics estimate that over one third of the nation's children are overweight or obese (Wang & Beydoun 2007; Ogden, Carroll & Flegal, 2008). Obesity is associated with decreased life expectancy and increased health problems (e.g., heart disease, type 2 diabetes, certain cancers, sleep-related breathing difficulties and osteoarthritis; Haslam & James, 2005). At an individual level, most obesity cases are believed to result from excessive caloric intake, limited physical activity, and genetic susceptibility (IOM, 2001). Societal factors associated with obesity rates include increased availability of calorie-rich foods and decreased physical activity (Lau et al., 2007).

The socio-ecological model offers five contexts for people's health choices: individual, interpersonal, organizational, community and public policy (Hawley 1950; Bronfenbrenner 1979; Green, Richard, & Potvin 1996). At the individual level, choices may be associated with one's attitude, values, and intentions. At the interpersonal level, people's choices may be associated with relationships (e.g., family, friends, peers and co-workers). At the organizational level, people's choices may be associated with rules, policies, procedures and incentives. At the community level, people's choices may reflect social norms, social networks, rules and practices. Finally, at the public policy level, people's choices may be associated with government policies, regulations and laws (i.e., local, state, and federal). The socio-ecological perspective affords designers the opportunity to frame design interventions in multiple contexts.

Childhood obesity is the most common medical condition primary care doctors face (O'Brien, et al. 2004). Surprisingly, families are often unaware that their child is obese and may reluctantly discuss the topic. Alternatively, they may expect their doctor to initiate such a conversation. Physicians feel time pressure during well-child visits; many lack effective strategies to discuss child obesity prevention. Only 12% of physicians providing routine office care reported high self-efficacy in counselling about childhood obesity; 39% felt effectiveness would improve with training and tools (Perrin, et al. 2005). For 96% of respondents, a better counselling tool was the most desired office change (McGaffey, et al. 2010).

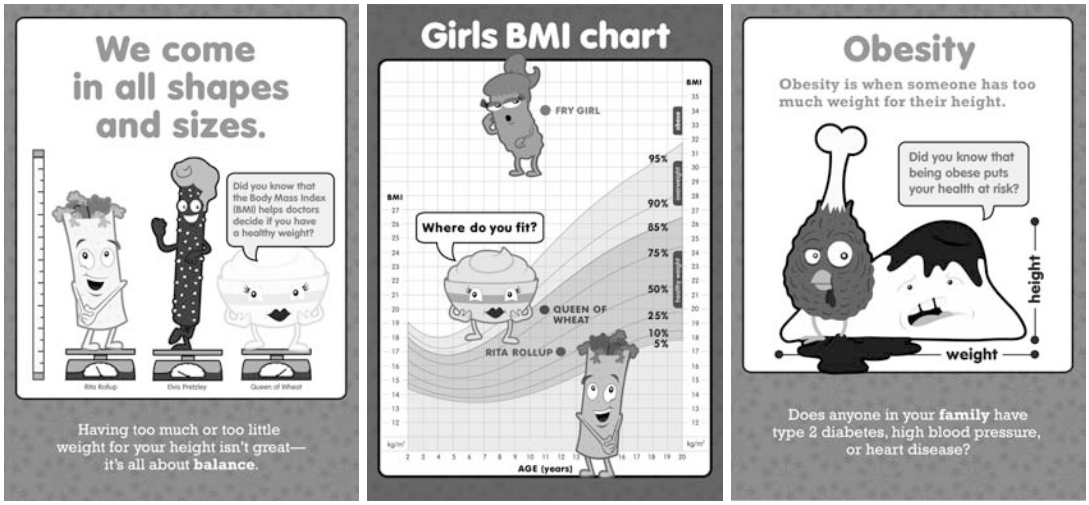

Figure 1. Example of 3 of the 17 Fitwits MD educational flashcards.

Prevention of chronic illness in new models of health literacy is based on knowledge dissemination, ability to act on such knowledge, and behaviour modification (Peerson, & Saunders, 2009). The Fitwits MD intervention was designed to help physicians talk with nine to twelve year-olds and their families during well-child visits and increase health literacy. Well-child visits are periodic checkups for children that cover: health promotion (diet, healthy lifestyles, safety and discipline), preventive measures (immunizations), and screening tests (physical exams, lab tests). Fitwits MD is a set of seventeen educational flashcards that help physicians talk with their patients about obesity, family history, body mass index

(BMI), and practical directives regarding portion control, nutrition and fitness (Figure 1). Fitwits MD, aims to increase health literacy of children and their families.

Theories Shaping Sustainable Co-design

When asked, "What are the boundaries of design?" Charles Eames replied, "What are the boundaries of problems?" (Eames, Eames, Neuhart, & Neuhart, 1989). The boundaries of obesity prevention are tied to the context and the actors involved. Two theoretical models often used in public health framed our design activity: the socio-ecological model and stages of change model. The socio-ecological model describes the levels where the Fitwits MD intervention can operate:

- At the individual level, the intervention supports the physician, patients, and families.
- At the interpersonal level, in the office environment, the Fitwits MD intervention changed the organization of work between physicians, nurses and staff.
- At the organizational level, new leadership roles were introduced to ensure that Fitwits MD intervention happened smoothly both within each medical office and between the three participating offices. The Fitwits MD intervention encouraged healthy norms regarding office snacks.

The socio-ecological model frames sustainable co-design processes around the emergence, dissemination, and evolution of the Fitwits MD intervention and services.

- At the individual level, participants need to be engaged in participatory design activities.
- At the interpersonal level, workgroups need to adopt the intervention, then, remind, and support group members.
- At the organizational level, three aspects are important for sustainable co-design. Physicians and staff should be encouraged to participate in design workshops and contribute to assignments. Challenges within a medical educational practice, include: (a) continual rapid pace of learning under fatiguing circumstances (didactic learning and learning with real patients who must have their needs met); and (b) a perpetual annual turnover of residents and new entering residents. Leadership and coordination is necessary to ensure that new office staff is taught, new physicians are trained, and champion roles filled (i.e., process champions, organizational champions, and outreach champions). Champions are necessary for a smooth dissemination process within and without the office setting.

The stages of change model describes five stages people undergo to change behavior. These stages are: precontemplation, contemplation, preparation, action, and maintenance (Prochaska & Velicer, 1997). Precontemplation and contemplation stages indicate that behavior change is unlikely because one is either unaware of their problem, or ambivalent. The Fitwits MD intervention educates all patients and families regardless of diagnosis. Upon diagnosis continued interaction with the core health ideas may increase awareness of the problem, facilitating the move from precontemplation to contemplation stage. The Fitwits MD intervention delivers health messages through fun characters and games in a non-threatening manner, making the transition from contemplation to preparation stage more likely. Similarly, if an individual is in the preparation or action stages, this indicates that they have recognized the problem, have decided to improve their own health, or have already initiated some changes. In this case, the Fitwits MD intervention provides the necessary scaffolding to continue in a healthy direction. By design, the intervention aims to accommodate and teach people regardless of their stage of change.

Participation in co-design is linked to the stages of change model. Sanders (2006) argues that participation in co-design activity reflects the creativity levels demonstrated in people's lives (i.e., doing, adapting, making, and creating) and that as expertise, interest/passion and effort used grow, so does the level of creativity. We claim that the model of change also contributes to people's participation in co-design. Participants must overcome four participation barriers: (a) limited understanding of the field of design (b) the paradigm shift from using tools to adapting, making, and creating tools; (c) limited time available; and (d) limited trust in the design process.

Theoretical linkages exist between the model of change for individual change and organizational change (Prochaska, Prochaska, & Levesque 2001). In other words, the model of change applied to individuals involved co-design activities also applies to groups working in organizations. For example, people and groups involved in co-design activity must overcome personal, interpersonal dynamics, and organizational norms to fully participate. Likewise, organizations involved in participatory design activities

must overcome barriers to recognize and encourage meaningful participation. More generally, the stages of change model is likely to apply to change in the five levels of the socio-ecological model (i.e., individual, interpersonal, organizational, community, public policy). Stage-of-change progression at different levels of the socio-ecological model ensures long-term sustainability of co-design activities.

The design team created participatory design activities, facilitated design workshops, and encouraged participation. We were mindful of barriers and stages of change progression. The design activities were ordered to:

- Creating effective health literacy through design
- Catalyze collective problem solving
- Prepare design activities to maximize outcomes minimizing time commitment
- Build trust between the participants and design team
- Acquire community values, culture and practice
- Flexibly define problem to allow for iterative problem definition
- Allow multiple approaches for community needs and behavior change
- Enter into the problem without a pre-determined solution

Sustainable co-design

Our term, *sustainable co-design*, refers to the practice through which sustained collective creativity unfolds over the span of design emergence, dissemination, and evolution. A sustainable co-design approach is warranted for design problems that: (a) involve a rapidly changing environment and require sustained involvement with the community of use to disseminate and evolve the solution, and (b) require a consistent approach but varied artifacts, services, and processes each to address multiple contexts and the actors involved. For example, nutrition and exercise choices are grounded in individual preferences, values, family and group belonging, organizational settings, community norms, and public policy. One of the greatest obstacles to effective obesity prevention at the community level is the lack of coordination of efforts across different sectors, that is, from the clinician's office to schools and day care settings, to parks and playgrounds, and to grocery stores and restaurants (Davis et al., 2007).

Three terms describe the sustainable co-design phases. The emergence phase involves the creation of a new product, service, or process in a design-based approach (i.e., participatory design, co-design, iterative testing). The dissemination phase involves recruiting, training, and championing the use of the new product, service, or process in the context of the community of use (i.e., medical intervention, protocol, evaluation). The evolution phase involves empowering continued innovation cycles in the community of use. Innovation may involve product innovation, service innovation, process innovation and social innovation.

For the co-design process to be sustainable, it must include active design engagement in three phases: the emergence phase, the dissemination phase, and the evolution phase. Active engagement of both participants and designers in three phases ensures that the product development, service deployment, and subsequent evolution occur seamlessly and continuously. In short, sustainable co-design ensures that the co-design coalition continues to innovate and generate new solutions to productively respond to user needs over time (Figure 2).

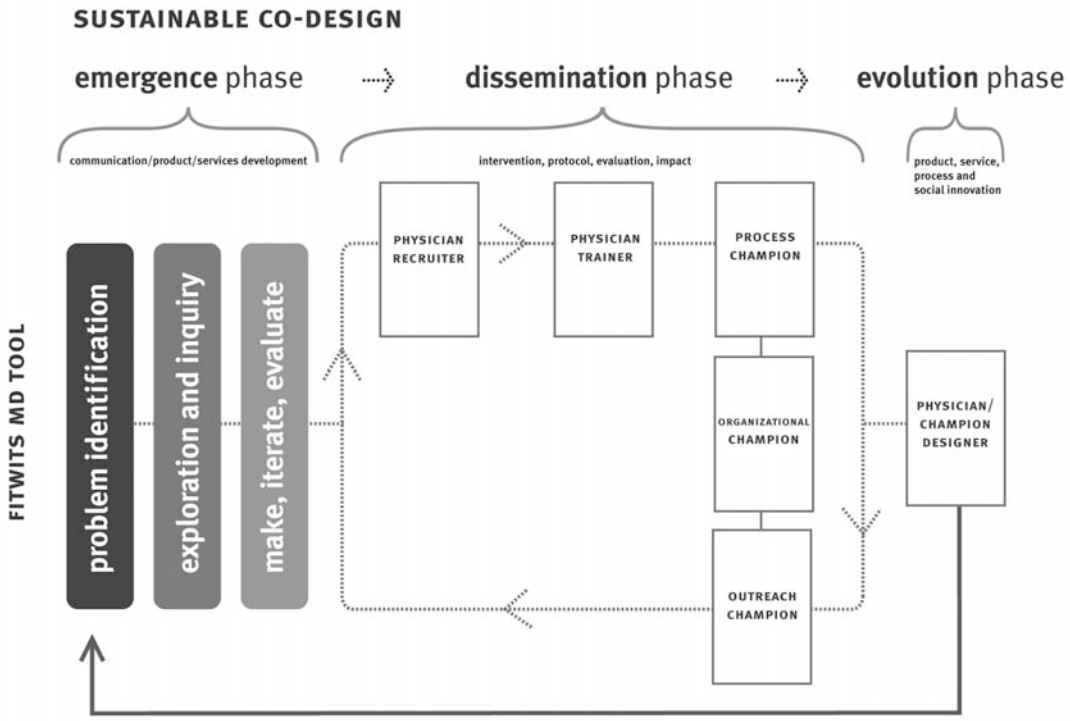

Figure 2: An overview of the sustainable co-design model

Fitwits MD Sustainable Co-design Process

Participants During the emergence phase our team was composed of 4 professionally-trained designers, 11 physicians, 2 dietitians, a doctor of pharmacy, and a medical librarian. As we moved into the dissemination phase we had 33 physicians enrolled in the study; of those 33, we interviewed 10 physicians, 5 of which had been through both the emergence and dissemination phase and are currently active in the evolution phase.

In this section, we report on interviews taken with ten physicians. Two physicians with prominent roles during the sustainable co-design phases were interviewed and eight were interviewed about the setbacks during the dissemination of the Fitwits MD intervention. The physicians interviewed worked in three family health clinics (FHCs).

Methods Two participants, who played leading roles in the co-design process, were asked to reflect on the following: agency over co-created health communications, physicians as designers, training experiences, the role of champions, environment and organizational change linked to Fitwits MD. Eight physicians were interviewed about their experiences delivering the Fitwits MD intervention.

Results The involvement with the Fitwits MD is evidenced by the quotes below in the emergence, dissemination, and evolution phases. In the emergence phase, participants in the co-design process are engaged in thinking, making, creating, and evaluating the Fitwits MD intervention. In the dissemination phase, participants brainstormed and implemented protocols to deliver the Fitwits MD intervention. In the evolution phase, participants developed new ways to engage physicians and patients with the Fitwits MD intervention.

During the emergence phase physicians learned about design, the barriers to participating in co-design, and how to apply design methods to new challenges. Below a physician compares the design process and medical practice describing barriers physicians face.

> Having watched and admired the design process, I suppose it is something like the art of medicine but with observation and reflective listening by designers and design students to several parties, all of whom must trust that their thoughts and ideas are appreciated and are not subservient. That is an in-

> teresting proposition for any physician, who with a minimum of roughly a dozen years of education/training beyond high school, might expect to produce some ideas that trump others – but that is not the case. It so happens that the critical Fitwits MD work really turns on the ideas, learning styles, and playfulness of children and oftentimes, of parents who may not have profited from formal education.

One physician noted how her perspective changed on design.

> Being involved in the design process has mostly made it glaringly obvious why the medical community is struggling with patient education initiatives. The processes, theories, etc., that designers utilize to create any product are well established and introspective. I don't think the medical community uses any well-established protocol or design methodologies to create patient information. Furthermore, most often medical patient information is uni-directional; e.g., "Here is a pamphlet of information we think is important that you should read." "Human-centered design" creates a product around a conversation. This is the new era of medicine – the times are changing from "I am the doctor and this is what you should do 'Because I said so,'" to an era of informed patients and shared decision-making.

Another physician notes the child-centeredness of the Fitwits MD intervention.

> The tools and games are "child-centered" and that is what makes them so different than any "other animal" out there; all of the tools that we can find in our current search are "parent-centered," meaning physician-parent communication and goal setting with the child on the sidelines for understanding the conversation and decision-making.

The design process engaged some physicians to take on more work adding to their overburdened schedule.

> The (co-design) process generates more reflections, ideas and voluntary work than one might expect to contribute and there is an amazement and excitement that is palpable, especially as a tool or strategy is generated that almost seems "out of thin air" from diverse conversations and activities in design workshops.

Physicians saw themselves as co-designers and applied their learning elsewhere.

> We get to make sure our most important messages are in the materials but you help us do it in a way that is most appealing to our patients. We learn a lot about what our patients want and need from a conversation with their doctor, which carries into how we approach problems outside the realm of the specific design question.

Few interventions occurred during the first three months of the dissemination phase. The design, medical, and evaluation teams brainstormed four solutions to increase the interventions: (a) new protocols to follow (b) roles assigned (i.e., recruits, trainers, and champions); (c) reminders were developed (e.g., buttons, screen savers), and (d) an intervention challenge between the three FHCs to encourage participation was launched.

Dissemination phase protocols were developed for the staff filling three roles related to the dissemination process (i.e., recruits, trainers, and champions). Recruits received the Fitwits MD intervention; trainers learned the Fitwits materials and trained others; champions organized and disseminated the intervention. There are three kinds of Fitwits champions*: process champions, organizational champions*, and *outreach champions*. The quote below is from Dr SF, an *organizational champion*, describes her role in the office and illustrates how physicians went from recruits to trainers.

> The resident (physicians) currently working with the group had just "heard of Fitwits" and approached myself and the other doctor about it. They began to participate in various activities and became more comfortable with the materials, then began to take over my role. I look at Dr A as a prime example of this – he asked about it, became involved peripherally, then learned to run session at Propel (School) and now is taking the lead on many initiatives.

For example, Dr A acted as a *process champion* when he made tools to facilitate the dissemination of the Fitwits MD intervention by the organizational champion.

> Dr A provided training remarks for each Fitwits School didactic slide and for the remaining program. This has been used Fitwits team residents and for community medicine projects run by residents.

The *process champion* role is to make the Fitwits MD intervention occur smoothly. Nurses and social workers in the family health center played a key role in ensuring that the interventions occurred smoothly.

> Our social worker made sure that when we had a patient between nine and twelve coming in for a well-child check there would be a reminder, either in our emails or in the room when we went to see the patients.

Dr M below describes a breakdown when a *process champion* is missing.

> There was always confusion as to who should get consented to get the Fitwits thing done. We were told that the nurses could do that. So, I could just walk in and do it, but that often wasn't the case.

Outreach champions organize and manage recruitment and training events in other community organizations. The quotes below demonstrate outreach initiatives. For example, Dr AM ensured that the Fitwits MD intervention was happening in other family health clinics (FHCs).

> I sent messages to the other FHC medical directors (several times) to encourage resident use of Fitwits with well-child and select illness visits. I realized that no (process) champions were present for evening hours and therefore made efforts to have the (organizational) champions indoctrinate a staff member(s) during evening hours. I asked the (organizational) champions to designate evening nurses to consent patients or went through the process with the evening nurses myself.

Other *outreach champions* brought Fitwits elsewhere.

> Dr. MJP used Fitwits games at the Alle Kiske Hope Center (women's and children's shelter) with children and their mothers, the All About Me resident team -- YMCAs, Boys and Girls Clubs. Second year medical student PA and a second year public health student are using this training for the Braddock Youth Project, Bridging the Gaps internship program for teens mentoring youth.

The role of *organizational champion* is filled each year in the office setting rendering the dissemination phase of the process sustainable.

> Dr SF trained all new interns, fellows, and faculty not yet familiar with the Fitwits intervention during 2009 and 2010. Dr. V and Dr. K will train all 2010-2011 new family health center physicians using the training power point made by Dr SF and will collect remarks from the new trainees.

To help physicians remember to deliver the Fitwits MD intervention, "What is Fitwits?" buttons to wear and Fitwits computer screen savers in the computers in the visiting rooms were created. These are examples of artifacts to facilitate dissemination (Figure 3).

Figure 3. Reminder buttons and screen savers in the examination rooms to remind physicians to deliver the Fitwits MD intervention.

To encourage the deployment of Fitwits in the three FHCs a competition was launched. The physicians in one FHC launched poster contest to win the competition through increased awareness of Fitwits in their center (Figure 4). The poster competition engaged both from staff and patients, and increased participation.

Figure 4. Poster competition held in one of the family health offices.

Currently, we are engaged in the evolution phase for the Fitwits MD intervention. The positive response to the poster competition in the waiting room inspired the design team and the medical team to add a mural and interactive game to engage patients with the Fitwits MD prior to the physicians visit (figure 5).

Given that the family health center practices are linked to a residency program, each year physicians complete residency and new ones arrive. We are re-engaging the resident physicians in the evolution phase to adapt or create new artifacts, processes, and services. Currently, we are adapting the Fitwits MD intervention so parents, dietitians and nurses can deliver it.

Figure 5. The waiting room interactive touchscreen game and mural.

Discussion and future work

The Fitwits MD intervention case study illustrates the concept of sustainable co-design. In our experience, sustainable co-design requires the continued engagement of the design team and medical team in the emergence, dissemination, and evolution phases.

We acquired strategic insight from the socio-ecological model and the stages of change model. The Fitwits MD intervention touches on three levels of the socio-ecological model: the individual level, increasing patient and family health literacy; the interpersonal level, engaging families during the visit and with take-home activities increasing healthy literacy; and, the organizational level, accommodating changes in the physicians' offices and introducing new norms regarding healthy office snacks (i.e., fewer chips and more vegetables). The outreach activities are expanding the Fitwits MD network to new organizations. Our current direction aims to reach more people, families, and organizations, to then change communities and public policy.

Future work involves three directions: (a) an advanced Fitwits MD tool with in-depth intervention for other chronic illnesses (e.g., asthma, diabetes, coronary disease), (b) a training module to disseminate Fitwits outside of our research partnership, and (c) a portable Fitwits Family Check-up Service to empower families to monitor their health in between visits.

Summary

Obesity prevention challenges physicians and families during well-child visits. The boundaries of problems related to obesity prevention are tied to the context and the actors involved. Two theoretical models from public health, the socio-ecological model and stages of change model, informed the co-design team on the broader context and people's willingness to engage in the design of change.

Our term, *sustainable co-design*, refers to the practice through which sustained collective creativity unfolds over the span of design emergence, dissemination, and evolution. The involvement of individuals and groups varied around Fitwits MD as anticipated by the stages of change model. Keeping the design team and co-designers involved in the design emergence, dissemination, and evolution was critical to sustainable co-design.

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Social sustainability and development

Case example of participatory approach to developing bamboo furniture by craft persons for Primary Health Centres in Assam

Ravi Mokashi Punekar
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Bamboo craft forms an important economic activity in the entire northeast region of India. However for a craft which is so prevalent amongst the local community in the region, its effective utilization for public community facilities such as primary health centres in rural areas has not been tapped by the local government.

This paper presents a case example of participatory approach to developing sustainable products and services that meet the needs of rural health centres in Assam. Involving the participation of local bamboo craft persons, volunteers of the Primary Health Centre and designers at Department of Design,

IIT Guwahati, a range of bamboo furniture was designed and developed to meet the needs of the primary health centres located in rural villages. The paper suggests that parameters such as employment generation and an integrated inclusive growth of local community are necessary factors to be considered for achieving social sustainability. Such an approach is increasingly relevant for a very large resource pool of talented crafts persons who may often be uneducated or unemployed.

The paper suggests that models in design education have to adapt and make inclusive social sustainability a necessary parameter in evaluation of grassroots level design development initiatives.

> Approach to Design for sustainability aims at design of a system of product and services which would jointly be capable of satisfying specific needs of users and the related innovative stakeholders' interactions leading towards eco-efficiency, social equity and cohesion.
>
> The broader view on the outcome of such an approach would aim to achieve:
> - Improvement in employment and working conditions of the producer
> - Improvement in equity and justice in relation to the stake holders
> - Enable a responsible / sustainable consumption
> - Favour / integrate the weaker and marginalized social strata
> - Improve social cohesion
> - Empower / valorise local resources

> (Vezzoli 2005)

How does design for sustainability as a perspective reflect when applied in the context of health care for a typical rural community in India? Does the local context involve issues that are economically challenging and culturally sensitive? The section to follow presents a case example that looks into some of the above mentioned issues and presents the outcome of an initiative in the design and development of a range of bamboo furniture for Primary Health Centres (PHC's). This project was undertaken at the Department of Design (DoD), IIT Guwahati after considering the ground realities of health care facilities extended by the state government to rural villages in Assam. The project received support from the Development Commissioner (Handicrafts), Government of India, Ministry of Textiles, New Delhi and the Khadi and Village Industries Commission(KVIC), Mumbai.

Scenario 1: The state of Primary health facilities extended by the state government

Dr. Prajyoth Bardolai, MBBS heads the day-care Primary Health sub- centre, at Abhaypor village. The village is located on the North bank of the river Brahmaputra in Guwahati city. Such sub-centres extend basic health care facilities including free medicines to a population of about 6000 people of the local community around its vicinity. The doctor has a support staff of one male and one female health volunteer. The salary of the staff is paid by the state government. In addition the centre also receives a meagre sum of Rs.3000/- per annum to cover rentals and a contingency of Rs. 3200/- per annum to meet other routine miscellaneous expenses. The state has around 5109 such sub centres.

A few kilometres away is located the larger Primary Health Centre (PHC) that has been set up subsequently to cater to a population of 38,000 people of 6-8 villages around its vicinity. The centre is headed by a qualified Medical Officer(MO), supported by a support staff of nearly 14 paramedical and related staff. The PHC is expected to extend both out-patient health services and also admit patients for treatment. It should have nearly 4-6 beds for patients. Further, as per structured government norms, higher up comes the Community Health Centre (CHC) that extends health services to a population of 1,20,000 people and acts as the referral centre for 4-5 PHC around it. A CHC is staffed with a qualified surgeon; one physician; one gynaecologist; a paediatrician plus a support of 21 paramedical and other staff.

The present performances of these centres leave much to be desired. They are marred by absenteeism of the medical staff, lack of adequate infrastructure and paucity of funds. The current figures indicate that one hospital bed caters to an average of 12000 populations in rural Assam. Recent initiatives focussing on extending basic Primary Health services to the remotest corner of every village have taken a new dimension in the state. Assam has become the first state in India to table the Public Health Bill, 2010, which seeks to make healthcare facility a basic right of every citizen. Adopting a Public Health approach, it makes mandatory for all new development projects to carry out a health impact assessment study. One would wait and study how these new ambitious plans bear fruit in the foreseeable future.

Scenario 2: Bamboo craft in the north east region

In the state of Assam nearly 87% of the population resides in rural areas. Industrial activity is minimal. Agriculture is the primary economic activity. Complementing agriculture, the craft sector forms an important economic activity amongst the skilled man power in rural regions. Amongst these, textiles and cane and bamboo crafts are a household activity practiced across the entire north eastern region. There are nearly 350 variety of bamboo in this region. Unlike timber, they are a fast growing species, and reach their mature height and full growth in about 5 years. Their life span is approximately of 40 years duration. Their size varies in length; width up to 60 meters length and 25 cm diameter. Bamboo is fully fibrous and possesses formidable strength, lightness, workability and easy availability especially because of its capacity for rapid regeneration. It is an ideal choice for several applications, particularly for poorer segments of society.

Bamboo can be a potential source of employment generation in rural areas through manufacturing activity and utilization of local material in value added products. There are approximately 13 lac persons involved in bamboo work all over the country. Of this approximately 5-6 lac workers are involved in bamboo craft. Bamboo craft has reached maximum levels of sophistication and applicability only in the north-eastern parts of the country. The range of applications includes housing, grain storage barrels, agricultural implements, animal carts, furniture items, hand tools, household containers, ladders and temporary structures. In the context of its relevance to the immediate community of the region this non-formal handicraft sector with a focus on bamboo craft, offers a huge potential as a stakeholder to contribute and benefit from a model in design for sustainability.

Local community, Design School as collaborative stakeholders in design for social sustainability – an initiative in design and development of bamboo furniture at Department of Design, IIT Guwahati

The campus of Indian Institute of Technology Guwahati is located in a predominantly rural setting on the north bank of the Brahmaputra river in Guwahati city. Established in 1997, the institute with its 11 de-

partments of science and technology forms an important educational hub and an institute of excellence for the entire north eastern region. The Department of Design (DoD) offers undergraduate, postgraduate and Doctoral programs in Design with a focus on the areas of Product Design and Communication Design. The department lays special emphasis on the design and development of product / service and communication systems relevant to the development of the eastern sector. It combines broad-spectrum design and development activities ranging from high technology products on the one hand to design of products and communications systems that meet basic needs. Use of appropriate technology for sustainable development is one of the areas of attention. Ecological considerations in the context of environmental concerns, use of locally available materials, recycle ability find special attention in evolving design solutions in the improvement of the small and medium scale industries and crafts sector in this region.

The education model follows an approach of 'learning by doing' through the different projects that students undertake during their program at the institute. Right from its inception it has been the policy of the department to make Appropriate Technology and Craft Design an integral part of its education curriculum. The department believes that there is tremendous potential to raise the quality of locally made products and crafts through a fusion of technology and crafts. It believes that economic and social considerations relevant to local needs should be developed with participation of communities and use of local resources and materials. These initiatives can best meet sustainable modes of development particularly in strengthening infrastructure in rural and semi-urban locations. The design curriculum attempts to integrate project work for students with such a focus.

The department undertook to partner with the local community and contribute by initiating a project on the design and development of bamboo crafts. It adopted a participatory model in this development. A field study of the local environment indicated that the infrastructure of furniture presently available in institutions such as Schools and Primary Health Centers in the rural sector continues to be pathetically inadequate. Most of these public institutions are unable to provide basic facilities due to paucity of funds. In many instances the facilities available are inappropriate, very poorly designed or sometimes non-existent. There was an urgent need to strengthen the basic infrastructure of furniture for public institutions like rural schools and Primary Health Centres. Bamboo furniture for Primary Health Centres was identified as the context for applying system thinking in identification and development of a socially relevant project that would bring about interaction between the above stakeholders. This process could utilize materials and skills available in the local community. Cane and bamboo offered tremendous scope for introducing a new range of furniture that can be locally produced with locally available skills of the regional crafts community. There was enormous scope to design and develop economical and sturdy furniture in cane and bamboo to meet these needs. The demand for such furniture seems vast and could develop itself as an organized enterprise creating new avenues for employment generation and enterprise in the rural and semi-urban sectors of the region. The location of the department in the midst of such a rural setting made it additionally relevant that partnership be initiated between the concerned stakeholder to ensure that objectives are outlined and achievable goals set to create change to improve the existing facilities in these public institutions for the better of the local community. The project therefore set out to meet the following objectives:

- Develop innovative functional objects
- Develop process rationalization
- Train craft persons in new techniques
- Create new business opportunities

Work Method

In this project the method of enquiry involved a multipronged approach. Field studies were undertaken in different Primary Health Centers in specified locations of North Guwahati to understand the different environments of use. Interaction with crafts persons was done to study, document and understand their crafts skills and practices. The properties of cane and bamboo as a raw material for making furniture were examined. A study of anthropometric data was examined to ensure that ergonomic factors in furniture design were incorporated.

Such a comprehensive study led to design conceptualization and making of a set of bamboo furniture prototypes. A core team of bamboo craft persons were identified and involved in developing the furniture right from the inception. Constant interaction was held with the staff and doctor of the local PHC. The first set of prototypes was given to the local PHC for use. Design refinement was initiated based on trial with end users at the PHC. Design finalization involved making technical drawings etc and documentation of the entire process of product development.

At this juncture interactions with the officials of the PHC were held and it was decided that the PHC be furnished with the complete set of new furniture to demonstrate the centre as a model centre that showcased and presented the new design possibilities. The products were exhibited to decision-making authorities including local government officials

The Results

The final outcome led to proposal for a set of 16 hospital furniture items designed at the department and made by local bamboo craft persons. Items showing a comparison of cost of existing furniture vis-à-vis bamboo furniture for the PHC are listed in the table below:

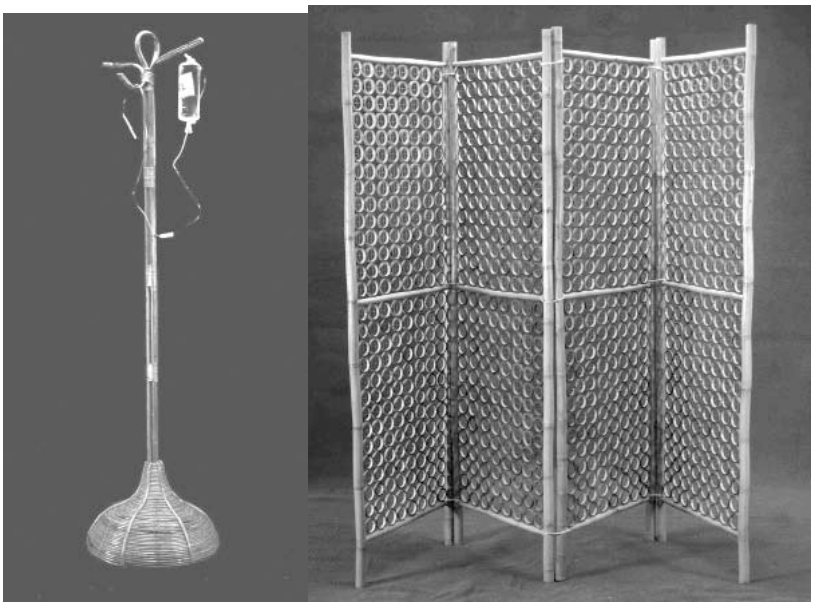
Table 1: Estimated cost of proposed furniture in bamboo vis-a-vis existing wooden furniture

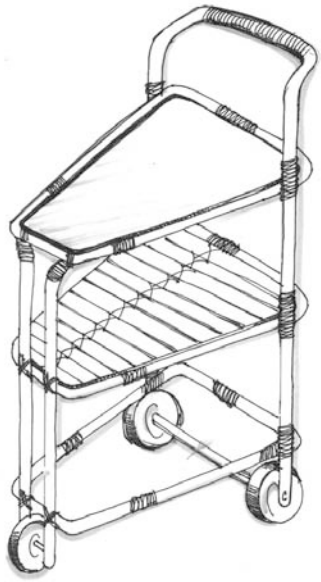
Item (made in combination of Bamboo and cane)	**Dimensions in mm**	**Existing cost of furniture in Rupees**	**Proposed cost of New design in bamboo in Rupees**
Bamboo Hospital bed	1800 x 950 x 460	8000	3000
Examination table	1620 x 500 x 800	3500	2000
Doctors Table and Chair	1020 x 790 x 840	2500	1650
Medicine trolley	760 x 340 x 915	3000	1200
Laboratory Table	1200 x 600 x 1000	1500	800
Bamboo Wheelchair	1050 620 x 930	4000	1800
Table and Chair	915 x 450 x 650	1300	500
Trolley for Oxygen cylinder	180 x 225 x 550	850	350
IV fluid stand	1600 height	1200	300
Medicine Rack	1600 x 440 x 1580	2500	1000
Stool	900 x 300 x 1370	600	350
Partition Screen	1500 x 600 (3 pieces)	1500	400
Outdoors Bench	1200 x 600 x 450	3000	2000
Stretcher	2500 x 570 x 210	3000	750
Computer Table	915 x 450 x 660	4000	500

To disseminate the new design proposals to a larger group of craftsperson across different locations, the Khadi and Village Industries Commission (KVIC), a nodal national organization involved in supporting and promoting rural crafts development was approached for financial support for organizing craft training programs. A series of 6 training programs were conducted for nearly 150 craft persons across identified craft clusters located across different geographical locations in the state. The craft persons were trained in the making of the new range of furniture. Of the furniture so produced two sets of furniture were located in the PHC in North Guwahati and at the sub centre and put to use over the duration of the full year. A public exhibition was organised for the full range of furniture and adequate publicity through the local Television channels and the press was given to bring awareness of the initiative amongst the local government and trading community.

The positive follow out of these initiatives has been the recognition of the department and its ongoing interaction with the different craft clusters in the region. There has been a sustained enquiry from the local community for further project assignments in design and development of the crafts activities. Financial institutions have come forward to support local craft groups by extending financial support in the form of loans etc. The students have consistently interacted with local craft persons on their other projects, maintaining a healthy social connect. Craft groups continue to visit the department throughout the year and are given an exposure to the new design and development craft products developed at the department.

Range of bamboo furniture for Primary Health Centres (PHC) developed at Department of Design, IIT Guwahati. Designers: Sudhakar Nadkarni and Ravi Mokashi Punekar





Designers: Sudhakar Nadkarni and Ravi Mokashi Punekar

Conclusions

It is evident from the above outcome of the project that it has comprehensively attempted to meet all three dimensions of design for sustainability viz. on the Environment dimension; on the social-ethical dimension and on the economic dimension. Through design intervention, it has reasonably attempted to achieve:

- Improvement in employment and working conditions of the producer
- Improvement in equity and justice in relation to the stake holders
- Enable a responsible / sustainable consumption
- Favour / integrate the weaker and marginalized social strata
- Improve social cohesion

It is only appropriate that an institution of excellence such as IIT Guwahati, which receives financial grants from the central government, contribute back to society through real life and people centric participatory initiatives such as these. Education can and should enter into such partnership for the society and make its contribution relevant. It will enrich the whole process of learning as a wholesome one.

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Ravi Mokashi Punekar is a Product Designer and Professor at the Department of Design, IIT Guwahati.

He completed his Masters in Industrial Design from the Industrial Design Centre(IDC),IIT Bombay in 1984. After an early stint working as in house Designer in industry, he joined the Faculty of Industrial Design at the National Institute of Design, Ahmedabad and was with them between 1986 -2001. He subsequently joined the newly formed Department of Design at IIT Guwahati and has made significant contributions in commencing their three design programs . He has spent the last 10 years at IIT Guwahati and is currently engaged in teaching; design research and product development activities. In addition he has held responsible administrative positions at IIT Guwahati as Associate Dean (Student Affairs) 2002-05; and Head of the Department of Design 2005-09.

He current research interests are in the area of design, material culture and sustainability; form studies and Systems thinking in Design. He completed his doctoral research on 'A study of user preferences for the visual domain of product form' from IIT Guwahati (2008). He has to his credit research publications and projects in the areas of product design and craft studies undertaken for leading industries and government organizations in India.

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Slow Shopping

Creating meaningful experiences and relationships

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Prof. Dr. Brigitte Wolf
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The following article describes a new concept in consumption, named Slow Shopping, and how it would be applied on retail stores. Slow Shopping is inspired by the Slow movement, a philosophy that rethinks the values of our every-day actions, and proposes a new strategy for clothing consumption, making it more conscious and sustainable. Though rethinking services and how products are displayed in the physical environment, we present a new possibility of store, which provides to users a different experience, aligned with the current need of resources optimization and sustainable businesses in the economic, ecologic and mainly social aspects.

Introduction

This article describes the results obtained during a workshop in the First Sustainable Summer School, an event aiming to bring together stakeholders from around the world to think and reflect about the construction of an ecologically sustainable society. The workshop, called Light Lifestyles and coordinated by Prof. Dr. Brigitte Wolf, aimed at reflection and development of projects that contribute to the changing habits of our daily life, towards a more sustainable society while maintaining individual comfort and life quality.

The reason, both for the event and the workshop, is the urgent need of modern society to revise its operating mechanism so to avoid collapsing. This necessity arose since humanity increased the consumption of natural resources, as if there is available raw material in a quantity equivalent of four planet Earths, even though there is in reality only one. From this perspective, it is impossible that industrial production and resource consumption continue at the current pace. We must find alternatives to the contemporary lifestyle, pointing a way without extreme sacrifices, so that everyone can adopt it gradually and in a natural way. According to Manzini, theoretician on the subject of sustainability, we must learn to live better by consuming less environmental resources. For this, we must introduce systemic changes in our lives. (Manzini, 2006)

However, the routine of the contemporary world requires a high speed, never seen before. All our daily tasks must be performed more quickly and precisely for this reason, the awareness of our actions becomes even more difficult. Doing takes place before thinking and this reflects in the quality of products and services that circulate today.

Consumption has become almost a mechanical activity. People have no more awareness of what they are buying, or why they are buying it. They do not ask where the products came from, of what they were produced, and most importantly, what ecological footprint they have. The unbridled consumerism not only produces an exaggerated expense of raw materials, but also fosters psychological consequences, such as compensation for personal problems through unreasonable purchases.

Therefore, this article presents a concept that seeks to rethink the act of buying the way it currently exists. Slow Shopping is a new expression, which includes the purchase and sale under the guidelines of the slow movement and proposes new forms of interaction during this experience. Through a store model, we describe a possible application of this concept that could become a viable contribution to the environmental and social needs from our society.

Slow movement and design

The Slow movement emerged as a philosophy of opposition to society's current situation, where everything is constantly accelerating, from work to family life. The beginning of the movement is associated with a demonstration in Rome against the opening of a branch of McDonald's®, an American fast food network, in the 1980s. Carlo Petrini, one of the demonstrators, devoted himself to spreading the concept of Slow Food that, by countering imported and junk food, emphasizes the importance of a natural and conscious diet and the support to local food production. Thereafter, the movement developed demonstrating that the addressed need comprehended not only eating habits, but could be applied to life as a whole.

In the last decade the movement has taken hold and spread to several cities and several areas of daily life. It is possible to find variations of Slow movements for travelling, schools, reading etc. The movement's apex is the creation of Slow Cities (in the original, città slow), a proccess initiated in Italy, where entire towns are committed to live according to the movement by encouraging activities that promote their dissemination.

It is important to state that, in this context, Slow does not necessarily mean slow in terms of speed. The concept has an intrinsic relationship with life quality. It means slow down so we can meet our basic needs, as the quote in the Box 1 explains:

Box 1: Slow movement philosophy

Source: Prof. Guttorm Fløistad, University of Oslo

> The only thing for certain is that everything changes. The rate of change increases. If you want to hang on you better speed up. That is the message of today. It could however be useful to remind everyone that our basic needs never change. The need to be seen and appreciated! It is the need to belong. The need for nearness and care, and for a little love! This is given only through slowness in human relations. In order to master changes, we have to recover slowness, reflection and togetherness.

The search for life quality through proper appreciation and awareness can only happen if we allow the time to do it. That means we need to activate a form of slowness in the society.

The Slow model is of great interest for Design, which covers the development of not only products but also systems and experiences, because it is able to propose successful strategies for social development and well-being. This model has an influence on human relations and suggests the investment of power to local society to improve their life quality; that is, in the Slow model, final users could participate in the chain production at various levels, becoming co-producers. In this sense, we contemplate the contribution that Design can bring to the Slow movement when it creates systems and services with these characteristics.

According to Manzini, bringing together the Slow Food experience and Design opens new opportunities. Meanwhile, Design could create conceptual and operational tools for the Slow model. Thus, both could be contributing to the change in search of a better society.

Slow Shopping

The number of people who comprise the consumer class, that is, the mass that accumulates non-essential goods, is growing rapidly: approximately 2 billion people belong to this class and another billion should be added in the next 10 years (David Butler, 2009). To make it possible to meet these demands without destroying the planet or depleting natural resources, it is necessary to consider new strategies for production, purchase and sale. Greater connection between producer, seller and buyer should be set so as to optimize these new ideas to come.

Slow shopping is a new concept that suggests a new way to buy and sell, through a re-planning of the store as a whole, from the type of offered services and customer relationships to physical environment and concernment about the product's origin. Slow Shopping aims to change the current dynamics of consumption, promoting user awareness and rescuing the rhythm which is necessary to understand the product and its necessity in our lives.

The type of product chosen for this proposal was clothing. This is not only due to the big consumption of clothing in all age populations, but also because it is a good that reflects personal identity, a product

that people want to choose well because their image depends on it. In addition, clothes have a variable frequency of use depending on the importance they have in the wardrobe. Many pieces stay there for long periods without being used. In fact, most of people do not use 25% of their wardrobe. At the same time we always want to buy more items. This habit goes against the philosophy of sustainability, which proposes a light lifestyle.

Another reason for the large consumption of clothing is the psychological effect of fashion. Users, who are bombarded by messages about how they should dress, feel compelled to constantly update their wardrobe. Because of that, decreasing consumption is not an ideal solution that could easily be applied to society. Alternatively, there are services that seek to encourage the clothing exchange from one's wardrobe, so that a person can take advantage of the less used clothes, replacing them with others. The idea to sell or swap used items is old and provides greater variety at lower cost.

However, this idea needs to be rethought to fit current reality. To make clothes trading a widespread action, it is important to embed it in everyday shopping activity. Some stores offer customers the option of trading clothes, as the American brands Buffalo Exchange® and Out of the Closet® already do. Another service that facilitates such action is offered by the Thred Up® trademark, in which the transaction takes place online and the products are sought and delivered at home. However, the customer can not try the product on, as in buying in person.

Repair of clothing also works very well for increasing the life cycle of raw material, while allowing a personal customization on the product. The work of German designer Kirsten Zimmerman, through the store Mein Einzel-Stück (My Single Piece) is a successful example of this service.

In all of these cases, the systems for buying and selling clothes innovate in the acquisition and production of items, but it takes a little more to step toward the Slow Philosophy. For this, the experience of buying has to be different, starting with the environment, which should be appealing, till the customer engagement process, who musts feel conscious and in control. The popular retail clothing stores are actually in the opposite side. A wealth of clothing, where the atmosphere is cramped and oppressive and cloakrooms are ergonomically flawed. One can not find a single piece, and there is a lack of information about the materials and methods of production of clothing. The stores should be designed according to the desired experience: involving comfort and pleasure, learning and reflection, interaction and customization. For a successful proposal, one must keep in mind not only the principles of the Slow Philosophy as well as issues of a new type of customer, an interactive and aware one.

Companies are going through a time of resetting values to their target audience. Transparency and accountability are socio-ecological demands of the customer of the future: the sellers must have an engaged discourse, concerned with the production and its consequences for the environment and society. According to the study "The Enterprise of the Future", made by IBM, the consumer of the future is informed and faithful. The key for maintaining customers is the relationship. The survey also mentions that the increasing power of informed consumers can be used positively. Based on this principle, companies can benefit from a co-creation with the user, customizing the experience and providing unique products with personality. This co-creation will allow the formation of a bond of loyalty between consumers and the shop based on customer participation in the construction of their own experience.

Guidelines for setting up Slow Shops

To put into practice the concepts we described above, it is necessary to consider critical issues of service design: how to approach the customer and how to deliver a true experience that inspires people. The success of an enterprise of this kind is the integration of all parties. In order to be consistent from start to finish, the system must be considered holistically. The first step of this proposal is a reconfiguration of services offered by the store. Currently, the role of a clothing store is to constantly bring new options of items to buyers. The store does not usually have any concern about the disposal of the product, either when it is no longer able of being used or when the user no longer wants to own it. It is not the shop's duty to take responsibility for the fate of the products it offers, but this may be an opportunity for innovation in services.

The exchange of products, as described above, is an interesting alternative. For this, the store should encourage the system of selling used clothes, offering professionals and a place for sale. They can earn a percentage of the sale, but also use this material brought by the client as raw material for redesign of new items in order to add value to old clothes.

If the client is very fond of a garment that is damaged, they can take it directly to the redesign section and retrieve it, paying only for this specific service. It is important that this section of redesign is open to

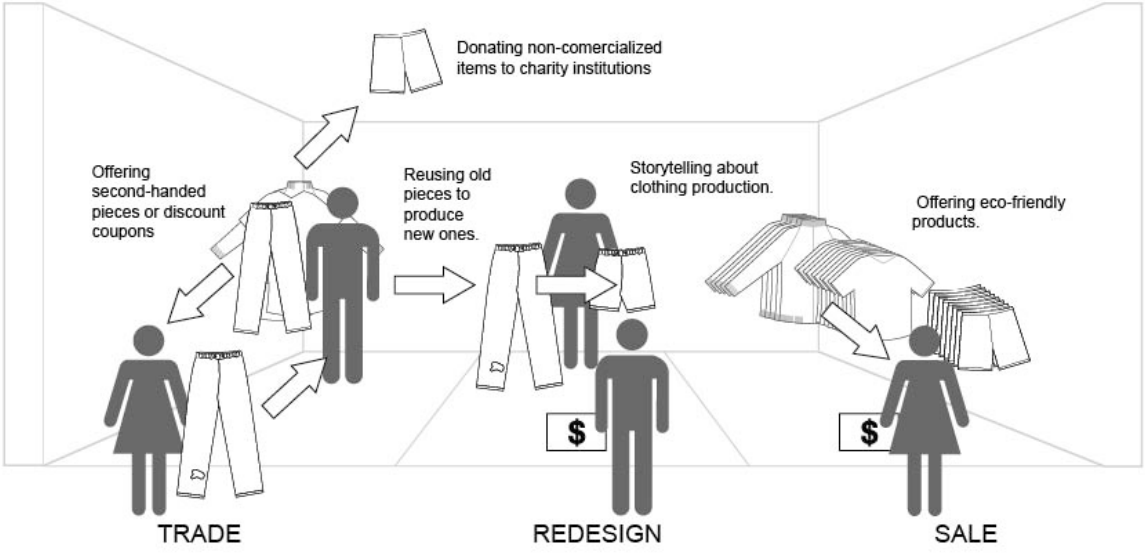
dialogue with consumers, because the user wants to participate each time more, especially with an item that he will wear, co-creating their own image. To be economically viable to hire professionals only for redesign, it is suggested the recruitment of young professionals or students of fashion, also creating a new mean of integration of these new graduates into the labour market.

It is possible to encourage users to bring more old and used clothes in exchange for discount coupons to buy new or redesigned items. The old outfit is worth in exchange for benefits for the rest of the store. Store employees should know how to evaluate the best destination for the arriving clothes: is it better to sell it directly or to take it to the redesign area? If some pieces are not of interest of the target audience, the store can give them as donation to needy organizations. It is a way of taking social actions, recognized by the aware customer, for a low cost. It is important that this kind of awareness must be also considered in relation to traditional sales. Offering products from socially and environmentally responsible companies is important to be consistent with the Slow thought. Although these products are more expensive, there are each time more people who are willing to pay higher prices for a fairer product.

The combination of these three possibilities of service (Figure 1), which can co-exist and interact mostly among themselves, is the first part of the guidelines for making a slow store. However, other aspects such as reflection and awareness about the products should also be considered.

Figure 1: Services offered in an apparel Slow shop

Source: Light lifestyles workshop, 2009



In order to have an effective change in consumption, people need to be aware of the origin and destination of products before and after use. Understanding the life cycle of a product is the first step for the user to act consciously. Understanding that objects do not disappear or appear from out of nowhere and that everything is the result of transformation can be an inspiring beginning for everyone to rethink their wardrobes and make it more dynamic. The suggestion is that the physical space of the shop is used to bring this learning to their customers.

This can happen attractively through panels with tactile and visual displays, including the telling of stories and facts through multimedia. Consumers need to feel invited to enjoy the products of the store and learn from them, for example, when explaining that the wool comes from livestock and cotton from plants. Whenever possible, participation and customer interaction with these panels should be encouraged. In the area of customization, the history of clothing and its various changes can be documented and assembled from materials provided by customers themselves. Creativity contests and other events like parades and new releases can also be produced in order to attract people and spread the philosophy of the

store. All these must be designed so that leaving home for shopping is more than just going and getting a product. The consumer will attend the store, hoping to learn and participate in the process.

The ambiance of the store is also essential to follow the Slow Philosophy. The user experience should be light and pleasant and the ambiance should be based on that. A cozy atmosphere, which is accompanied by soft music and natural elements, invites the customer to stay longer in the store, and thus know all the goods and services. The redesign section should be next to the exchange section, in order to maintain constant dialogue between the two sectors. The user participation in the redesign process can be stimulated by the area and positioning of the elements, to create a common area where the customer can see the clothes being remade, unlike traditional balconies, which sets customer and employee apart.

The cloakroom is an important detail when thinking about comfort in buying clothes. Comfortable furniture for escorts and large mirrors are good steps to create an interesting environment. But the light is crucial in the sense that the user will have to look at themselves in the mirror with the clothes on. The light needs to be closer to the natural one as possible, avoiding the cold light, which makes people pale and less attractive.

Levels of interaction

A feature of the system described above is the inclusion of users in the marketing process. The services depend on user participation and promote interpersonal relationships face to face. The user can be completely passive, maintaining the current stance of just buying new products, but they should be encouraged to interact, bringing antiques, participating in the creation and customization of the displays. Thus, it stimulates the creativity of the participants, engaging them in constructive activities.

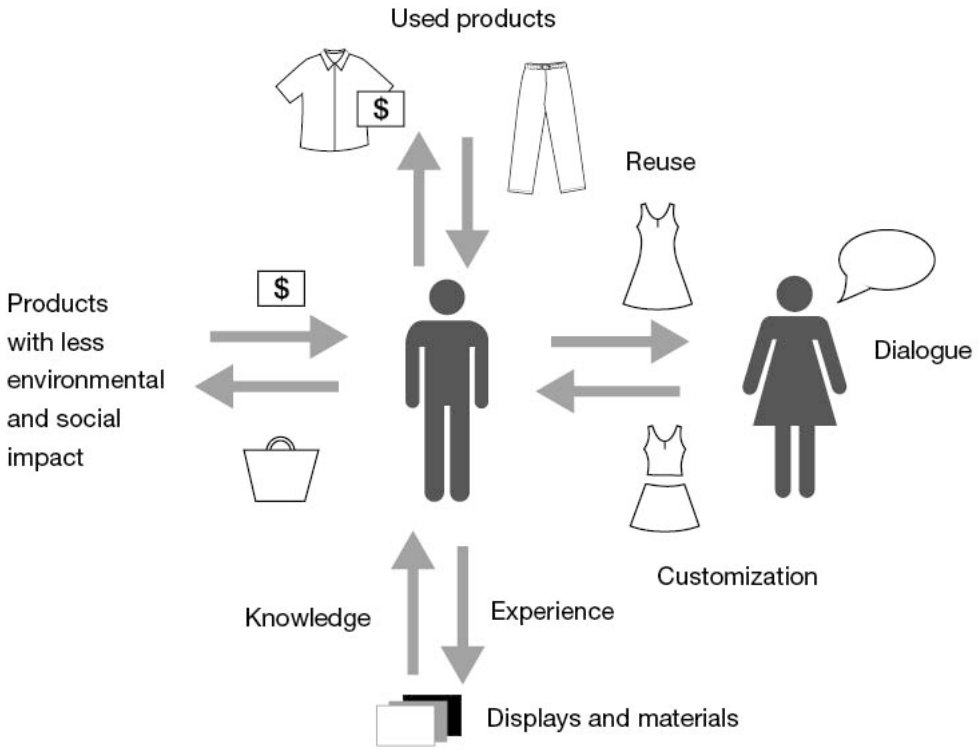
The proposal of creative communities, which use interpersonal relations as an intrinsic part of the service operation, is one of the results obtained by Manzini, in the development of Sustainable Everyday Project. In this proposition, we imagine a company that develops itself based on collective power and gives citizens a chance to turn into active participants in the search and construction of well-being and life quality. However, this is still only a projection into the future and we know that this change must happen gradually, through small changes in local systems.

The design of a Slow Store is very complex and has several levels of interaction simultaneously. The user, a central figure in the next diagram (FIgure 2), receives not only physical products as they would in a common shop, but he is also in touch with experience and knowledge about the universe of clothing. Consumers are gradually educated to participate and collaborate, in addition to acquiring awareness of the issues covered in the panels.

The customization part allows flexibility and interaction with professionals who help them to make decisions about their products. The vendor-customer relationship gains several other levels of meaning because the store employee acquires knowledge about the customer’s taste. The dialogue is stimulated in the personalized customization. This knowledge can then be used to promote a relationship between the store and consumers by creating a customizable database of clients who are contacted when an item the client wants arrive, or when it fits their profile.

It is also important to consider that with the increasing use of the Internet, consumers have gained a new tool, in which they search for information quickly and expose their views and expectations for everyone. Thus, the consumer becomes more demanding and gets a publisher role, as they use the mechanisms of the Internet. This is the time to captivate that customer, who comes to be both a threat and an opportunity for a sustainable mechanism, transposing this new skill to the interests of the store.

Figure 2: Levels of interaction between customers and the various parts of the system.



Source: Light lifestyles workshop, 2009

Conclusions

The concept of Slow shopping innovates by rethinking the sales activity, when proposes a new store model and contemplates the tripod of sustainability: economy, society and ecology. In the social aspects, there is the development of personal relationships, creating a bond between client and vendors who are able to understand the customer's taste and may recommend clothes and customizations. At the same time, there are other opportunities for learning among consumers, who can understand the system of production and reutilization of products.

On ecological aspects, we find the reduction of natural resources, because there is a decrease in production due to the reuse of materials of old pieces to create new products. Thus, there is less material consumption without reducing the supply of products and their variety. It becomes easier and ecological to change the wardrobe through this system. In addition, the system promotes an awareness of consumers regarding the use of materials and their origin, by investing in the disclosure of such information. In the economic aspect, the store benefits from the reduction of material costs and the socio-ecological responsibility, which currently attracts more consumers, concerned about the issue. This system should promote a reflection on the values of a product, with an emphasis on quality. Customers will also be attracted by the possibility of saving through the exchange of old parts for discount coupons, or even by another piece of clothing.

The establishment model in this paper is formulated to build a new store, however it can be easily implemented into already existing business, gradually and according to the real possibilities of each business. As a suggestion for future development of this research, one can adapt a pre-existing store into this model. The process of user-centred design is essential to implement a model like that, because without the knowledge of the user, one can not establish guidelines for a project that fully depends on the interaction between client, employee, supplier etc.

Of course, these guidelines suggest a path that will be followed by those who want to stand out and are ready to handle a more sophisticated consumer who demands not only quality products, but meaning-

ful experiences. In the future, companies will seek to articulate needs and desires, creating unique products, services and experiences of the kind that users never actually asked, but were exactly what they wanted. Slow shopping plans to offer a unique shopping experience while following the direction of a more conscious and sustainable world.

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Experiences and proposals on sustainable materials and energies

the Learning Network on Sustainability

Feasibility study of in-situ generation of electricity and its advantages

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Shortage of power is a persistent problem today in spite of various types of running power plants installed across the country. Many of these issues arise from the inherent problems associated with centralised power generation. There is a significant loss in power, mainly in the form of heat at the production stage and at the transmission stage.

The thermal power plants produce electricity at the cost of a lot of unusable heat, which escapes into the nature by means of coolants. The hydroelectric power plants and wind power plants are seasonal; their efficiency depends on the time of the year. The solar power plants too, have a variable efficiency, which depends on the time of the day, weather and geographic latitude of the location.

This paper justifies the feasibility of captive electricity generation systems at individual building level, while avoiding the problems faced by large scale electricity generation. The cost-benefit analysis shall also be dealt with, to encourage the public to think towards these systems.

This paper deals with the feasibility of installing small scale electricity generation systems at the building level, and the various steps involved in developing customized solutions of hybrid electricity generation systems. Following this, the paper justifies the practicability of these systems in generating adequate energy while tackling the problems faced by the present system of large scale generation of electricity. Also shall be listed the comparison between the costs involved in captive generation, against the consumption of electricity supplied through the grid.

Scope of study

This study shall take into consideration all the residential establishments of Mysore city, and then extend the study area to various States in India.

The residential consumers of Mysore city constitute a significant demand on the State electricity grid. As the population of the city is forecasted to grow in the future, the demand for electricity will only increase with time. The paper shall deal with alternatives to serve this demand without the installation of extra large scale power production.

Mysore is located at 12°18′N 76°39′E / 12.30°N 76.65°E and has an average altitude of 770 metres (2,526 ft). Situated in the southern region of the state of Karnataka, at the base of the Chamundi Hills and covering an area of 128.42 km^2 Mysore is the second largest city in the state of Karnataka, India.

The summer is from March to June, and the winter from December to February. The climate is very equable with temperatures ranging from about 20°C to 35°C in summers and about 14°C to 28°C in the winters. The city has moderate rainfall each year during the monsoon season, between June and November, which is approximately 800mm.[1]

[1] http://en.wikipedia.org/wiki/Mysore#cite_note-scondl-0, Mysore, as seen on 13th July, 2010

The population in Mysore during the census of 2001 was noted as 799228. It is projected to grow to between 13lakh and 19lakh by the year2020. The areas considered for this paper are the residential buildings. The Mysore Urban Development Authority (MUDA) has formed many layouts and distributed nearly 35,000 sites and 10,000 houses after it came into existence.[2]

Current scenario

The majority of consumers in the State of Karnataka, as in the whole of India, are dependant on the central power grid for their electrical needs. However, at various times of the year, the States face power shortage. In many cases, the peak power demand cannot be satisfied and hence, many activities, including business activities that depend on electricity suffer. In general, the progress of the economy is affected.

Current power situation

The total electric consumers in Karnataka at the end of March 2010 were 1.69 Crore ($1.69 * 10^7$) and the total installed capacity in the State was 9712.10 MW. However, this magnitude of power comes at a similar magnitude of cost.

The total length of HT lines in the State is 209052CKm, and the total length of LT lines in the State is 457076CKm.[3] The total transmission losses in transmission in the financial year 2007-08 were reported as 4.369%.[4] The total capital expenditure of Karnataka Power Transmission Corporation Limited (KPTCL) was 1809 Crore in the year 2008-09.[5] In spite of this expenditure for the given population, the organization has to purchase power in some seasons to supply the consumers in the State.[6]

The Government of India has an ambitious plan to supply power to all citizens by 2012. The per capita consumption in India as on March 2009 was reported as 612kWH. In this direction, the Government has initiated many schemes and has released funds for many projects such as extension works, service connections, Rajiv Gandhi Grameena Vidhutikarana Yojana (for Rural Electrification) and Accelerated Power Development Programme (APDRP). There are many State level, District level schemes which are working towards extending the reach of power supply across the State of Karnataka.[7]

Karnataka is well endowed with hydroelectric power potential of about 7750MW of which 3652MW have been harnessed so far. During the seventies, the State had surplus power, but due to rapid industrialisation, and disproportionate growth in demand, it faces acute power shortage in recent times.

Since the policies of the Government aim at further industrialization, coupled with the population forecast, it is expected that this power shortage shall worsen. There are still many rural areas with no power, which need to be electrified.

Implication

It is evident that the future of the power situation in the State of Karnataka, or even India, is dire. The above statistics persuade us to conclude that, large scale production and distribution of electrical energy will not only be extremely expensive for the country, but will also not ensure adequate power to the citizens. The population is increasing at a rate much higher than the increase in production. Also, as the standard of living goes higher, the per capita consumption of electricity is bound to increase in a very short time, much more than the grid can ever satisfy.

The national grid has about reached its economic limits, and any development in that direction shall involve huge resources for small development, rendering the solution of growth of centralized grid, unworthy of further investment.

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[2] http://jnnurm.nic.in/nurmudweb/toolkit/MysoreCdp/MysoreCDP.pdf Mysore City Development Plan under JNNURM Scheme, page 46, as seen on 13th July 2010

[3] http://115.119.32.238/Statistics/KPTCL%20at%20a%20Glance.pdf KPTCL at a glance.pdf(30-April-2010), as seen on 19th June, 2010

[4] http://115.119.32.238/Statistics/Tr.%20Loss.pdf Transmission Loss.pdf (7 May, 2010) as seen on 19th June, 2010

[5] http://115.119.32.238/Statistics/Capex.pdf , Capex of KPTCL.pdf(7 May, 2010), as seen on 19th June 2010-07-14

[6] http://115.119.32.238/Statistics/Summary%20of%20P&L%20Account.pdf, Summary of P&L Account -2008-09, (7 May, 2010), as seen on 19th June 2010

[7] http://planning.kar.nic.in/2010-11-volumeI/Chapter-10.pdf, Power Generation.pdf(19th March, 2010), as seen on 19th June, 2010.

Present energy demand and assumptions

At present, the per capita electricity consumption is reported to be about 600kWh/year.[8] Also, in the study area of Mysore, most of the residential buildings are low rise, that have a maximum of four storeys, and many of the houses are between 600sq.ft and 1800 sq.ft.

For calculation, an assumption is made as four residents per storey of a residential building.

Following these numbers, we can estimate the energy requirement of a building to be about 2400kWh/year for single storied buildings and corresponding multiples for multi-storeyed buildings.

Energy potential

Ironically, in the current situation of energy shortage, we have abundant energy wherever we look, in many forms, such as electromagnetic waves, sound, wind, gravitation and so on. What we need is just a change in the way we utilize these sources of energy in sustainable ways to ensure abundant electricity. We have developed ways to transform various resources of energy to electricity.

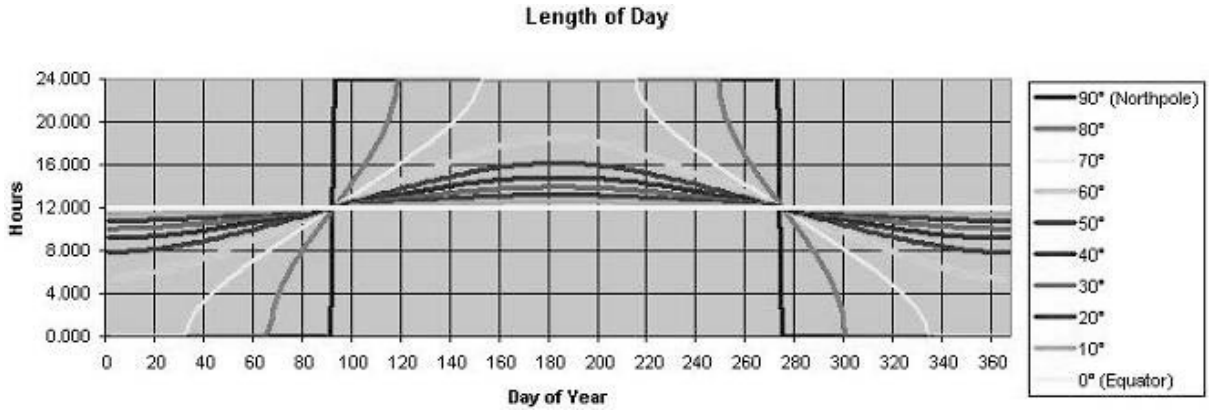
Let us consider our currently viable resources and technology to study the feasibility of their utilization at residential level.

Solar Energy

The study area is in the tropical zone, on the 12°N Latitude. At this latitude, the length of day will vary between about 11 hours to about 13 hours throughout the year (Herbert Glarner, 15th Jan, 2006) and illustrated in the following figure.[9]

Figure 1: Length of Day graph showing lengths for various latitudes (Note that X-Axis starts with the Winter Solstice, and not on the first day of the calendar year)

Source: Herbert Glarner(15th January, 2006), http://www.gandraxa.com/length_of_day.aspx, Length of Day and Night,[13th July 2010]



In the Mysore City Development Plan, the proposed land use in 2011 allocates about 6097 hectares of land for residential buildings.[10] Most commonly, the houses are between single storey and three storeys. In case of single storey buildings, we have a requirement of about 2400kWh/year, for a building having terrace area between 300square feet and 1200square feet. That amounts to the requirement between 8kWh/sq.ft/year and 2kWh/sq.ft/year.

[8] http://en.wikipedia.org/wiki/Electricity_sector_in_India, as seen on 13th July, 2010, as seen on 13th July, 2010

[9] Herbert Glarner, (15th January, 2006), http://www.gandraxa.com/length_of_day.aspx, Length of Day and Twilight, as seen on 13th July, 2010

[10] http://jnnurm.nic.in/nurmudweb/toolkit/MysoreCdp/MysoreCDP.pdf Mysore City Development Plan under JNNURM Scheme, page 46, as seen on 13th July 2010

Similarly, for three storied buildings, considering three families, we have a requirement of 7200kWh/year for a building of terrace area between 300square feet and 1200square feet. This amounts to the requirement between 24kWh/sq.ft/year and 6kWh/sq.ft/year.

In terms of the energy incident on the surface of the earth, the daily average solar energy is reported to be between 4 kWh/m^2 (0.37kWh/sq.ft)and 7kWh/m^2 (0.65kWh/sq.ft) for duration of about 3000 sunshine hours per year, which is far more than the energy consumption. If the solar photovoltaic cells are installed over rooftops of residential buildings, the energy requirements of the inhabitants in the building can be served for almost all the year as there are about 300 sunny days in a year.

A functional solar photovoltaic system has efficiency between 5% and 12%. 1m2 of heliostatic solar PV panel would produce 30W/m2 (~2.79W/sq.ft.) to 70W/m2(~6.5W/sq.ft.) for a day.

However, this source is still prohibitive to the majority of Indian population because of high initial cost of the photovoltaic cells.[11] Also due to variable magnitude of power generated at various seasons of the year, and at different times of the day, solar energy independently cannot satisfy the demands of consumers.

Wind Energy

Situated in a peninsular region, Mysore has a great wind potential. The monsoon winds are dominant in this region and show significant activity for nearly eight months of the year. The southwest summer monsoons occur from June through September and the northeast monsoons take place from December to early March.[12] This wind carries with it a lot of kinetic energy, which can be exploited by wind turbines. For a typical single storied residential building, we can assume the height to be about 11-14 feet above the ground.

The most important factor in any wind power installation is the height of the hub. As a thumb rule, the wind generator is considered most effective for its height, when the hub is 30 feet above any wind obstruction upto a distance of 300 feet. This is because of the turbulence caused by the obstructing object is considered to be significantly reduced at that distance.

Further, experiments have proved that even slightly increased tower height can yield correspondingly high increase in power production.[13] For instance, to raise a 10-kW generator from 18m (60foot) tower height to a 30m (100 foot) tower involves a 10% increase in overall system cost, but it can produce 25% more power.

A small wind generator of 1kW of rated power with a blade diameter of about 10 feet, should be sufficient to power a house of four residents for at least 8 months of the year. The building, in case of additional requirements, or in case of multi-storeyed buildings, can do a comparative analysis between the cost of installing two 1kW rated wind generators, and a single 2kW rated generator. Installing a windmill that generates higher power also implies a greater height of installation. In case of residential buildings in a densely populated residential zone, heights above 60 feet are generally not appreciated, because maintenance of the generator becomes a great issue when it has to be lowered down. In cases where there is not much space to aid in erecting and lowering of the windmill, it is more convenient to install two wind generators at a lower height that can together generate the same power as a single generator with higher rating and higher altitude.

However, unlike solar cells, wind generators require regular maintenance as they have moving parts. They need to be lubricated at least twice a year to keep them running with minimum wear and tear.

An important advantage that wind generators have over solar power cells is the cost. Wind generators are much more cost-efficient compared to solar PV cells, and have a cost of about Rs.20,000/kW of power output in the Indian scenario, while solar cells are about ten times as expensive for installation, owing to their high cost of manufacturing.

Hence, it is wise to use the wind generator as the main source of energy while supplementing it with the solar cells.

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[11] http://www.alibaba.com/product/in104239641-104826188-100775709/Solar_Panel_Price_List_Rs.html, Solar Panel Price List on Alibaba.com, as seen on 14th July, 2010

[12] http://en.wikipedia.org/wiki/Monsoon, Monsoon, as seen on 14th July, 2010

[13] http://www1.eere.energy.gov/windandhydro/small_wind_system_faqs.html, Wind and Water Power program: frequently asked questions on small wind systems, as seen on 14th July, 2010

Rainwater generator

Monsoon winds are a great source of electric power, but they do not power the wind generators throughout the year. The windmills tend to produce less than rated power at the end of the south west monsoon, around November. The wind generators cannot be solely relied upon during this period. However, there is an alternative, the rainwater generator[14], which can be designed to generate electricity exactly during this period, hence, supplementing the wind generator.

A wind generator is to be installed with such a design so that it generates a little more power than required. During the southwest monsoon winds, this produces excess power which will supply to the building, apart from storing water at a height.

Southwest monsoon, in Karnataka, brings with it rain, which can be harvested safely for domestic use. This water, when harvested, is collected in an underground sump, which can be pumped to be stored at a height using the surplus energy of the wind generator. However, this technique is only effective when the water is stored at a great height, especially in case of multi-storeyed buildings. Also, this source of water is limited by the amount of water stored, and hence, this cannot be used for a long period, but only for a few days, and for electric equipment that has a relatively low demand.

Various studies have been conducted in this direction and claim that this source can be conveniently used on high storied buildings.

The water stored in this potential energy tank can be recharged anytime when there is surplus energy produced by the other sources of energy combined. This source of energy is literally, meant for the rainy day.

Microbial fuel cells

This is an interesting source of energy which can supply electricity throughout the year. This runs on the microbial metabolism, to produce electricity for supplementary purposes, whenever the fuel cell is supplied by wastewater[15] [16] [17]. There have been many studies in this direction, but so far, the power density of this equipment happens to be low and can be used only for small demands.

In the recent past, there have been many designs such as membrane designs, single chamber designs, upflow designs, and so on. As studies proceed further, these designs can be improved to produce power at a much higher power density in the future.

Advantages of in-situ generation

In-situ generation of electricity, using a hybrid system combining the above techniques, has many advantages over dependency on the grid supply of electricity. The advantages can be shared between the consumers as well as KPTCL, the financial organizations and other stakeholders.

Advantages

Advantages for the consumers

- The building is free from electricity tariff. In other words, the building generates free power.
- No unscheduled load-shedding. The consumer knows when the power is surplus and when otherwise.

[14] Juneau Todd L., Combined Water Tank and Generator, http://www.faqs.org/patents/app/20090289458, as seen on 14th July 2010

[15] Ghangrekar M.M. and Shinde V.B., Microbial fuel cell: a new approach of wastewater treatment with power generation, http://www.microbialfuelcell.org/Publications/ENV-CE-IITKGP/P-37-MFC-MMG.pdf, as seen on 21st June, 2010

[16] Aelterman P., Rabaey K., Clauwaert P. and Verstraete W., Microbial fuel cells for wastewater treatment, http://www.microbialfuelcell.org/Publications/LabMET/2006%20-%20Aelterman%20-%20Microbial%20fuel%20cells%20for%20wastewater%20treatment.%20WS&T%2054%209-15.pdf, as seen on 15th July, 2010

[17] Mathur Anil Kumar and Singh Dhananjay, Microbial fuel cells: A promising technology for waste water treatment and power generation, http://www.mnnit.ac.in/departments/eed/iee_sem/sem_proced/vol1/Microbial%20fuel%20cells%20A%20promising%20technology%20for%20waste%20water%20.pdf, as seen on 15th July 2010

- The building can be eligible for various incentives for energy efficiency, initiated by the government.
- The residents are more conscious about the electric supply, and are aware of the limits of their supply and usage.
- The hybrid energy generation system is perennial, and does not fail, if properly maintained.
- The excess energy generated, can be used to store in batteries, to be run by UPS systems. In fact, the inverter – UPS system acts as a bridge between the generation system and supply.
- The residents are in full control of the electric supply system, and under operational limitations, the system is very reliable.

The installation of these generation systems have a high cost, as well as retrofitting cost for the building, but the advantages that they promise, as well as the electricity that they generate far outweigh the cost of depending on the grid for the electricity supply.

The foremost advantage for the State in case of in-situ generation of electricity by consumers is that, much more energy is saved by the State than is actually produced and consumed by the consumer. This is because the electricity to be supplied from the grid to the consumer is a result of all that is lost during production and transmission over hundreds of kilometres. The transmission loss can be greatly reduced if captive generation is encouraged.

Advantages for the State

- The demand on the grid does not increase irrespective of the increase in consumption of electricity.
- The agency does not have to maintain the supply to this building, if this building goes off-grid.
- The load on the grid is reduced.
- The projected increase in the demand is drastically reduced, hence, reducing the need to further upgrade on better transmission systems.
- The State does not even have to connect remote villages to the transmission and distribution system for electrification. Captive generation can override this necessity, thus cutting down expenditure.
- The grid can supply energy to the industrial consumers more satisfactorily, without the necessity to upgrade their generation and transmission infrastructure.

Considering the above advantages, the State can encourage the citizens in this direction, by coming up with popular schemes to facilitate the economic aspects of installing captive generation.

In comparison with electricity tariff

KPTCL has provided a tariff system[18] for the users of electricity from the grid. According to this system, Mysore in included in the ‘c’ category of the consumers. For the residential consumers, the consumption, as stated earlier is about 200units/month for a typical family of four in a single floor house, considering the minor changes in consumption during different seasons of the year. In this case, the cost of electricity per month would be Rs.618.50.

On the other hand, a wind generator installation cost amounts to about Rs.20,000/kW rating, with additional cost for maintenance for twice a year, safely assuming Rs.1000.00 for a single instance of service procedure.

Therefore, if a 1kW rated wind generator is installed per building of four persons, then, to breakeven the cost of windmill will take about 35 months, that is about three years, which would make the captive generation option very popular among the general public.

In general, the consumers can get interested in the concept if the breakeven period of the system is less than three years, and in this case, the numbers prove promising, apart from the fact that this power is adequate, reliable and available when required.

[18] Tariff 2005 Snapshot.xls, http://www.kptcl.com/Tariff%202005%20Snapshot.xls, as seen on 4th June, 2010

Extending the study area to other regions of India

The primary study area considered for this study is Mysore city. However, this was just to have a worm's eye view of the situation. Now, to get a bird's eye view, we can extend the situation to other regions of the country by considering the tariff structure, power situation and energy potential of the regions.

The power consumption of the consumers in the other states is more or less similar throughout India. The energy potential however, varies depending on the geographical conditions of the region.

Throughout the western side of the Indian peninsular region, the monsoon is active for nearly eight months, making it a very effective zone for wind power. In the state of Kerala and Karnataka, the total length of day varies between 11hours and 13 hours, while for Maharashtra, the length of day varies between more than 10 hours to nearly 14 hours, making this a very capable zone for solar power.

The southwest monsoon carries a lot of rain for these regions and hence, the rainwater generator system is also applicable here. The cost of installing windmills across the country is similar. However, due to varying energy potential of various forms of energy, the windmills required to be installed would be of varied rating. Since, this is the cheapest form of energy considering the installation cost and the requirement of space, the wind energy can be considered as a dominant part of the energy generation system.

The table below shows the cost of 200units of domestic electricity consumption, along with the breakeven period required for various states in southern half of India.

Table 1: Showing the cost of electricity consumption for different States in the southern half of India, along with the breakeven period required for installation of wind power systems

State	Cost of 200units of domestic electricity consumption (calculated in Rupees from tariff description of respective State)	Breakeven period for installation of wind power systems (approximately in months)
Karnataka[19]	618.50	33
Kerala[20]	183.00	110
Maharashtra[21]	800.00	25
Tamil Nadu[22]	560.00	36
Andhra Pradesh[23]	517.50	39
West Bengal[24]	530.25	38

The Table 1 shows that in most States of peninsular India, the breakeven period required for installing wind generator systems is around three years, which would make wind energy a popular choice among public, provided the public is motivated and informed.

Educating consumers

The consumers have a great advantage of captive generation over dependence on grid. However, this trend is still in its infancy, mainly due to lack of awareness, lack of confidence in this field and fear of loss. These issues need to be addressed and tackled from the minds of the consumers in order to propagate and popularize the concept.

To convince the consumers in large scale, initiatives can be taken up by various stakeholders. These include, The Government, financing bodies such as banking organizations, manufacturers, architects, energy consultants, and solution providers.

The various aspects that cause trepidation in the minds of the consumer regarding captive generation are listed here.

[19] Tariff 2005 Snapshot.xls, http://www.kptcl.com/Tariff%202005%20Snapshot.xls, as seen on 4th June, 2010
[20] http://www.kseboard.com/634021091765000000_RETAIL%20SUPPLY%20OF%20TARIFF.pdf, as seen on 15th July 2010
[21] Your approximate electric bill, http://210.212.176.138:8080/billcalculator/calculatebill as seen on 15th July 2010
[22] http://www.tneb.in/template_3.php?tempno=3&cid=0&subcid=54, as seen on 15th July, 2010
[23] http://www.apcentralpower.com/customer/tariff0910.pdf, as seen on 15th July, 2010
[24] http://www.wbsedcl.in/tariffdetails.htm, as seen on 15th July, 2010

- **The installation cost:** This issue needs to be addressed by the financing agencies to encourage loan schemes. The government can also come up with incentive schemes to encourage the citizens to think in this direction.
- **The breakeven period:** This issue is the period when the cost of the system is yet to be recovered. A small survey of forty people suggested that in most cases, the practical breakeven period for most citizens is about three years. If the breakeven period is more than three years, most of the consumers are discouraged. The manufacturers and consultants should work the financial aspects to avail this information to the consumers.
- **Comparison with power tariff:** The power tariff is an important factor in the popularization of these systems. While it is true that the government should not make the power tariff inconveniently high, it is more practical that the government can initiate schemes of exemptions, and net-metering facilities by implementing the smart grid system.
- **Tax exemptions:** These systems can be made very popular by introducing tax exemptions for the expenses in installation.
- **Green building certification:** There are some powerful institutes and organizations across the country that are authorised to conduct energy audits and certify the green buildings and assess the carbon footprints of various establishments. The concept of energy efficiency should be made more popular by the government, by providing tax rebates for consumers of buildings rated well by these institutes. The government as well as the energy certification institutes should also extend the popularity of the concept of carbon trading incentives among the general public.
- **General environmental awareness:** The active citizens and non-government organizations should conduct various public awareness activities, perhaps independently, or supported by manufacturers, or consultants of these systems. The manufacturers are anyway required to take an active role in popularizing and marketing their products.
- **Technical guidance and motivation:** The stakeholders should also make it possible to avail technical guidance and help to the consumers in these systems. These organizations and active individuals should motivate the public and popularise these systems in order to make it a socially appreciated approach.
- **Academic courses:** The academia can make a big difference to the society by including short-term certificate courses related to energy auditing and installing captive generation solutions.

Conclusion

The advantages of in-situ generation of electricity undoubtedly outweigh the convenience of dependency on the State grid. With initial investment for installation of captive generation systems, after a brief breakeven period, we can avail free electric energy without being dependant on the State grid. Moreover, a hybrid system, although more expensive, can be totally reliable and can supply continuous energy at all times of the year rather than any single renewable source. This is not only convenient in the long run, but also accounts for carbon credits of the building.

The government needs to invest more on captive generation systems than on extending the state grid to electrify remote villages. By this the government can make the people self-sufficient in electricity and promote the idea of green buildings at the household level. This is a green pasture for employment while making the society more environmentally conscious.

All informed citizens should actively involve themselves in promoting the concept and reducing the dependency on the State grid, which can be used to supply principally to large scale consumers of electricity.

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the Learning Network on Sustainability

Thinking through bamboo

The challenge of designing for sustainability in Argentina

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This paper analyzes a case study of an experience done in Buenos Aires, Argentina during 2010. The Metropolitan Design Centre (CMD) decided to put up a workshop to explore and realized products in bamboo in line to the current city campaign to adhere to ecological principles. Afterwards, we, designers working in this centre, realized that there was a project from Buenos Aires province government to help the development of bamboo in the region. Both institutions joined forces and plan their collaboration. Therefore, forty designers from different disciplines gathered to make products in bamboo supported by these two institutions.

We show the obstacles and opportunities of this collaboration, stressing on the possibilities that the project open in the future agenda. We address the questions: How could governmental policies motivate design for sustainability in developing countries from a designers' perspective? How policies could reinforce collaboration while the goal is sustainability?

Introduction

In this section we propose to map the state of the design for sustainability (DfS) in Argentina. It is however, a difficult task as there is not a centre, or an institution that would concentrate the efforts of the country in this matter. Information is spread in within various organizations and there is not a conscious and systematic effort to centralize and document the projects that intend to promote DfS. As a consequence we have decided to concentrate on the information and experience that we were able to collect as designers working for the government of Buenos Aires City and in Buenos Aires University. We focus on our experience in the management and organization of activities that deal with DfS. In addition, we complement our practical knowledge with some interviews to the designers that participate in the workshop and to experts in environmental issues and certifications.

> Global initiatives are requiring greater product responsibility from producers. In Europe, new regulations have been enacted that require producers to take more responsibility for their products by providing for the disposal or recycling of products at the end of their useful life. Labelling products with environmental performance data can help to differentiate products as well (Yarwood & Eagan, 2001: 10).

Though many ISO (International Organizations for Standards) and IRAM (Argentinean Institute for Normalization and Certification) standards are required in Argentina, it is globalization with its growing possibilities for exporting products that encourages Argentinean companies to adhere to these certifications. ISO standards that relate to environmental issues are not yet commonly used but they are being adopted gradually. The Argentinean government has implemented a permanent plan to help and assist companies that want to get these certifications. However, the most important issue, as they are voluntary

certifications, is to sensitize designers and companies in order to understand the importance of sustainability matters. This is not an easy endeavour because Argentinean citizens, mainly from the biggest cities, are vaguely conscious of the collateral damage that their everyday behaviour could cause to the environment.

Other influential characteristic is that in Argentina, compared with European countries there is a big quantity of small and medium sized enterprises (SME). This was the consequence of an industrial development that has a history of ups and downs due to changes in the economic and political system. Frequently these enterprises are family businesses with a small structure and therefore hiring a professional designer to develop a product line, for example, is still a way ahead in most of the cases. As a consequence, many designers, from the beginning of their careers set up their own companies and start to build a SME. One of the major challenges for these designers, setting up their business as soon as their bachelor degree is finished is that they do not have anymore contact with other professionals in the field. They continue in contact only with close friends, but there is not a network of collaboration among designers. There is not a strong design union to congregate and give advice to designers, not enough offers for master's degree that could satisfy the needs of the 1500 designers that complete their degree in Buenos Aires University, to give only one example. This number corresponds to the year 2005 (UBA, 2010).

Another issue that is important here to take in to consideration is the fact that in Argentinean Universities there is not a clear state in the curricula addressing design for sustainability. In addition, there is no Argentinean University in the Learning Network for Sustainability. This fact does not mean that nobody mentions the existence of this subject, but that the presence in the curricula depends on the volunteer action of the teachers and professors. In general terms it is possible to affirm that there is a slow and growing attention to these issues but not a conscious and intentional project that could position design for sustainability in the education agenda as a key factor.

Given these conditions, the Metropolitan Design Centre (CMD) has been a meeting point for many free-lancers and entrepreneur designers organizing several courses, seminars, events and other activities for designers. In parallel, the CMD had the initiative to use these meeting for discussion that deals with design for sustainability.

To describe this situation, enables us to affirm that this informal education of graduate designers towards design for sustainability is a key factor, as they are the leaders of their small and medium sized companies and they can influence with their design production both clients, end-users and the society at large. This process of sensitising the designers towards DfS, is a long one. This is not a short-term strategy, but a long-term attempt that will show its impact in the next ten years. In this process we do not intend to deal only with technical solutions that designers might implement, but also with psychological ones. In our opinion it is vital for designers to understand how they can influence consumer's behaviour and government policies that relate to design for sustainability.

Designing a DfS workshop

In the previous section we present and describe some of the circumstances that have made designers a key player in educating the society towards sustainability. In this section, we will concentrate on our concrete actions, as learning tools to reflect on the issue. The bamboo workshop that we coordinate in the Metropolitan Design Centre has shown us the need to research into the policies and government measures that could motivate design for sustainability.

The aim of the program "Integrating the Future" (Integrando al Futuro) is to contribute to raise awareness transferring from design patterns of development, production, business and consumption behaviours that encourage Corporate Social Responsibility, social and environmental sustainability, which tend to internalize the Fair Trade criteria.

Within this program the Metropolitan Design Centre has organized many activities; workshops that explore different materials (adobe, bamboo, nylon scrap, etc.), conferences that gather different lecturers to talk and transfer their experience and approaches with the different themes, product exhibitions, debate forums with the different stakeholders, window shopping circuits addressed to all brands and design studios, where the objective of the activity is to work not only from the production side, promoting products that incorporate sustainable design criteria, but also from the consumption side, encouraging responsible consumption behaviours.

The bamboo workshop is an activity focused on research and experimentation. We invite designers to explore with materials and techniques so as to generate new tools to transfer in the future to other agents of the value chain as we explain in previous section. The workshop as an activity gave us the possibility to get to know a vast group of designers and discuss with them on the basis of their design proposals. In general, designers are more familiar with this type of discussion, based on their own proposals. Presenting design decisions behind a proposal, designers present themselves and their values. In other events (as conference or festivals) we have had difficulty in creating fruitful discussions that really influence design decisions, but workshops allow designers to learn in our own way, by doing. This aligns with the "designerly ways of knowing" (Cross, 2007).

The workshops we organized in the CMD always consist of six meetings, being the second one a whole day trip somewhere related to the material in question. This trip is important to get to know the group and to break the ice among the participants. In this case we went to the Tigre, delta part of La Plata River. There, we saw the bamboo plantations and we listened to a lecture from a researcher in bamboo from the Provincial Direction of Islands.

The workshop series based on a material that can be considered "eco-friendly" as bamboo is an easy way to start discussions and tackle the complex problem of design for sustainability. It is thinking about sustainability, through bamboo. As we say in the previous section, there is not in our country an awareness of the importance and impact of design decisions on the environment. Therefore, in order to start sensitising the designers, choosing an eco-friendly material was the simplest way we could find for opening the discussion on the subject. Also, beginning by selecting a material that is renewable, recyclable and compostable was a way to start the life cycle of the products in line with design for sustainability principles. The selection of the material makes designers psychologically aware of and conscious about the framework of the workshop in within sustainable development. They could not avoid thinking about other characteristics of the design proposals that reinforce their projects in this context.

By departing from the material we introduce the topic of design for sustainability and in parallel present other ways to initiate a design process. We propose some exercises as a brainstorming and a sense and body exploration. These were seen for designers as a great exercise to break the ice motivating them to share and get to know who was besides them.

The Metropolitan Design Centre is promoting design for sustainability in collaboration with other agencies and organizations. In this case, we have set the collaboration with the Provincial Direction of Islands (DPDI). We found out during our previews research that the DPDI has an economic development program based on bamboo for the Delta area that had some points of connection with our project. Therefore, we decided to propose a collaboration agenda for the project. During the trip day, they lecture the participants on the material mechanical properties and also gave a concrete overview of the different stakeholders involved with bamboo as well as advice on how to choose the right type of bamboo. Their expertise on the subject was an important starting point for the designers. On the other hand, we will be organizing another workshop addressed to Delta craftsman that is part of the bamboo Producer's Forum, organized by DPDI. This workshop will deal with production and design methods with the aim of getting better commercial products. Another city sector with which we organized design-oriented activities is the Environmental Protection Agency (APrA).

These collaborations should not happen by chance. We would need to implement some common platforms to get to know about each other projects and interests. At the beginning of our bamboo project we understood the importance of creating a discussion forum in order to share ideas and debate. This is why we started a blog, together with all participants of the workshop, to promote the online discussion with the members of the other organizations, producers, vendors, designers and researchers that could be interested in bamboo.

In addition the blog (http://workshopbambu-cmd.blogspot.com/) was presented as a learning tool for the participants in the workshop having in mind different goals. We wanted to introduce new technology to participants, create a discussion forum, and build knowledge together on design for sustainability issues. We gave to all participants editorial rights and we encouraged them to write and collect research material together in the blog. The blog as a daily tool to publish online was new to most of the designers that participated in the workshop. They do not use blogs for their daily professional activities and neither do they comment on other blogs regularly. They have used the blog to collect material about how bamboo was used in others part of the world and to publish their design proposals.

However, it is not common practice of industrial, textile, graphic designers and architects in our country to share their drafts and discuss online about the design possibilities. Though, we have insisted and tried to promote the blog as a discussion forum, designers mainly used it as a place to share their investigation and show results. Only when they have their products in a mature state with nice drawings and

finished proposals do they dare to publish them in the blog. Neither have they had comment on others design possibilities online.

An interesting fact to notice is that participants from the bamboo Producer's Forum participated in our workshop. This was possible thanks to the collaboration network we establish with DPDI and also to the actual state of bamboo development in the country that is still handle by a small or manageable amount of organizations so its easy to find the actors that are working with it. This was a key issue for getting to know the producers and other stakeholders that were involved with bamboo from a different perspective.

The bamboo design objects that came out from this workshop showed the result of the material research and the processes exploration. There were products that used the bamboo in a laminar way, others that took the natural shape of it, some added new technology to its processing as laser cutting to generate textures. Also, there were products that merged the bamboo with other materials as the aluminium, using the bamboo as the structural material.

It was also interesting the connotative work of some of the projects. The bamboo has a strong East reference therefore it is challenging to design products in the West. The barbecue table may be the most striking product when we analysed the results from this point of view. The necklace also showed a new way of using the material, a new application of the wood, as a delicate material merged with metal cords. The bamboo design objects were: lightings, room dividers, curtains, women clothes, a long board, two chairs and one table, sushi table, barbecue table, rack, artist nibs, a necklace, a raft. Figure 1.

Figure 1: Necklace. Designers: Tamara Lisenberg and Martín Martini.

Designers need more recognition and support to carry on with sustainable projects, as the one they have started in the bamboo workshop. In the last meeting we opened the debate about what designers need to continue the production and commercialization of the products they had developed and the main concern was the financial assistance and access to economic resources. Analysing the comments that resulted from the forum we understood that what is really needed is the knowledge and the support in putting together a business with these characteristics due to the fact that the economic resources may be found when you have a clear vision of what you need.

Government, Companies, Designers and end-users

It is important to acknowledge that though we try in this paper to explore an answer to the question of what the government can do to motivate DfS from a designer perspective; the umbrella question would be what all the stakeholders involved could do. Creating awareness and sensitising about this topic should happen together with all the groups involved in product development, such as companies, designers, end-users and the government. For example, Argentinean companies could be involved in the World Business

Council for Sustainable Development (http://www.wbcsd.org) in order to get support to operate, innovate and grow in a world increasingly shaped by sustainable development issues.

As designers, we have our own perspective on understanding what the government could do, because we are exploring this issues using our designs as tools for understanding what kind of needs and support our sustainable design proposals need to be realized as products. In previous section we notice the lack of meeting points with several organizations whose work relates to sustainability. Making use of web 2.0 tools could be a way to advance towards solidifying the net of collaboration. But the real change could come only if government policies motivate collaboration. The same as with the University, at the moment the collaboration within organizations is not set as priority in the agenda, but as something that might or might not happen depending on the good will of the persons involved. Sometimes collaboration means that we spend working days by travelling to meet people in other parts of the city. In the case of the bamboo workshop for example there is two hours car trip from one organization to the other. Incentives for workers involved in networks of collaboration within other organizations could be a positive change.

During the time of the workshop the Metropolitan Design Centre also organized an event on the Environment day where some of the participants in the workshop came over. In this event we had a panel discussion on design for sustainability. Some designers that had already started their collections based on sustainable design sold their objects. This type of events are important to get to know other people interested in similar issues but also, as only designers doing and promoting design for sustainability can participate and sell their products for free are a way to recognize them within the design community. Also, it showed the designers that participated in our workshops and do not have a line of products on the market, that design for sustainability could be the concept of a design company.

On the other hand, the CMD, has a program named IncuBA that works like most of the incubation programs but what differentiates it is that the project that are selected must have a design based business. This program has selected and promoted projects based on design for sustainability, there are 3 enterprises in the current program that put together their business plan based on design for sustainability; Gruba (http://www.gruba.com.ar/), MHU! Minimahuella (http://www.minimahuella.com.ar/) and Mateos Davenport (http://www.mateos-davenport.com.ar/).

At the moment there is only one significant competition or prize in the country that specially deal with the issue of Design for sustainability, and this could be a simple way to put designers to incorporate these values to their design decisions. It is, nowadays, starting to be one of the basic criteria used to select the awarded ones. The most important National Design Competition (Innovar, 2010) deals with innovation and has special categories for sustainable projects.

Some manufacturers require their suppliers to have an environmental management system (EMS) such as ISO14001 as a way to demonstrate their commitment to the environment (Kurk & McNamara, 2006: 29). In Argentina important oil companies are asking their providers to get the certifications in this way they generate a chain of good practice. IRAM (Argentinean Institute for Normalization and Certification) has the IRAM-ISO 64 that provides a manual for dealing with environmental issues in product development. Another important certification that is gradually being adopted is the ISO/TR 14062. This normalization is about environmental management and the integration of environmental aspects into product design and development.

The government could provide support for translation and printing of the already published material on Design for Sustainability. Editorial projects that promote and communicate concrete tools for designers are missing. We believe that by promoting these projects designers could make more informed decisions.

“Ecological accounting through the use of analytical tools, such as Life Cycle Analysis, and standard practices that measure environmental impact is an element of good product engineering and design”. (Ceridon, 2009: 3). Designers and companies need more instruction for using analytical tools such as the one that Kimi Ceridon proposes as a good practice for measuring environmental impact. But also there is a need to understand labels and policies related to sustainability. For example, they would need support for implementing the ISO 1043-1 for marking plastics.

There are certain restrictions as the European Union RoHS directive (Restriction of Certain Hazardous Substances, effective July 2006) that set maximum levels for lead, cadmium, mercury, and other substances (Kurk & McNamara, 2006: 12). Some European companies are already prepared for such restrictions. Therefore, if Argentinean companies intend to commercialize with European countries they should start to consider them and be prepared to adjust their products to them.

The issue of design for sustainability is in line with other city government actions for a more ecofriendly life in Buenos Aires city. We understand that this workshop is only a small contribution, but it has helped us to draw directions and map possibilities of what could governmental actions can do to grow

the seeds that we are planting. The more the government should induce companies to get the certifications supporting their payment, excepting companies that voluntary use the international labels from taxes, and giving consulting guidance, the more the companies will react positively towards sustainable issues.

Discussion

In this process we do not intend to deal only with technical solutions that designers might implement, but also with psychological ones.. In our opinion it is vital for designers to understand how they could influence in consumers behaviour and governmental policies that relate to design for sustainability.

In section 3 we give a detailed description with concrete ideas on how the government polices can promote articulating, consulting, educating, spreading, standardizing, getting financial support, researching and recognizing the DfS. As designers working in the area is important to have a sensitive ear on policy issues and be ready to understand how these issues influence our daily work, our products and our decision making processes. Being more aware and documenting these issues are important steps towards learning on sustainability. On the other hand, designers well informed on policy issues can influence DfS and with it take informed decisions.

Every designer should have the possibility to access information related to laws, methods and tools addressing sustainability as a basic component of the syllabus of every subject. Though, we believe that education towards these issues should happen constantly, it is vital to be presented in the first years of our vocational training as the bases of design.

In concordance with Ezio Manzini (2007: 239) the governance tools needed have to promote horizontal links between peers, while connecting different vertical levels of the public administration organisational structure. This workshop illustrates the linkages between actors, artefacts and social arenas and show how these elements build upon each other while sharing values and promoting sensibility towards design for sustainability. This process of incorporating a new sensibility towards sustainable issues happens not without tensions; this is why we wanted to reinforce the proactive role that governmental institutions could have.

As a country that is in a development stage in this area we need to enable new solutions and propose new paths without necessarily going through every step the developed countries took. We have the advantage that we can learn and replicate good practices in the light of the aim we want to achieve.

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the Learning Network on Sustainability

Poetry and aesthetics of sustainable design

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One purpose of "critical design" is presenting visions of the future by leaving the path of current production and market reality. In presenting a luxurious utopia of CO_2-neutral living by harvesting biodiesel from your personal garden-based algae power station, "Plant 1" is definitely a critical design object. In addition to retelling the story of this 2008 Viennese project, this paper starts a discussion on the poetic aspects and potential aesthetic strategies for "green" design. Moreover, a useful schema for the evaluation of existing or intended products (or systems), bringing together both aspects of real sustainability and perceived "greenness" of appearance, is introduced.

Identifying ideas and options for the future – that, too, may be an essential mission of design, aside from developing products within an industrial context. The worldwide reduction of carbon dioxide is one of the most urgent goals for the survival of our earth climate. As the CO_2 emissions caused by traffic are still at an alarmingly high level and the 2012 Kyoto goal is beyond the reach of most concerned countries, enhancing awareness and stimulating discussions about future scenarios and possible solutions for shrinking the CO_2 footprint of the industrialized world is becoming an increasingly important task for designers and design researchers. Various models of sustainable design, including terms such as "ecodesign", "system design for sustainability" (Vezzoli, 2007) or "cradle to cradle" (McDonough and Braungart, 2002) have emerged. When speaking of "sustainable design", the authors of this paper refer to the definitions in Tischner and Charter (2001).

Following the ideas of Anthony Dunne and Fiona Raby (2001), all design per se is ideologically motivated. Every design process is influenced by values, diverging social and cultural ways of perceiving and reflecting reality as well as various conceptions of self-image and the designer's role in society. The importance of ecological sustainability as an ideological starting point and an aim of design thinking has gained broad consensus during the last decade, even if its relevance in everyday production reality certainly differs for financial reasons.

Box 1: Critical design

Source: Dunne and Raby, 2001, 58

> Critical design is related to haute couture, concept cars, design propaganda, and visions of the future, but its purpose is not to present the dreams of industry, attract new business, anticipate new trends or test the market. Its purpose is to stimulate discussion and debate amongst designers, industry and the public (…)

As stated above, the main goal of "critical design" is not providing new products, but making people think and pushing the cultural and/or aesthetic potential to a maximum. The Vienna-based design studio EOOS, which usually works together with brands like Armani, Alessi, Bulthaup, Dedon, MatteoGrassi or Walter Knoll, developed a conceptual prototype of such a critical object for the Vienna Design Week 2008. "Plant 1 (Home Edition)" presents the utopia of everyday life with – at least partial – independence from energy lobbies by means of an algae power station for CO_2-neutral energy production directly in your garden.

Home grown algae power – the story of Plant 1

For EOOS, the intention behind the "Plant 1 (Home Edition)" project was to create a product that makes an energy-neutral lifestyle imaginable and tangible. The algae power station is designed in such a way that – if it were ever technically realized – the biofuel regularly produced allows for the energy-independent operation of a fuel-efficient compact car. Environmentally conscious consumers could install "Plant 1" directly in their gardens or on the roofs of their houses, for instance. On a minimum base area of about eight square meters, 60 transparent reactor rods serve to cultivate microalgae, the world's fastest growing plants. In addition to sunlight, the fatty algae "feed" mainly on carbon dioxide. The following comparison illustrates the potential ecological significance of an algae power station like "Plant 1": while a fully grown spruce tree with a height of 40 meters takes more than 100 years to filter a ton of CO_2 from the air, "Plant 1" would need only about 16 months to break down the same amount and metabolize it into biomass through photosynthesis. Under optimum conditions, the microalgae in the reactor rods would multiply continually. The oil they produce could be harvested for biodiesel production by means of a centrifuge. Using the esterified algae fuel produced by 60 reactor rods, a three-litre car could be driven for 10,000 kilometres per year. The carbon dioxide balance would be neutral, as the approximate amount of CO_2 emitted by the car would have been metabolized by the algae power station in advance. Alternatively, the fuel produced could be used to operate a generator, producing electricity for an electric car or a household. "Plant 1" could make a significant contribution to CO_2 reduction and reduce our ecological footprint in terms of individual mobility considerably.

In the course of the Vienna Design Week 2008 (www.viennadesignweek.com), EOOS premiered its mock-up of "Plant 1 (Home Edition)" in front of the display windows of the exclusive boutique "Song" in Vienna's inner city, attracting a lot of attention. In view of funding limitations and the primary objective of generating publicity and awareness of the needful reduction of carbon dioxide emissions, a small version of "Plant 1" featuring ten reactor rods filled with green coloured water was presented at the festival. All visitors of the "Plant 1" installation obtained a fact sheet on the ecological footprint of the Western world and the potential energy output of the algae power plant, so that they could get an imagination of the environmental context and how "Plant 1" would work.

Figure 1: A mock-up of "Plant 1" was on display while Vienna Design Week 2008 in front of an exclusive boutique. Inside the shop, EOOS installed a temporary bio lab, where visitors could observe different types of micro algae through a microscope.

"Plant 1" plays with the strategy of "shrinking" a technology that is usually applied in a large-scale context to a size for home usage. This can transform the meaning of its usage into a social-political statement by the individual. Tapping the biodiesel could become possible at the push of a button in people's imaginations – preferably as with an espresso maker, where the only commands needed are 'Start' and 'Stop'.

The archaic origin of life in water gets combined with cutting-edge science and technology to create the concept of a luxury item that anticipates a completely new lifestyle in an ecological context. The green movement, which began as a sort of grassroots movement in the 1960s, is nowadays increasingly supported by the wealthy and celebrities; consider, for instance, politicians or stars pulling up at the Os-

cars in hybrid cars. That is exactly what the "Plant 1" project takes as its point of departure: starting with the luxury sector, which demonstrates positive change for society, the phenomenon could spread throughout our consumer culture and become more affordable in the process. In a first stage, for instance, a company headquarters or a flagship store could conceivably be supplied with energy using algae power stations. Companies could build on the idea to create positive brand awareness, and profit from media attention and a boost to their public image.

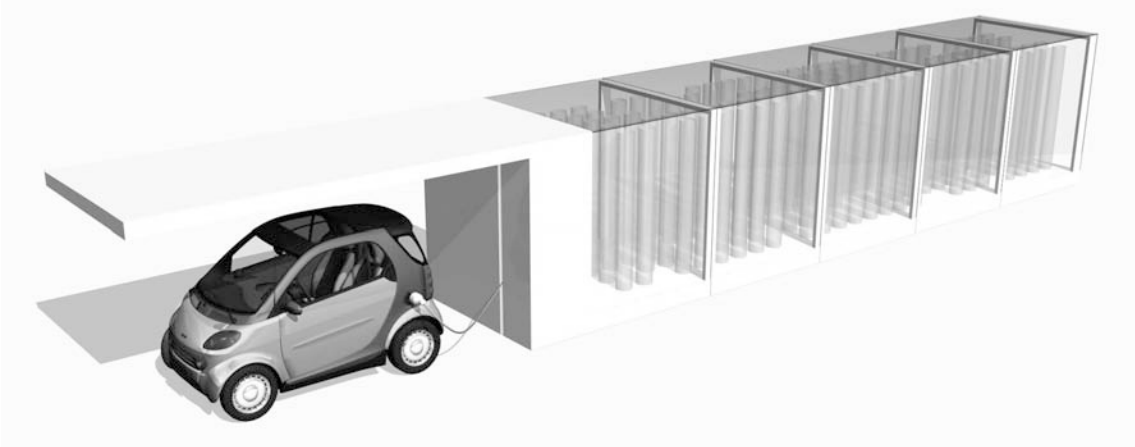
Table 1: "Plant 1" data sheet, based on realistic calculations by the biologists and engineers who supervised the project.

Sources: EOOS, Federal Environment Agency Austria, VCÖ (Austrian Transportation Society), University of Vienna (Department of Marine Biology), ÖBf (Austrian Forestry Association), BDI BioDiesel, Cologne Climate Alliance

Technical data	Model "Plant 1"	Explanatory notes
Type	Algae bioreactor	
Number of reactor rods	60	If greater capacities are needed, the basic system can be expanded with additional modules of reactor rods.
Biodiesel output per year	300 liters	Tested under laboratory conditions.
Potential range of a compact car per year	10,000 km	Underlying assumption is a three-liter car.
Weekly output of biodiesel	6 liters	Harvested approx. once a week using a centrifuge.
Energy output per year	approx. 2,800 kWh	Output equivalent if biodiesel is converted into electricity by means of a generator.
Powered by	Solar energy/ carbon dioxide	
CO_2 emissions per year	- 720 kg	The algae power station does not release harmful CO_2, but instead uses it as the basis of algae growth. Carbon dioxide is injected into the reactor rods and used for algae photosynthesis.
Energy efficiency	CO_2 neutral	The CO_2 emitted by the car is metabolized in advance by the algae power station.
Length/width/height	4 m/2 m/2.2 m	Measurements are exclusive of parking space for the car. The bioreactor could conceivably also be put on a roof.
Weight	approx. 4000 kg	More than 90% of total mass is water.
Construction		The structure is made from recyclable materials. The strict requirements of ecological certification are observed.
Ecological footprint	- 1 gha	An algae power station can reduce its user's ecological footprint by a global hectare (mean value). The average footprint of Austrians measures 4.9 gha. A fair footprint, enabling all people in the world to live well, would measure 1.4 gha.
Oxygen output per year	420 kg	Algae photosynthesis entails the production of oxygen, which is released to ambient air.
Base area comparison of algae power station vs. tree planting to break down the CO_2 produced by diesel consumption	8 m2 vs. 600 m2	Calculation of the ecological footprint also takes into account the surface area needed for the degradation of pollutants: in this respect, algae reactors are about 70 times more effective than a comparable area of closely planted trees.

Figure 2: Original concept of the algae power station "Plant 1 (Home Edition)" by EOOS, 2008

Source: EOOS



New cooperation scenarios. Plant 1 and its stakeholders

As Carlo Vezzoli states in his 2007 book on system design for sustainability, the role of the designer is changing simultaneously with the rising evidence of the effects of carbon dioxide emissions and global warming. If design should be able to help in solving these worldwide problems, a designer today must be able to

- not only think about intelligent products, but also think about intelligent services around these products,
- interact within innovative configurations and build completely new kinds of partnerships as a starting point of the design process, and
- facilitate participatory design processes, if these are able to better support sustainable solutions (Vezzoli, 2007, 215f).

The designers of EOOS also created a new cooperation scenario for the "Plant 1" project, including institutions and experts from very heterogeneous sectors, who came together for approximately two months of consultations.

Table 2: Overview of roles and interests of the participants within the "Plant 1" project

Sources: EOOS, IDRV

Stakeholder	Description	Interest and role within the project
EOOS	Vienna-based studio for furniture and product design	**Interest:** Creating an object that provokes questions about future sustainable lifestyles, positioning the studio in the context of sustainable design **Role:** Concept, design research, searching for experts and building the team around Plant 1, design
Vienna Design Week	Annual Vienna-based festival on product, furniture, industrial and experimental design	**Interest:** Displaying an aesthetically and thematically ambitious object which attracts visitors **Role:** Organization of the festival, PR
BDI BioDiesel International	Company that develops solutions for the future energy market and constructs customised BioDiesel plants	**Interest:** Participating in an interesting design process, scouting potential production options for the future **Role:** Providing expertise and materials for the algae laboratory (inside the Song store)

Stakeholder	Description	Interest and role within the project
University of Vienna, Dpt. of Marine Biology	Research institution	**Interest:** Participating in an interesting design process based on scientific images and results **Role:** Providing knowledge and materials for the algae laboratory
Smart (Mercedes)	Company that builds cars	**Interest:** Participating in Vienna Design Week, communicating an eco-friendly company image **Role:** Providing a car for the Vienna Design Week
Song	High-class clothing store and gallery in Vienna's city centre	**Interest:** Participating in Vienna Design Week **Role:** Providing space in front of the display window (Plant 1) and inside the boutique (algae laboratory)
Die Grünen	Austria's Green party	**Interest:** Promoting renewable energy and sustainable mobility, politically motivated **Role:** Contacting EOOS to learn more about Plant 1
Zukunftsinstitut, Matthias Horx	Popular German research institution, specialized in futurology and foresights	**Interest:** Matthias Horx, chairman of the Zukunftsinstitut, and his family will move into a Vienna-based "house of the future" in autumn 2010 **Role:** EOOS proposed to install the first functioning prototype of Plant 1 there, but has not received a positive response to date
Media	National and international newspapers, magazines and broadcast corporations	**Interest:** Featuring an interesting and new topic **Role:** Publishing articles, broadcasting TV pieces, posting on the web, uploading videos on YouTube

Archaic nature meets technology. Poetry of sustainable design

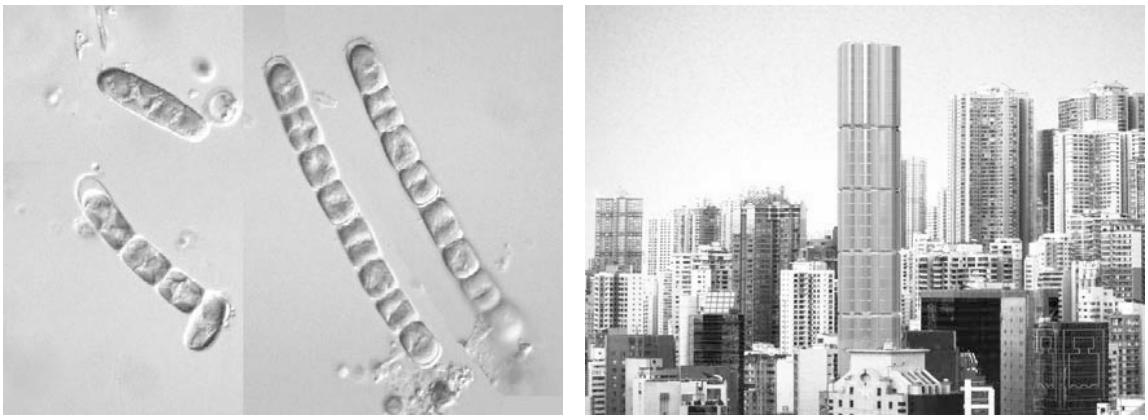
The concept of "biomimicry" (Benyus 2002) is based on the idea of taking nature as a model, a measure and a mentor for technical innovation. This concept has been adapted by design practice as an innovation strategy as well. A photovoltaic "leaf" is typically realized for production reasons as rectangular sheet, which is not a "natural" form. This leaf serves as a metaphor for a biological process, rather than describing a visual similarity with its original form. A design prototype shown in the MOMA exhibition "Design and the Elastic Mind" brings the rectangular photovoltaic elements into the shape and size of high-tech leaves, creating a poetic moment that refers to its original model (Sargent, 2008). The leaves are not green, but their shape and arrangement and their technological dark blue surface create a high-tech character of nature which is not only decorative but also produces energy.

Krippendorff describes different visual design strategies according to semantic categories. The use of "visual metaphors" (Krippendorff, 2006, 95) is proposed here to make new technology comprehensible. It is not Krippendorff's idea to create a poetic moment, but to enable the users' understanding. In the meantime we have learned to decode the rectangular panels on roofs as photovoltaic elements. The addition of the "visual metaphor" to the technological biomimicry creates a poetic moment. Visual metaphors and metonyms (Krippendorff, 2006, 114) are visual strategies not only for creating understanding, as is desired by product design, but also for creating poetry.

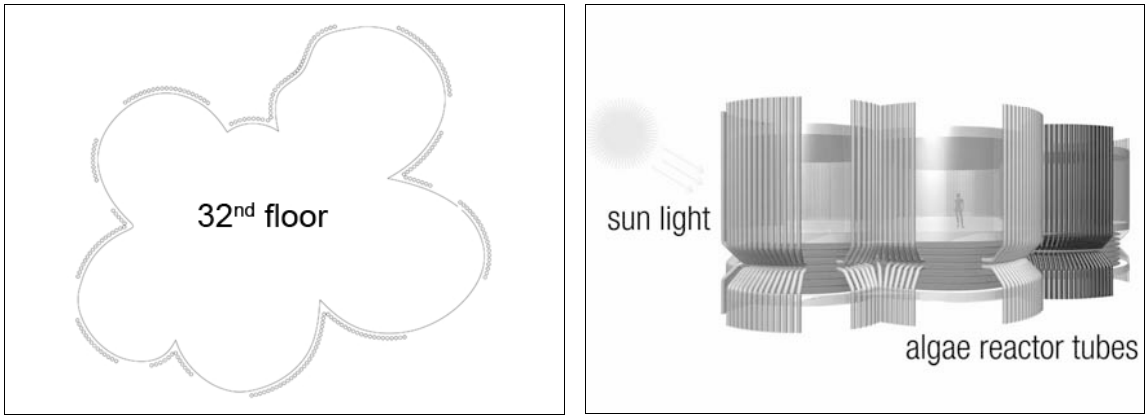
The original concept of "Plant 1" shows the water-algae mixture in big translucent reactor tubes. The tubes look rather technical, like in a laboratory. On a second glance, disorder is created by a geometrical pattern in which some reactors are missing. This is a visual strategy for creating a "natural" disorder in a rigid geometry. The tubes are green because the growing algae are green. The second level of poetry arises out of narration. The algae reactor is a small representation of the production of the atmosphere at the beginning of life on earth on a global scale. Without algae in the sea there would be no breathable atmosphere, which was the starting point of life on earth. The beginning of life on earth (biomimicry) is used as a model for neutralizing the carbon footprint of our personal mobility in a very small and individual scale. Like in ancient cultures, models of the universe are scaled down to be operated symbolically in a meaningful and poetic way.

Figure 3: Concept design of a Skyscraper with algae bioreactor tubes attached to the facade. The appearance of side (1) and ground view (2) is reminiscent of the natural beauty of algae plants.

1



2



The design idea of an "Algae Skyscraper" was developed by EOOS for the "If only…" rubric of the UK-based FX Magazine. The question EOOS asked here was "why can't we build skyscrapers like trees?" Trees use CO_2 for their photosynthesis and produce oxygen and energy. This apartment skyscraper (32 floors) would use algae bioreactor tubes attached to the facade to produce energy and reduce the CO_2 in the air while producing fresh O_2.

To create its unique aesthetic, this concept took scientific images of microalgae as a starting point for the creative design process and allowed the shape of these microscopic organisms to grow to building size within the context of a megacity. Living in such a building could offset our individual global footprint and provide the inhabitants with all the energy they would need. A high-tech 'tree' for dense cities, but much more environmentally effective.

On the aesthetics of sustainability

Box 2: Aesthetics as a result of the production system

Source: Walker, 1997, 179

> Product aesthetics cannot be separated from the bigger picture of product production and the organizational, cultural and environmental aspects of that production. Designers may be hesitant to acknowledge it, but the aesthetics of a product are, to a very great extent, a result of the system

> which produced it. The definition of form and the detailing of shape and surface are both constrained and largely determined by the overall production system. Therefore, we should not be attempting to find a new style which might characterize as form of "sustainable aesthetic".

Box 3: Aesthetics' importance for the customers perception of improvement

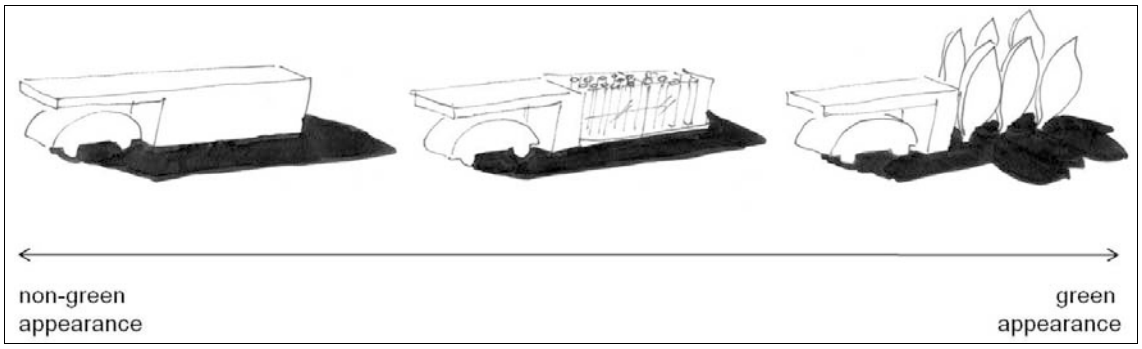
Source: Vezzoli, 2007, 42f

> (...) an innovation, which is environmentally sustainable, without being perceived as an improvement (compared to obsolete solutions), is not enough. In other words, it must be aesthetically captivating.

The two citations here should be taken as examples of the breadth of the discourse on sustainability aesthetics. While Walker thinks that there is no need for a "sustainable aesthetic", Vezzoli has a more marketing-focused point of view which might be nearer to the reality of consumer cultures. Regardless of what theorists and designers are thinking about this topic, consumers have long ago learned to decode the aesthetics of products by themselves. An interesting pilot study was commissioned by the mobile phone producer NOKIA (Hassi, 2009) that ranked materials, colours and images of mobile phones in a survey based on the subjects' perception of the test objects' eco or non-eco message. Materials like wood, stone and leather and colours like green, white and blue were perceived as more eco-friendly than metals or plastics and the colours black, red or violet. Moreover, "simple" design styles were perceived as greener than technical looks (Hassi, 2009, 207). It seems that consumers have their own conception of "greenness" – which not always is in line with the product material reality. Moreover, it seems to be advantageous in some cases when an eco-friendly product also stands out through its "green appearance". For example, an Austrian producer of compostable yoghurt cups and garbage bags, made from cornstarch, said in a TV interview that the people using his products are often confronted by others for throwing these bags or cups into the bio-waste container. As the cornstarch bags don't differ from normal plastic bags in their visual appearance, passers-by are unable to realize the difference in their environmental sustainability. During product design processes, these insights could be used at a very early stage of product development. To create design options (material, form, use) for a sustainable design project at a very early idea stage, the following ideation strategy could be helpful in testing design options that exemplify innovative products. This diagram was not used during the design process of "Plant 1", but it is expected that the following manner of thinking was unconsciously applied to create the initial design. The positioning between the invisible and the theatrical formulation of greenness is in line with other EOOS projects, where poetic thinking is applied in a similar way. This diagram could not only be helpful in facilitating ideas, but also in pre-testing the consumers' understanding of a sustainable design solution.

Figure 4: Three possible aesthetic realizations of "Plant 1", ranging from covered and therefore invisible algae reactors (sunlight conducted by fibre glass) to translucent tree-shaped reactors forming a futuristic forest. The neutral type in the middle – neither hidden nor exaggerated – shows the one on display at Vienna Design Week.

Source: Institute of Design Research Vienna (IDRV)



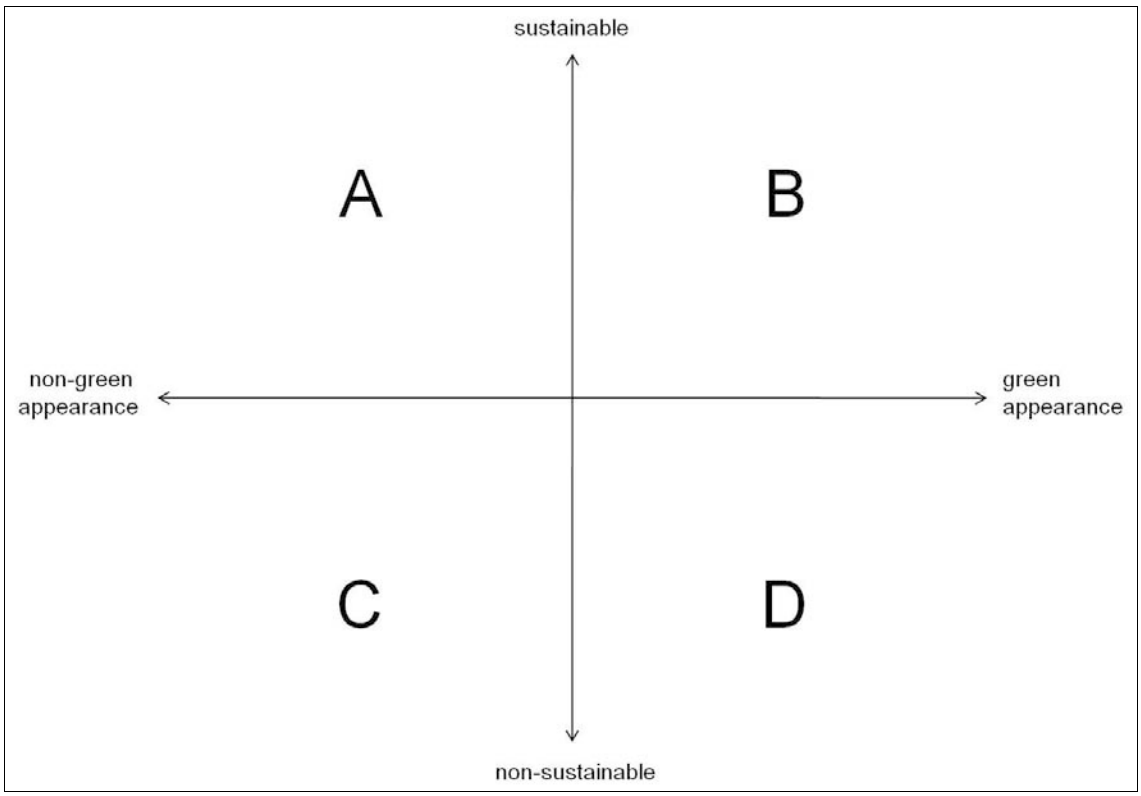
Strategies of visualization

The weakness of the model above (showing the three aesthetic articulations of "Plant 1") is that the visual aspect of sustainability is studied independently from the real technical material quality and its adequate usage with regard to eco-friendliness. This can easily lead to non- or less sustainable design developments. To avoid this trap, the authors propose a new model for examining the complex relationship between the use of material, its correct application and the visual/aesthetical language of products.

The following model combines the aesthetic appearance as horizontal axis with technical aspects of sustainability in the vertical. This diagram can be used as a positioning aid to analyze competition, as well as to study different design options for a singular project. Moreover, this interpretation schema could be projected onto different consumer groups.

Figure 5: Easy to understand schema for identifying the technical/ecological and visual quality of existing or intended products, followed by a short description of the four possible types of design.

Source: Institute of Design Research Vienna (IDRV)



Design A
The aesthetics of the product are not related to the general perception of greenness, but the conception and the material use is sustainable or eco-design.

Design B
The sustainable construction is combined with a new or accepted form of sustainable design aesthetic.

Design C
A form of non-sustainable product design without perceived "greenness" which should immediately be faded out with the help of various stakeholders.

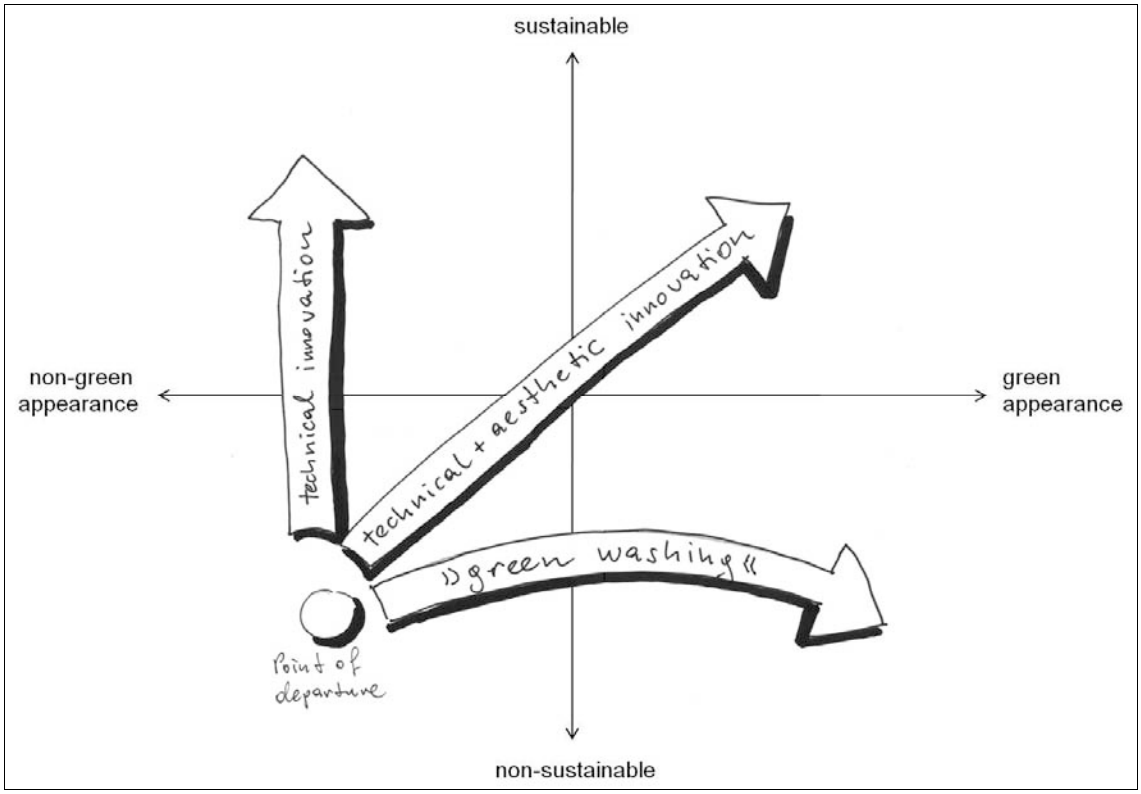
Design D
The green appearance is generated with the wrong material (per lifetime assessment) or the sustainable aesthetic is used as a marketing tool only to sell non-sustainable products.

Strategies of transition

In the context of industrial production, there exist different ways of bringing a brand or a product on a "greener path". If innovation only concerns the technical aspects of a product, this might of course enhance its eco-friendliness and sustainability. But if the look of this product doesn't change at all, it might lack public awareness and understanding of this improvement. The other extreme would be the so-called "green washing" of a brand or a product. This means that although there is no or only little technical/ecological innovation, the brand or product gets decorated with aesthetic symbols perceived as "green" by the consumers (see Hassi, 2009). See Gruendl (2009) for a profound reflection on a marketing action by the street fashion brand Adidas which placed an enormous logo made of grass on the highly frequented St. Stephan's Square in Vienna's first district.

Figure 6: Three strategies of transition to a new era of sustainable production, ranging from technical innovation without the development of an adequate aesthetic appearance (vertical) to "green washing" a non- or less sustainable product or brand by (ab)using "green" symbols and messages (horizontal).

Source: Institute of Design Research Vienna (IDRV)



Conclusions

As discussed using the example of the "Plant 1" installation, design can help to improve awareness of environmentally relevant topics and push ideas of potential future scenarios for sustainable living on earth. Currently, international design thinking and production systems are in a state of transition. Though there is a broad ideological consensus regarding the importance of innovation, it will take time to realize these needful changes. When we take the "NOW!" as central point of our considerations, aesthetical articulations following the ideas of "critical design" can be able to circulate and promote design strategies of the future already *now*, even if the needed technologies are still in development and not yet available to industry. As it is with "Plant 1", utopias of today could metamorphose into sustainable everyday lifestyles of tomorrow.

Additionally, in this paper, the Institute of Design Research introduces an easily adaptive schema on visualization and transition strategies in the context of sustainable design and future-oriented design thinking. It can be used by designers and other stakeholders for classifying objects or brands and for reaching decisions on a more complex – but easy to understand – basis.

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About the authors

The **Institute of Design Research Vienna** (IDRV) was founded in the spring of 2008 with the goal of making, through design research, an independent, academically influenced contribution to the establishment of the field of design studies. This non-profit scientific organization was created to make interdisciplinary and disciplinary discussion contributions to the concrete issues within the field of design, for example, in the areas of pedagogical research, service and sustainable design as well as design history.

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Harald Gruendl finished his habilitation in Theory and History of Design at the University of Applied Arts Vienna in 2009, is one of the three founders of the design studio EOOS and the chairman of IDRV. He teaches design theory as well as design practice and advocates bridging disciplines. Harald published two books to date, "The Death of Fashion. The Passage Rite of Fashion in the Show Window" in 2007, and "The Cooked Kitchen. A Poetical Analysis" in 2008.

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Experiences and proposals on product design for low-income contexts

the Learning Network on Sustainability

Design for Sustainability

A practical experience at Jequitinhonha Valley

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This paper aims to share a practical experience of Design for Sustainability and the importance of participative design as a tool for the best development of a community leading to their sustainability. Our experience is at the Jequitinhonha Valley, a region in the state of Minas Gerais, Brazil, which has the lowest Human Development Index (HDI) of the country (the fifth lowest in the world).

In the last past years it has been evident that the earth has been claiming for better care, that people need to have more respect, better living conditions, care for the environment and it is fundamental to have an ecological consciousness. The search for solutions leads us towards design for sustainability which is no longer a simple choice, but a real need. One of the main objectives of such design is to promote sustainability and social inclusion, taking into consideration a region's economy, its environment and its population.

The goal of this project is to show how design for sustainability can bring meaningful changes to regions of low Human Development Index (HDI), such as the Jequitinhonha Valley, in Brazil. There, one is faced with two distinct and conflicting realities: it is one of the poorest regions of the State of Minas Gerais, and, at the same time, it is one of the richest regions in mineral resources, natural beauty, history and the production of handicraft.

At first, we listed all the projects implemented at the region by different organizations and the results they achieved. We observed that in spite of all the efforts, the economic growth of the region remains a challenge. Even though the attained progress was relevant, the region still presents an HDI below the minimum suggested by the United Nations. Taking into consideration this initial observation, we sought out to identify the factors responsible for the more expressive results as well as those that did not contribute to reach the proposed goals.

As far as the positive points are concerned, one can observe that there were improvements — both entrepreneurs and craftsmen had their eyes opened to a globalized world reality, to the need of enlarging their horizon by seeking new clients, to the necessity of changing product layout and company organization and to the help of external assistance. Also, through the institutional support granted, there was an increase in product value and openness to new cooperation agreements and larger projects.

Based on these considerations, a research project was developed — "Products innovation and value of Jequitinhonha Valley natural resources through the Participative Design". The main objective points are: a) bringing value for the products, reinforcing their local identity; b) fomenting the development of alternatives of financial incoming for the local community; c) exploitation and protection of the immaterial and material values of the region; d) fomenting the integration between institutions of knowledge in Design and the communities.

The research method adopted is the research – action, which conduct is based on a cooperative action between research centers of the referred university and local communities, through visits, interviews, workshops and design projects.

During this project we also percepted the competitive territorial integration, through the exploitation of human and physical resources of the contemplated locations, innovation in products and the development of networks between institution of education and research and communities.

It is well known that a design for sustainability is an important key for a deep change in the community. Design for sustainability is no longer used as mere tool, but as an opportunity for innovation and adaptation of both old and new products: producing more for less — adding quality and quantity.

Sustainable Development

After centuries of misuse of our environment, due to climate changes, misery and massive residue, sustainability is no more a possible way of life but necessary for human existence.

Sustainability main focus is to make the best of human economic systems and have less impact on ecological systems resources. It is also used for analyzing and managing human activities, especially as they relate to nature, resources, and development – environmental protection *(*Brundtland Report 1987).

For a sustainable development, the challenge is to inspire and motivate public and private organizations to grow with a bigger knowledge of responsibility with the help of technology willing to improve our quality of life.

Human development is about to create an environment in which people can develop their full potential and lead productive, creative lives according to their needs and interests. People are the real wealth of nations.

Design

Design is an activity that aims to establish different qualities to objects, services and systems in its complete cycles of life. Therefore, design is one of the main factors for the humanization of technology innovation, adding functional, creative, artistic, ergonomic, expressive and practical factors; it is about matching the needs of the user, so essential for the culture and economics.

Design has gained prominence through the marketing as a tool for sales, but we must also highlight its part sustainable and their important role in the planning of a future more responsible and committed to the environment and the society.

However, the socio-economic-environmental reality in Brazil has a lack of balance and justice on the people living in general. According to Christian Ullman (Ullman, 2003), a solution to this inequality would be “the exploitation of natural resources, culture and the technical craft of each region, employing a minimum of technological resources needed to make the bridge with new consumer markets”, which result the strengthening of the market for EU products. The author also notes that “some of the most important are the recognition, qualification and enhancement of traditional knowledge, so to get a fair price to the consumer and a fair remuneration of the community as well as the designer himself.”

Therefore, the design would be an important factor that could contribute to the increase in the economic and social development of traditional communities. Designers see a problem as a situation to be resolved through a sequential process, obtaining results sometimes original, sometimes predictable and seek to transform the problem into a beneficial solution and appropriate for each situation. Since there is no single answer, the professional responsibility to do our best to find a solution most appropriate for each context. Both the simplicity of daily life of the community as the observation and exploitation of its legitimate features are the key to the creative process of their local production. However, the work of creating and, to some extent, the processing of the products of a community should not be done only by designers alone, but by a multidisciplinary group enabling artisans, not only for activities geared to the production of objects, but also the logistics and marketing.

Design for sustainability

Managing of the environment has always been linked to social relations, due to the fact that men, and live material, have throughout history been forced since to organize collectively to produce their livelihoods – that depend on non-renewable resources of the earth.

We live in a complex time of transition. The sustainable product must still be produced in a less aggressive to the environment, saving raw materials and energy. But on the other hand, the production of new artifacts, even if effective, carries a side effect: it does not slow down the production and consumption. Therefore, we should bet on another alternative: the welfare-based contexts and not in products that lead us to the desired quality of life (Kazazian, 2005).

Studies in design has undergone a major change from the moment they began to take the focus from the object to put it on people and sustainability of the planet, and by revaluing the last decades, reflecting a shift in perspective it becomes imperative now for the exploration of a sustainable world.

One of the areas of Design is the Eco design. Design, where we deal with products, their manufacture and distribution until it is disposed. Within this category there is sustainable design, which aims to promote sustainability and social inclusion, taking into account a region's economy, its environment and its people, creating new jobs and other economic benefits and more socially just, without destroying the local culture.

The green design, ecodesign and design for sustainability are attempts at building a new project, which includes not only products but also the way they use and the various levels of social relations. Since 1992 the design for sustainability has gained strength, I have greater awareness worldwide. According to Christian Ullman (Ullman, 2003), projects related to sustainability has four conceptual basis for establishing the balance between natural and artificial quotas that surround us are required simultaneous actions aimed at further development of renewable sources of production, new products, processing of products and services in new scenarios of behavior. Thus, design for sustainability seeks alternatives not only from innovations in products, but by proposing alternative ways of dealing with them.

Box 1: Creativity and Sustainable Development

Source: Kazazian 2005

> If the desire is the engine of sustainable development, creativity is your fuel: it is the creative one who will push the entrepreneur to imagine a product or service that offers more (needs satisfaction) with less (resources and labor). It is creativity that will inspire the political or the legislature to devise the most appropriate and flexible structures. It is creativity that will enable the researcher to find elegant solutions to increasingly complex problems. And finally, the creativity that will give ease to the consumer, the voter, the investor to choose a development that has more sense.

According Ezio Manzini (Manzini, 2008) transition to sustainability is a process of social learning in which humans have to learn to consume fewer resources and better living environment, enhancing or even having to regenerate their contexts of social and physical life. The approach of design for sustainability is mainly a reduction of the company, within a context that leads to increased welfare through the use of consumption and not necessarily with an emphasis on quality versus quantity. We see how designer of players capable of contributing to the sustainability-oriented social learning process.

Participative Design

Design is the result of a collective reflection and its goal is to make the life of all easier it seeks to use each society knowledge, materials and culture in order to find smart solutions that enable better resource usage by improving processes and service.

Participative design is a process that consists of many of the steps of a traditional socio-technical systems change process and involves not only a designer but everyone that takes part in the process. Aiming for a change in an organization by exchanging ideas, knowledge in different perspectives. In this was, as applied in this project, it is possible to obtain a better result that, embraced by the ones that are benefit, will bare fruits even after the project is finished (Schuman n.d.).

Practical Experience at Jequitinhonha Valley

The Jequitinhonha Valley is located in the northern part of the state of Minas Gerais, it is where the Jequitinhonha river flows through. It occupies an area of more than 85 thousand km² where almost 1(one) million people live, distributed in about 80 cities. With an HDI around 0,56 it is considered one of the poorest regions of Brazil as well as of the world.

Most of the land is arid being and is regularly damaged by droughts and floods. What also contributed to the degradation of the region was the predatory activity of the mining and extraction of diamonds (Wandeck, 2002). Around three fourths of its population lives in a rural area practicing rudimentary agriculture and livestock. Even though throughout the state of Minas Gerais the average percentage of the unlettered people is about 12%, in some cities of the Jequitinhonha Valley, almost half of the population (45%) suffer among other things, with lack of knowledge. (Domingos, 2004).

According to Luis Oliveira (Oliveira, 2006), in Jequitinhonha Valley people reinvented life, moved by the need and their creativity. Its secular cultural expressions and craft reach, nowadays, an international projection. The main products are ceramic, baskets, wood, leather and embroidery. They also have lots of traditional dances such as the "Festival of Kings", 'the Suit of Shepard".

Considering the importance of the preservation of cultural property as an strategic action to prevent the extinction of cities, there are great opportunities for the socio-economic region. It brings true value to the cultural roots at the same time that it contributes to increase tourism and the generation of business.

Our project

The originality of this project stems from its theme, the approach, expected results and, above all, the prospects for disseminating of its results. Among the possible impacts of research, we highlight the competitive territorial integration through the valorization of physical and human resources of the locations covered, innovation and the development of networks among educational research institution and communities. In this way, we expect to promote the productive inclusion, income generation and capability through a dialogic relationship with the community. Therefore, our proposal is to identify and offer to the selected resource and products of the Jequitinhonha Valley valorization strategies through the Participative Design, aiming at: a) adding value to the products by reinforcing the local identity; b) instigating the development of alternatives of source of income to the local community; c) Valuing and protecting the region material and non-material heritage; d) Instigating the intensification of University of Minas Gerais State, School of Design teaching staff as well as its student body performance among the communities.

We have conducted this study in two ceramic communities, in the town of Turmalina at the communities of Coqueiro Campo and Campo Alegre, located in the Jequitinhonha Valley. The result of this work led to: a packaging production line used for transportation of pieces of pottery, a way of adding value to the product and a creation of a gift package line.

Our Approach

Our first step was, through the conduct of site visits and field research, to identify the principal resources in the region used for manufacturing of both handcrafts and home made products which had a market potential and could be improved by Design. After the initial studies, we chose to work with three communities of potters Campos Alegre and Coqueiro Campo.

Since the beginning, the inhabitants welcome us by opening the door of their houses and allowing us to better understand the local context. Due to it, we could identify the community fundamental necessities concerning support and training.

Many are the problems faced by those communities, however, we had to choose a way of working that would not interfere with the product itself preventing us from running the risk of changing the product's characteristic. Ceramic is a tradition kept and transmitted from generation to generation, passed down from mother to daughter. Even though there were few changes in its techniques, there is a diversity of products. In the beginning there were only pans but today the most popular pieces produced by ceramists are the "Jequitinhonha's Brides". The ceramics produced in Turmalina are very fragile, because of that, a special care is required in shipping and handling. In consequence, one of the biggest problems faced by Jequitinhonha Valley craftswomen is the shipping of their goods. For shipping, firstly the products are packed in bubble wrap, then, in crumpled newspaper and paper strips, and lately, placed in cardboard boxes. The artisans buy the newspaper and scrap magazines, but depend on donation of bubble wrap and cardboard box. This procedure causes the loss of products during transportation and, due to the newspaper ink, the spots in some pieces of ceramic. In addition, this packaging is not aesthetically pleasing, does not hold dialogue with its product, is not proper for shipping, produces large quantities of residues and causes a higher environment impact.

Research, visits and interviews held with artisans and their customers show that both of them are not satisfied with the current packaging, not only for its poor presentation that devalues the product, but also because of the spotting of the pieces caused by newspaper ink. Having this in view, our team suggested packaging improvement in order to add value to the art and culture of the Jequitinhonha Valley. In order to avoid further damage to the products, to protect them and increase their value for sale and shipping, we proposed the use of low price, easy production raw material found in those areas. The packages were developed in workshops with the artisans, so that they could participate in the creating process and appropriate the final product. As a starting point, the suggestions developed by our team were presented to the

artisans. All comments and ideas were discussed with the group so that they could come up with the pack final version. We saw, throughout the packaging development process, an opportunity to alleviate another major problem among the potters: the lack of male presence in the communities. Culturally, ceramics are considered a female work, therefore, the male population, without work options; migrate to sugar cane plantations in search of sustenance, leaving their families by themselves during most of the year. Both the creation of a wooden packaging line and the location of a carpentry workshop would provide jobs for some members of the communities and consequently would cause them to settle down.

In many ways, Design can intervene positively in the handicrafts of the Jequitinhonha Valley. Nowadays, a good example of this intervention can be seen in packaging. It is possible, through the creation of a packaging line, to address the whole process of sale and shipping of craft items. In this sense, our project can be of crucial importance to increase sales and improve crafts distribution logistic. The team proposed three packaging lines for the ceramics made by Campo do Buriti and Campo Alegre artisans – all pieces made of eucalyptus wood – abundant raw material found in those areas due to the investment of large reforestation companies.

Box 2: Creativity and Sustainable Development

Source: Cerqueira 2010 in (ed.) Partipative Design – An Experience at Jequitinhonha Valley. Belo Horizonte: EdUEMG.

> The activity of design, of a practical and investigative character, focus on solving specific and concrete problems and seeks to apply its findings, by placing them into service of production. Thereby, the final product is viewed as a component of the process. The application of these principles in the development of the artisan product means thinking about the experimentation, the raw material, the technology, the market place and the new marketing possibilities. The challenge is to reconcile the needs – such as quality, cost, market access – and those aspects that characterize and turn handicraft so peculiar. The artisanal work of the women of Turmalina is a reflection of the richness of tradition as well as of the cultural characteristics if that region. Ceramics represent the ability and the creativeness of changing local resources – in this case clay – into a source of both employment and income. By hand-building techniques, they work the clay, sculpted it into different forms as brides, bullfrogs, flowers and vases – pieces that carry within themselves the identity and history of the land and community which make them. The ceramic-making process follows a ritual, a know-how – which starts with collecting and preparing the raw material followed by working in clay and choosing the given forms. Firing – which is just another part – it is a result of passing on of knowledge from one generation to another. The wood fired oven used to fire the pieces is the same to cook the beans, a ritual they carry out in their daily life. Throughout the day, they place and remove pieces from the oven which, sometimes, take up to a week to some of the clay pieces to reach maturity.

Understanding the process

The ceramic-making process follows a ritual, a know-how – which starts with collecting and preparing the raw material followed by working in clay and choosing the given forms. Firing – which is just another part – it is a result of passing on of knowledge from one generation to another. The wood fired oven used to fire the pieces is the same to cook the beans, a ritual they carry out in their daily life. Throughout the day, they place and remove pieces from the oven which, sometimes, take up to a week to some of the clay pieces to reach maturity. The whole process can be viewed by the value chain at *figure 1*.

Colors are a key element of the region identity. The several shades of clay pieces remind us of the heat, aridness and dryness of the region. It is also relevant to consider another feature that enhances the originality of the pieces: the use of natural dyes only. It was a tremendous honor for us to get to know the artisans and their work. Our challenge as designers was to interact with these communities in order to find solutions to those problems they face. Through the value chain analysis, we have noticed in which points we could contribute to develop those qualities that already existed. We detected two critical points: packing and shipping. Because of that, we proposed systems that could solve ongoing inefficiencies in this segment of the value chain. For instance, the cause of so much breakage and loss was the fragility of the clay pieces. Designers in conjunction with communities have developed a proposal. As a result, conducted tests confirmed the importance of providing packaging that would protect these products. Allowing the pieces to get to the final consumers right is a necessity in order to maintain the quality of the product developed throughout the manufacturing process. The challenge continues. Other questions arise: How to produce packaging in a continuous way? Where to market the products? How to share all the story of the products as well as their original features in a way that their qualities could be successfully

perceived by consumers? Some points of this project confirm the importance of the designer's position then acting jointly with the communities.

Figure 1: In a simple way, the whole process can be expressed by the value chain analysis

Source: Krucken & Montenegro, 2010

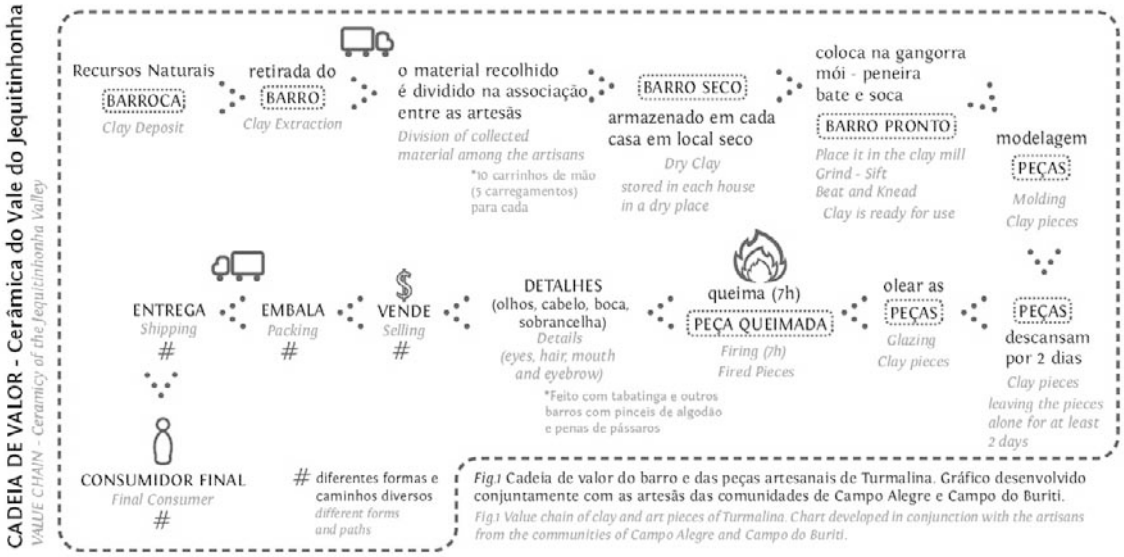

Fig.1 Cadeia de valor do barro e das peças artesanais de Turmalina. Gráfico desenvolvido conjuntamente com as artesãs das comunidades de Campo Alegre e Campo do Buriti.
Fig.1 Value chain of clay and art pieces of Turmalina. Chart developed in conjunction with the artisans from the communities of Campo Alegre and Campo do Buriti.

In contemporaneousness, the main challenge of Design is precisely to develop and / or support the development of solutions that require a broader vision of the project, involving products, services and communication, in a jointly and sustainable way. It is in this context that the interpretative richness, and the visionary ability the proper characteristics of this subject can contribute to the development of a number of solutions and to future scenarios. In this context, the term "creative" does not convey people's personal, creative capacity, on the contrary, it means the capacity of a group of citizens, through shared goals, to innovate and invent new ways to solve a problem and/or exploit opportunities. Contrary to the view of the current model, in which the service solutions are based on predetermined customer and supplier's roles, his one integrates participative proposal. Thus, on a broader scale, the designer interacts with community members – involving actors from business, government and academic sectors – in the development of joint solutions.

The new packaging proposal

During the process of creation, designers and local artisans took part in conceiving packaging. In order to accomplish that, those materials abundant in that area were employed. Due to the pack simple design, the model can be reproduced using not only ordinary machinery but also inexperienced labor. Given these facts, the improvement reached by the introduction of this design added value to the final product as well as increased the quality of life of the local residents. According to their necessities, together we had a result of three new lines for efficient packaging:

- For transportation: rustic and sturdy crates for air and terrestrial transport, retail sales and wholesale. These crates are returnable and during the test, were used by artisans as support for the exhibition of their pieces. The potters used them as modules of a shelf, building up a functional and practical display.
- Basic Package: natural unbleached cotton bags filled with popcorn, straw (banana leaf and corn straw), shredded sisal or eucalyptus sawdust to absorb impact suffered by the products during transportation.
- Premium Package: box-shaped as a portable wood shrine to shelter the three different sizes "little brides". Especially for corporate, business and commemorative dates gifts.

During a fair, those packaging were tested and approved by both artisans and customers. Throughout the pilot test, 400 ceramic pieces were tested and those in a gift packages were sold quickly. The customers approved the boxes and, when questioned, were willing to pay for them. Packaging, besides raising the value of the product, allowed costumers to identify the handicraft of each community, therefore they become a visual complement as well as product identification. Premium packages in small, median or large sizes used for terrestrial transport of single handicraft pieces increase the product value and promote the local culture. Thus, in the artisans' communities, the Design works in a conscious and sustainable way as a part of the Jequitinhonha Valley's life. Besides being functional, packages become another marketing tool for the sale and the distribution of the crafts produced by the communities. Thus, by respecting the local culture without infringing the customs and traditions, we have developed an inexpensive and practical, solution that can be easily reproduced.

Conclusions

In order to achieve the expected permanent results, it is necessary to invest in the qualification and training of the community, enabling access to instructors and tutors in the area, conducting a detailed research in the potential consuming market — considering the creative wealth of the local community and respecting the local culture and traditions.

Working with these communities is a learning process for both teams, us and the locals. I It is a very pleasant experience and we hope to help improving gradually but surely the HDI of the Jequitinhonha Valley. Hoping, in this way, to help to promote the productive inclusion, income generation and training through the interaction with the community.

Finally, we conclude with the testimony that extension projects, such as this, are an excellent opportunity to develop, in an integrated manner, knowledge and tools for performance. The association of academic, government and community sectors lead to the adherence to the communities' reality and real needs. By encouraging communities' innovative capacity, this opens up a lot of possibilities to be explored with the support of the Design, promoting, therefore, a better quality of life and a competitive, territorial integration

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Ragbag

A business case in social design entrepreneurship

Siem Haffmans and Ingrid de Pauw

Ragbag is a brand for fashionable products, which are handmade from recycled materials by deprived people in India and other developing countries. The portfolio of Ragbag consists of designs that are addressing both social and environmental sustainability. The company was started with a specific vision on sustainable design: in order to achieve sustainable business, companies should cooperate with instead of sub-contracting to people at the base of the pyramid (BoP) and thereby utilize the best of both worlds.

This paper features the case of Ragbag as a best practice in design for sustainability and investigates the lessons that can be learned from this start-up. It starts with a description of the company, its history, strategy and achievements over the past 5 years. Subsequently, the paper focuses on analyzing the case of Ragbag, by examining the companies' strategy in relation to BoP and it's achievements with respect to sustainability using Triple Bottom Line.

The Company

After being a sustainable designer for more than 10 years, Siem Haffmans started the social venture: Ragbag. Ragbag® is a brand for fashionable bags and accessories, which are handmade from recycled materials by deprived people in India and other developing countries. Ragbag products combine design with a unique story, social commitment and environmental awareness. Ragbag products give consumers the possibility to make a fashionable and sustainable statement.

The first Ragbag collection has been introduced in 2005 and consists of the following products: bags, organizers and wallets. These products are made of recycled plastic bags and are produced by Conserve, a Delhi based NGO. Conserve was established to recycle plastic waste and to create work and income for people in the slums of Delhi. They work with rag-pickers, who collect the plastic waste, collection centers where they wash and clean the bags and fabricators who make them into new products. The project is creating jobs for more than 60 rag-pickers, people at collection centers and fabricators in New Delhi, providing them and their families 'means of livelihood' and access to more opportunities. Additional collections are being developed with NGO's in Calcutta (India), Accra (Ghana), Nairobi (Kenya) and Brasil.

Ragbags are made for "Cultural Creatives", a group of consumers, who are characterised as people who care about relationships, peace, social justice, and about self actualization, spirituality and self-expression. In Europe there are approximately 80-90 million people who can be described as Cultural Creatives (Ray, 2000).

The first collection is successfully being sold through the Ragbag website and in more than 50 shops in the Netherlands, Belgium, Germany, United States, Japan, Australia, etc.

Ragbag has won several prestigious awards, such as: "Business in Development – BiD Challenge" (2005), "European Business Award for the Environment"(2006) and "Brand with a Conscience Award" (2009).

Figure 1: First collection – handmade recycled plastics, made in Delhi (India)

Figure 2 and 3: Production process: rag-pickers and collection center (Conserve India)

Ragbag and BoP

Ragbag has been founded from the desire to actively contribute to social development and environmental awareness through the creation and sales of well-designed products. In this paper we make a first analysis of how the companies' strategy relates to the Base of the Pyramid (BoP) concept.

Originally introduced as Bottom of the Pyramid, the concept addresses the need and opportunities for businesses to focus attention to serving the needs of people at the base of the income-pyramid (Pralahad, 2002). More than ten years after the first introduction, the concept has evolved into a broad array of strategies of how to serve these needs. One main interpretation of the BoP business approach predominantly views people at the base of the economic pyramid as consumers whom multinationals and other large companies could turn into a lucrative market and at the same time solve problems stemming from poverty (Kandachar, 2008). This BoP approach has been critisized by many for representing nothing more than "selling to the poor" (Karnani, 2007). Karnani states that "We need to view the poor as producers, and emphasise buying from them, rather than selling to them. The only way to alleviate poverty is to raise the real income of the poor" (Karnani, 2007). Hart urges that we move rapidly to a 'second generation' of BoP strategy, BoP 2.0, where the poor are not seen as either 'consumers' or 'producers', but instead as 'colleagues' and 'partners' engaged in the co-creation of entirely new businesses that generate mutual value (Hart, 2008).

Ragbag as example of BoP 2.0

The Ragbag company can be viewed as a typical example of 'BoP 2.0', in that the company develops its products through co-creation, in close partnerships with fair-trade producing companies that employ people from the base of the pyramid.

Target group

The products Ragbag develops are not intended for "the poor". Instead they are specifically developed for the high-end -currently Western- market, thereby creating financial margin to finance the fair-trade payments to the people producing the products. Ham and Thomas (2008) also describe case studies of enterprises targeting consumers at the top of the income pyramid. This differs from the traditional BoP concept of developing products for the poor, but is effective in channelling money from top-of-the-pyramid consumers to producers working at the BoP (Ham, 2008).

The value of design

As described earlier, Ragbags are made for the "Cultural Creatives". This specific target group is larger than the group consumers that go to special fairtrade shops. The latter are a niche group of dedicated consumers, willing to buy at special shops that contribute to social welfare. The cultural creatives also consist of people that are also interested in social and environmental aspects, but that only buy products that also meet their aesthetic requirements: the products have to be beautiful, and (only) then, the story behind the product is of added value .

Both groups value the uniqueness and 'authenticity' of the products they buy. For the cultural creatives, good design is however a critical product aspect to generate consumer value.

The business concept

Compared to other BoP case studies involving SME, Ragbag seems to differ in two aspects: the use of design and it's business model. Ragbag is neither a producer organisation nor a typical social trade organisation. The company describes itself as being a Social Design Entrepeneur. Ragbag is actively involved in the design process, in close and equal-based relationship with the fair-trade producers. This is illustrated with the example of the 'Delhi' product line,

Siem Haffmans visited New Delhi in November 2002 for a conference about Eco-Design. There he met Anita Ahuja of Conserve and heard about their project of plastic collecting and recycling. He ordered samples of the products that they were making and was very interested in the material and in the way

Conserve operated. However, the product design and marketing did not meet the requirements of what Haffmans saw as the feasible target group. He therefore developed the Ragbag® label and hired a talented young fashion designer, Ellen Sillekens, to design fashionable items of the Conserve recycled plastic material. Together with Conserve the designs were developed further and in 2005 the first collection was successfully introduced on the European market.

With this approach, Ragbag seems to have been among the first examples of companies doing business on an equal basis with organisations working at the BoP. Both Ragbag and the different fair-trade producing organisations operate independently, but work together to co-create products that make value of the skills of both parties. Producers like Conserve have the knowledge, skills and capabilities to organise the workers, make the best use of their skills and can address local opportunities for environmental design. Ragbag has the knowledge and skills to reach the target group interested in the products that can be made and coupling producer and market opportunities.

Contributing to the success is probably that both organisations actively pursue the same goals in social and environmental welfare. Thereby the local knowledge of the talent and production skills at the base are combined with the local knowledge of market needs at the top of the pyramid.

Figure 4 gives a schematic view of the business model. Values are indicative and vary per product.

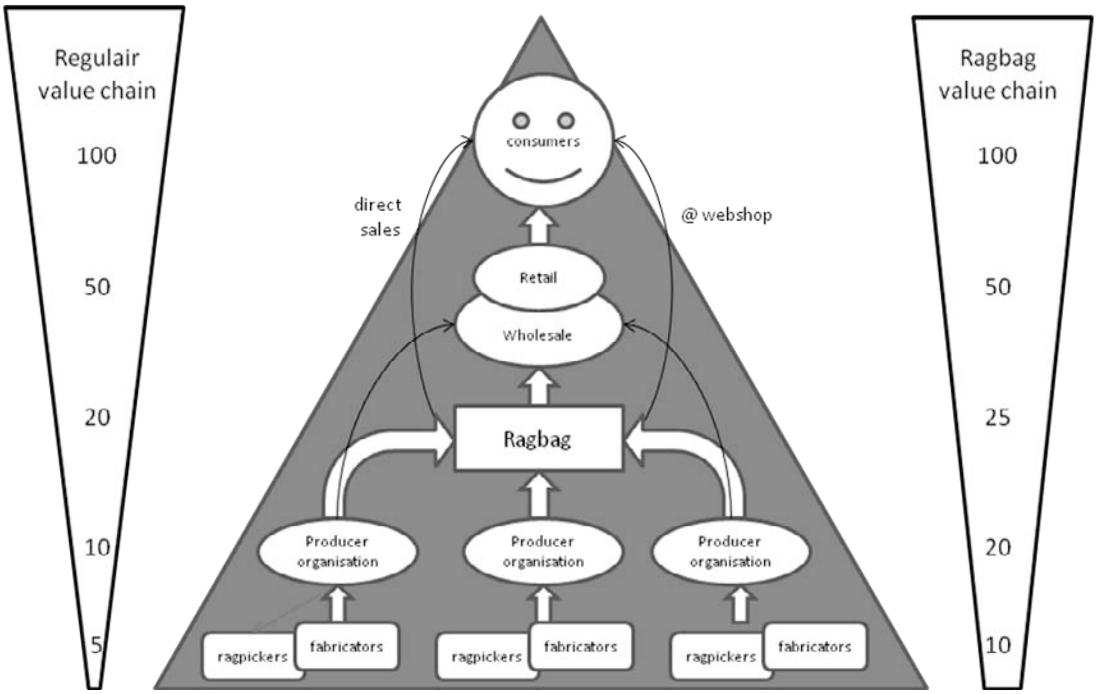

Figure 4: Ragbag in relation to BoP and the Value Chain

As can be seen from the figure, Ragbag works with different producer organisations. Both Ragbag and producers are independent of each other. For instance, Conserve has other wholesale partners besides ragbag, and sometimes surpasses Ragbag to sell to consumers of different target groups (for instance 'green' consumers with other taste in design).

Compared to the regular value chain, Ragbag calculates a lower profit margin, as part of it's company mission to operate fair-trade. This lower margin is ipartly compensated by also selling products directly to end-consumers.

Ragbag and Triple-P

While Triple-P approach advocates a balance between People, Planet and Profit, most business cases on sustainable design tend to focus on either environmental or social sustainability. Although many are working to finding a better balance, only few practical cases are known in which the three P's are in balance. Also within theory and design approach environmental and social sustainability seem to be separate disciplines.

Ragbag has tackled this issue by making both social and environmental awareness core principles of it's business concept. Without fair-trade practice or without the use of recycled materials, a product does not become a 'Ragbag'.

Figure 5 gives a brief summary of what Ragbag has achieved in 5 years time on each of the P's: people, planet and profit.

Triple-P	Results	Explanation
People		
Employment	60 people (Delhi) 20 people (Calcutta)	Average employment in Delhi and Calcutta
Fairtrade principles	Workers get paid fair wages, good working conditions, no child labour, etc.	Producer organisations are member of Fair Trade Forum India
Planet		
Recycling	10.000 kg plastic foil 5.000 kg waste cotton	Plastic waste collected in Delhi Waste cotton yarn and other rags collected in Calcutta
Positive statement	5 million people reached	Free publicity (tv, radio, awards, magazines, webloggs, etc.)
Profit		
Sales	Turn-over 100.000 euro (2009)	> 10.000 bags, 3.000 organizers and 5.000 wallets
Break-even	Reached within 3 years (2008)	Small profit in 2009

Figure 5: Ragbag in relation to Triple-P Bottom Line

Withstanding these accomplishments, Ragbag is very aware it's products and business are not fully sustainable. For instance, not all the materials employed in the products are recycled: the core is recycled material, but for instance zippers, and interiors are made of virgin materials. Also the products are shipped over long distance using traditional transport means. And it has taken many investments to set-up the company, which would not be acceptable for the traditional trade businesses. However, the balance between people-planet and profit is healthy and the company growing. Further improvements in profitability and environmental performance are striven for and anticipated when sales volumes increase further.

> **Conserve India**
> "Conserve pays a fair wage to everyone working for them. An average rag picker earns $25 a month. A ragpicker working for Conserve will earn on average $70 a month. They further offer training to its workers so that they can do better jobs throughout the organisation – from manufacturing to working in the head office. Conserve also supports schools in the slums where many of its employees live. Beyond training and education, Conserve is also starting two new projects which will track the general welfare of its workers and provide health clinics for those with no other access to medical help." Source: www.conserveindia.org

Figure 6: Fairtrade practice at the BoP

Conclusions & future plans

Reflecting on this business case of Social Design Entrepreneurship, we can draft the following conclusions:

Base of Pyramid (BoP)

- Ragbag sees a big potential of creative and motivated people at the Base of Pyramid. They should not only be seen as a large group of consumers, but also individually as valuable partners.
- The potential of the BoP can be mobilized in a fair way by working on an equal and respectful base, from the design stage until stable trade relations.

TripleP

- The case of Ragbag shows that it is possible to combine People, Planet and Profit but seems to indicate companies have to accept working with different profit margins than regular businesses.
- People: Ragbag has shown for 5 years now that it is possible to generate a stable and fair income for more than 60 people at the different producer organizations.
- Planet: A reasonable amount of materials is being up cycled from "rags to riches", but the communicative value of the brand might even be more important than this.
- Profit: The break-even point has been reached after two years time and a little profit has been generated since. Although this business is not yet earning much income for the entrepreneur, this is expected to be improved the following years by scaling up the sales volume and turnover.

Social Design Entrepreneurship

- Design can create added value in the chain that can be used to create a better income for the producers at the BoP.

Future plans

The following years Ragbag plans to expand the brand with new products and more producing partners in several countries. This way we will grow towards a social brand with more than 1 million euro turnover and 500 – 1000 people earning an income for their families in the slums of India, Africa and Brazil.

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the Learning Network on Sustainability

Design Possível

Brazilian case study on social design

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This article presents a Brazilian case study on social design, the *Design Possível*'s experience on working with design for poor communities and productive groups of the periphery of São Paulo city. *Cardume de Mães*, the attended group studied for this research, is a group of five women that, after attending a Technical Capacitation and an Entrepreneurial Training developed by *Design Possível*, is in the process of emancipation and self management, while developing and commercializing their products made out of reutilized vinyl plastic from companies' donated communications posters.

Introduction

This article presents a case study on *Cardume de Mães* (Shoal of Mothers), one of the groups attended by the Brazilian design association *Design Possível* (Possible Design), a social enterprise that promotes technical and entrepreneurial training for productive groups of crafts in the suburbs of São Paulo city. *Design Possível* aims to share a successful experience in which design practice and education converge in a harmonious and collaborative manner, dealing directly with social and local issues and this work will show how it is done, how Social Design and Sustainability can be applied in a contemporary environment.

The case study presented consists of qualitative interviews and a "before/after" view of the groups' formation and incubation process in order to analyze the interventions' actual results. In doing so, it is intended to show how *Design Possível* is working towards its mission of transforming society into one with more justice, balance and sustainability, while promoting and applying design as a tool not only for product development, but for productive management and comunications, thus contributing for income generation through human and social development. (designpossivel.org, 2010)

Design Possível

Design Possível is a non-profit organization from Sao Paulo, Brazil, that, using sustainability as its main direction, applies and promotes design while working directly with the city's peripheral and needy communities.

> "We develop products together with the communities, we comercialize these products, we develop the identity logo for a group or for the whole community, we stimulate activism and also student protagonism, which is another manner of stimulating design, and we also work on internal management in order to become a sustainable organization." (Pons, 2009)

Divided into four major areas – comercial, management, educational and comunications – *Design Possível* works in partnership with different organizations such as NGOs, government organs as well as private companies and industries, developing projects that will not only help generate income, jobs or comercial and craftsmanship opportunity for the communities' population but also allow human and so-

social development in such areas. In doing so, its aim is to use design in the transformation of the low level social hierarchy, benefiting primarily the needy ones.

Design Possível's history

In 2006, a project was launched as an extension activity of the *Universidade Presbiteriana Mackenzie*, Brazil, in partnership with *Università di Firenze*, Italy, in which students from both countries worked together in developing products to be manufactured by groups of artisans from São Paulo city's periphery. The initial project ended after the first year so the Brazilian group decided to continue the work with the communities, using design as differential for the productive groups' comercial products, thus contributing for income generation. It was soon noticed that the groups needed more than product development aid, so research on a full entrepreneurial training took place in order to enhance assistance to the artisans and craft workers.

By 2008, the one-year entrepreneurial training was fully consolidated. Using a constructivist method which establishes the importance of student participation in the content production, the training is divided into six main modules in which the participants have group strengthening activities, combined with theoretical classes on market dynamics, design tools for product development, "price-fixation" and commercialization methods as well as self management instructions.

In the beginning of 2009, *Design Possível* was institutionalized as an NGO in the form of an Association of design students and professionals directed towards sustainability. Aiming to multiply the association's methodology to others around the country, through talks and intensive workshops, the group began organizing the *Design Possível* Network, which presently accounts three other growing associations of "social designers", located in Manaus city, North Region of the country, and Florianópolis and Curitiba cities, South Region. In 2010, the group created LEDS (Study Laboratory on Design and Sustainability), a research group formed by *Design Possível*'s employees and volunteer workers intended to study, register and publish the enterprise's on-going research on sustainability and design education.

Design Possível's Entrepreneurial Training

The entrepreneurial training (developed by *Design Possível*) aims to capacitate and potentialize an entrepreneurial productive posture on the groups attended, in a way that, using their own skills and talents, they can develop income generation projects, achieving independence and sustainability. Its main goals are:

1. To create orientation groups that stimulate the basic skills for work or entrepreneurial actions.
2. To develop, consolidate and amplify technical knowledge in each group, allowing the preservation of craft and manual work, as well as it's improvement towards contemporary adequacy.
3. Labor market integration for the participant groups
4. To provide cultural, creative and social enrichment, amplifying the participant's comprehension on their products relations with society.
5. To create a relationship of friendship, trust and partnership commitment within participants, in order to help make a fertile ground for the implementation of self management and cooperative habits.
6. To organize productive groups so they can develop products directed to potential markets and inserted in the consumption-production relation.
7. The formation of entrepreneurial groups with productive autonomy and collaborative management and production.

Participatory Methods

In order to refrain from being viewed as a simple service provider, *Design Possível* requires a partnership and exchange level relationship with all partner entities, creating, in this manner, a social network of in-

terested organizations which will overcome social challenges of the involved communities in a collaborative and cooperative way.

In a similar manner, the capacitation projects of the productive groups are based on participatory educational methods, such as presented by a Brazilian Learning scholar, Paulo Freyre (1977), who considers that identity construction is a collective action, and craftwork a cultural manifestation. While approaching the participants' realities during the process, they are inducted to see themselves as a key part of local development as well as a multiplying character of knowledge, information and trends. In order to transform this social actor from being a simple recipient of information to a disseminator of knowledge, it is intended to show that his part is as important for the process, if not more, as the facilitator's.

The six modules of the Entrepreneurial Training are:

a. Group Formation – an initial but also parallel module, that can be repeated when needed, of which the goal is to stabilize and strengthen the groups, unifying its mission, goals and aims.

b. b) Technical Consolidation – a two-month period in which every participant shares with the others his/her own craft techniques in order to homogenize and evaluate the groups production skills and so that all participants have the same starting point.

   Around this moment in the process, the group begins to understand its identity and chooses it's name. Design Possivel's communications area then starts working with the group in order to collaboratively create the groups logo and other informational products, such as portfolios, business cards and product tags.

c. Market Dynamics – its when the artisans get in touch with concepts such as target market, suppliers, fashion trends, market rules and dynamics. When the group starts to be trained, it is when it is decided which will be their product. If it is a consolidated group, they begin analyzing their current products relations with society and with the market.

d. Product Development – design and creativity tools are taught within this module in order to capacitate the groups in product development so that, when receiving a briefing from a client or when analyzing a specific market need, they can autonomously apply the apprehended projection methods.

e. Production and Commercialization – concerns issues such as fair trade commerce and product price formation, as well as client-partners-supplier relations.

f. Self management and Business Planning – this last module's intention is to capacitate the groups for financial independence and sustainability, helping them to create an established partnership network with NGOs, productive groups and other partner entities of *Design Possível*.

It is important to note that, even after the Entrepreneurial Training process is over, most groups remain in an incubation phase for a couple of years before being able to gain full independence, time in which most of Design Possível's assistance concern productive management aid, client hunting, business plan updating and internal group relationship assistance.

Cardume de Mães

Figure 1: The 5 women of *Cardume de Mães* in their workplace

One of Design Possível's most successful attended productive group is Cardume de Mães (Shoal of Mothers), artisans that live in Campo Limpo, a neighbourhood in the Southwest of São Paulo city, whose flagship is the production of bags, purses, pencil cases, wallets and office materials made out of reutilized vinyl plastic received through donations of private companies' communications posters. Already stepping out of the final incubation phase, the 5 women are getting ready to move into their own rented space where they will no longer be under the wings of Projeto Arrastão, the 42 year NGO that started their technical formation on industrial sewing more than ten years ago.

According to the groups' business plan, their mission is "client satisfaction through punctuality, quality, fair price, and constant development of new products" and their services' advantages are socially concerned, exclusive and ecologically friendly products, such as shown on Figures 2, 3 and 4.

Figures 2, 3, 4: Bags, purses, cases and wallets – some of the groups´ products

Interviews

Cardume de Mães started being attended by Design Possível in 2006, then with 13 artisans and being called Group of Moms. In order to obtain a before-after view of this partnership process, in June 2010, the group was interviewed and answered questions on how their lives were before entering the group and

why they had made the choice of becoming seamstresses; on what were the current positive and negative issues of being in *Cardume de Mães*; and on what were their group and individual plans for the future. The group is currently formed by 5 women:

Figure 5: Eliane, 40, mother of four, worked as a cashier in a supermarket, before settling down and having kids. She has been with *Projeto Arrastão* for ten years.

Figure 6: Rosalina, married and mother of three, has been with the project for 9 years and had been employed in toy factories and offices, also before having her children.

Figure 7: Herculânia, mother of one, has been in the project for 9 years, had previously worked as a preschool teacher and in administration offices. She first heard of the project through friends, and the possibility to work at home pleased her.

Figure 8: Francisca, one daughter, has been in the project for 4 years and also had worked in schools and supermarkets before marrying. The project reached her through a note brought home by her child.

Figure 9: Solange, married, two children, has been in the group for 3 years and used to work as a saleswoman for Yakult, as well as a cook, and selling homemade truffles.

By the time they entered the seamstress project given by *Projeto Arrastão*, they were all unemployed, staying at home and taking care of their children.

The Before Picture

When asked what were the major motifs for wanting to participate in the sewing project, at *Projeto Arrastão*, most of them stated it was because of the possibility to earn a living by working at home, besides the opportunity of learning new things, in a free of charge course.

The first women that got together, more than 10 years ago, would meet in an afternoon tea type of encounter, where they would chat, exchange knowledge, learn craftwork and attend to lectures and workshops. The few services they would get were sporadical and mostly concerned about embroidery and crochet.

In 2007 began the partnership between *Design Possível* and the NGO (*Projeto Arrastão*) and a one month sewing course was given in order to capacitate women to, together with the already existing Group of Moms, form a productive group. By then, the seamstresses were already beginning to experiment with the vinyl plastic material used from donated communication posters and the products they developed were simple squared shopping bags, binders and pencil cases. By the end of the sewing course, eight women remained in order to, together with the earlier five, form the group that would be later called *Cardume de Mães*. According to those women, the biggest problems the group encountered in the beginning were related to the delivery of their production. Since they had different levels of experience and some were just beginners, many of them were not able to finish their pieces or deliver them on time, which made the whole group work overtime in order to do it right to the client. On the other hand, the close presence of *Design Possível*'s designers helped the group solve the relationship issues that would often result from those problems.

The Present Picture

Today, relationship issues are still the group's biggest trouble. Much more autonomous in the resolution of their problems, and with much less aid from *Design Possível*, the group struggles to overcome their difficulties in a fair and peaceful manner. Through voting and raffles, the remaining five women state that unanimity isn't always achieved, but once the debate is over and the voting begins, the end result is always respected by all. Mostly due to disagreements related to finalizing new prototypes – which techniques and materials are best for each new product – or to quality checking – preventing personal vendettas between the women to interfere with the quality of their products – *Cardume de Mães* perceives the group's lack of acceptance as their major current challenge.

On the other hand, even though they are lesser in number, problems related with the production and delivery ceased to exist and their current productive capacity is of 2500 products per month, amongst simple and complex ones. *However if a client wants a delivery of 12 thousand products in one month*, they say, *we make our working hours accordingly*.

A positive aspect of the groups change along the years is their growing capacity in product development. Today much more confident and experienced, *Cardume de Mães* excels in prototyping and delivering unique products, created entirely by themselves, almost always without any designer's help. An asset used as differential, in comparison to other sewing productive groups, prototyping is always a challenge for the group, for it demands time and material, and involves client cooperation and clear briefings. It is, however, the women's favourite aspect of being in the group, in which they are not "oblidged to bring everything ready and cut, without ever knowing how the whole process works, what people thought to make that product" (Rosalina, from *Cardume de Mães*)

Benefits

When asked what were the biggest benefits of being in Group *Cardume de Mães*, they answered:

1. "Realizing that you have potential. I hadn't worked for so many years, now I see that I can go back to work and still raise my children. Also, being recognized. We were lately indicated for the Milton Santos award." Rosalina
2. "New experiences, always learning new things." Eliane
3. "I like it here because of the experiences, every day is a new situation. One day you're teaching, multiplying your knowledge, the other day you're learning something new. And also the challenges that will come, to know that we're making it." Herculânia
4. "It is the experience, the companionship. Working in a group is hard but nice. Despite the difficulties, we learn a lot from each other, like we were family." Francisca
5. "The experience of transforming the vinyl plastic into a complete product, that you made by yourself, is very gratifying." Solange

Ecological Consciousness

The group's flagship is reutilizing companies' communication posters' vinyl plastic to make unique and innovative products such as purses, shopping bags, containers and boxes, office material, among other products. The sense of ecological or environmental consciousness within the group is tangible, since the gratification one gets from doing something, even small, that contributes for the environment is a frequent topic within the women's conversations.

> "Once we had an order of lots of PUFFS (a sitting support that utilizes Pet plastic bottles and is covered with vinyl plastic) and in the end I counted 702 bottles that weren't going to be thrown away in the river. It's that feeling you get when you collaborate a little bit." Rosalina

Client awareness, however, is still a challenge to overcome. According to the group, clients are still interested in their products because of their uniqueness or visual differential, and not because of their ecological value for environmental preservation.

Plans for the future

Planning the future is another challenge for *Cardume de Mães,* most probably due to cultural and historical reasons. It is often found that people that lead difficult lives do not acquire the habit, realize the importance, or are given the opportunity to think, plan and manage their future. Currently in the process of emancipation, the group is using a couple of years savings to rent a place to keep stocks, to have meetings and to buy machinery as well as working raw material. Their idea is to leave the once crowded room provided by the NGO *Projeto Arrastão,* and on doing so to be released of all other partnership agreements they have had, such as internal sewing projects, lower prices and place usage tax in all products.

Individually, most of them have vague ideas of what they intend to be doing in five or ten years. Going back to their hometowns, in the Northeast Region of the country, and opening a shop; becoming a business woman and owning some type of social enterprise; or simply going on with *Cardume de Mães* productive group, developing products, multiplying their knowledge, giving lectures and workshops... are some of the women's dreams.

In the group's initial Business Plan, first created in 2009, the group's aims were to earn a monthly salary of R$700,00 reais, close to U$400.00 dollars. This year, still struggling to keep a balanced income throughout the seasons, May was the most profitable month, each woman making up to R$1.100,00 (U$623.00). The worst, however, was February, in which the amount received for their work was only R$280,00 (U$159.00). In comparison to when the women first started working with the group, in which none were employed or earned a fixed salary, the growth rate of income generation is considerable.

Conclusion

"Persevere! That all that watch this video, in one way or another, can, like us, do a little something to preserve the environment."

Cardume de Mães' final message for those who are getting acquainted with their work clearly shows the gratifying and palpable results of working for ecological awareness, social development, community empowerment, self sufficient capability and income generation. This article attempts to show how *Design Possível*'s aims of applying design education and sustainability in a social context is achieved, by encouraging proactiveness and stimulating self awareness in a way that strengthens one's view as multiplier, as educator, as capable and essential transformation actor. It is thus expected that the demonstration of such experience may inspire and encourage others in dealing with similar obstacles, observing and respecting their own contexts and realities.

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the Learning Network on Sustainability

How to develop sustainable light products for low-income households

From participatory context research, co-design till market

Jan Carel Diehl
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This paper will discuss the participatory development and market implementation of the so-called 'MoonLight' a solar energy powered and locally produced light for rural Cambodia. Light is one of the basic needs required for education, improving the social security and advances productivity. In Cambodia 90% of the population does not have access to electricity from the public grid and rely on costly and low-grade lighting sources such as candles, kerosene lanterns and car batteries to provide light at night.

Introduction

Design for the Base of the Pyramid

According to the World Bank (World-Bank 2005), 4 billion people live on an income of US$ 3 or less per day and more than 1 billion people live on less than US$ 1 a day. This part of the world population is nowadays often referred to as the 'Base of the Pyramid' or abbreviated 'BoP' (Prahalad and Hammon 2002; Prahalad and Hart 2002). Most companies, professional designers and design schools used to (or still) target only end-users in advanced markets. This is a group of 'only' 0.5 billion people living at the 'Top of the Economic Pyramid' with an average purchasing power of more than US$ 10,000 per year (Rocchi 2006).

To develop and distribute products for these sofar overlooked BoP markets will require companies and designers to reconfigure their business assumptions, models, and product innovation approaches and products designs (Boyer 2003). The new design challenge is to generate innovations targeted at the world's emerging economies. BoP markets are rather different from the developed markets in the diversity of the user needs, motivations and the business environment dynamics. A strong understanding of user needs (social, cultural, economic) and the local business ecologies along with powerful technical insights is essential for success in these markets (Diehl and Christiaans 2007). In this situation it is clear that researchers and designers should engage with the cultures and contexts directly in order to better understand local people. Understanding people's needs and interaction with the material, economical and socio-cultural world is a basic starting point for successful product innovation, especially in the BoP (Rodrigues, Thompson et al. 2007).

In order to address this situation new integral design methodologies, tools and courses, which bring together user context research (based upon ethnography and anthropology), business development, sustainability and new technologies & innovations in a focused way have to be developed (see Figure 1) (Diehl, Silvester et al. 2008). Within this paper we want to illustrate how such a multidisciplinary team has developed the 'Moonlight'.

Figure 1: An integral product development approach for the BoP

Need for electrical light at the BoP

A considerable part of the world's population struggles with poverty. This situation is characterized by lack of access to basic needs as education, health care and infrastructure, such as clean water supply and electricity. Light, one of theses basic needs is required for education, improving the security of communities and advances productivity (Ramani and Heijndermans 2003). Therefore access to affordable domestic electric lighting could contribute considerably to the well-being of people living at the BoP (Gooijer, Reinders et al. 2008).

Worldwide 1.7 billion people living in rural areas lack access to electricity (World-Bank 2007). Grid-based electrification is capital intensive and because of the necessary high investments it is often not profitable to reach the low-income populations in rural areas. As a result one in three people in the world do not have access to electricity and rely on costly and low-grade lighting sources such as candles, kerosene lanterns, or gas lamps to provide light at night. Lighting costs can be as high as 10-15% of total household income (Nehme 2007). Their lighting fuel expenditure represents about 17% of the global lighting market, but they only receive about 0.2% of the global lighting output (Mills 2002).

In Cambodia the situation is even worse, 94% of 2.1 million Cambodian households do not have access to electricity from the public grid. Typically, 55% of the households use rechargeable car batteries and 35% use dry cells or have no access to form of electricity at all. In the last case they depend on candles and kerosene lamps for light (Rottman 2006). Though solar energy is abundant in Cambodia (over 1900 kWh/m2 per year) (Reinders, Gooijer et al. 2007). Solar powered lighting has demonstrated to be a good alternative to provide these in people in rural areas in low income with reliable high quality light and which has meanwhile a lower environmental impact than traditional lighting (Ramani and Heijndermans 2003). See figure 2 for the typical rural Cambodian houses and current light solutions.

Figure 2: Typical kind of rural cambodian housing and kerosine lamp a car batteries as basic resource for light.

Kamworks

Kamworks, a social enterprise, and it mission is to provide affordable sustainable energy systems for low-income consumers in Cambodia and to locally manufacture solar products in order to create jobs and income for young Cambodians. Cambodia has a large proportion of the population under the age of 20 years (60%) and employment generation for young people is an especially pressing issue. In addition, the aim of Kamworks is to connect the product design to the indigenous culture and the socio-economic context as well as to innovative advantages for the end-user like high quality and energy efficiency (Reinders, Gooijer et al. 2007). To challenge an integral solution for the need for affordable appropriate locally produced light appliances it was decided in 2008, in consultation with Kamworks and on basis of former projects (Boom 2005; Diesen 2008), to involve a Delft University of Technology (DUT) Integral Design Project (IDP) student team.

The development of Kamworks 'Moonlight'

From experiences with earlier BoP projects at DUT (Kandachar, Jongh et al. 2009), we concluded that creating products for BoP markets requires a deep understanding of the real daily needs and context of the people within it. In such a situation it is clear that designers, in this case the team of four IDP students, should engage with the cultures directly in order to better understand local people (Rodriguez, Diehl et al. 2006). Because of this reason a special emphasis of the IDP project was put on the local context research in the field. Knowing the context and observing and interacting with the user in his or her context helps to understand the latent need which come up with new appropriate product solutions that meet the real lighting needs of the user. As a result the most essential part of the IDP project took place in rural areas of Cambodia during a period of 3 months to explore and understand the local context and need as well as to come to local suitable design solutions for the lighting needs of the rural Cambodian.

Participatory market and context research

As a first step of the new product development trajectory, a thorough participatory market and context research was executed in the field. The market and context research existed of two parts: 1) observatory research and 2) participatory research.

As a first start for the designers to get familiarized to the local socio economic context as well some first detailed insights of the problems and needs for electrical light, observatory research was carried out (Alvarez, Papantoniou et al. 2008). The circumstances and use of the current lighting products were investigated in households in the Kandal in Cambodia to gain insight in the current use of lighting and electronic products. The design team executed observations by visiting local households as well as by doing interviews (see figure 3). Questions were asked by the students with support of local translators in relation to the way and purpose of the use of light.

Figure 3: Observatory research in rural Cambodia

In the second phase, within the scope of the BoP, participatory methods have been used to get a deeper insight in daily life in order to identify suitable product-market combinations as well as insight in the needs. Focus groups sessions, and day mapping (see figure 4) were used in order to identify and map needs and wishes of the rural Cambodian consumers for (electrical) light in their daily life.

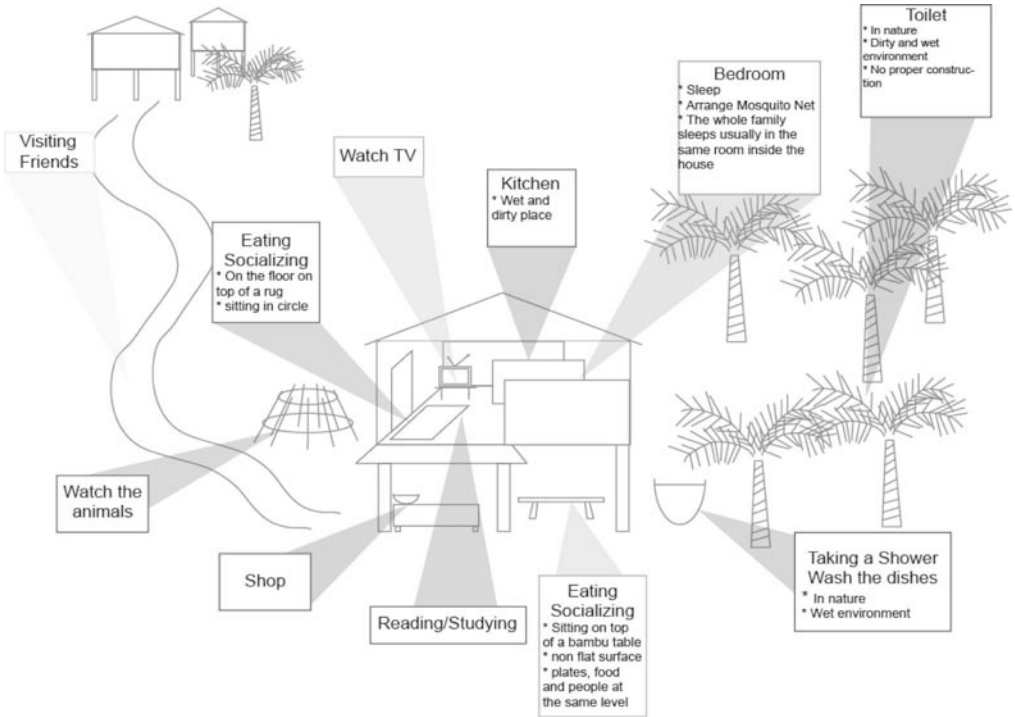
Figure 4: Participatory research in rural Cambodia

Participatory field research: User needs

One of the first outcomes of the participatory field research was a map of the current needed as well as wanted (electrical) light functions in and around the household like for example studying, managing the shop, eating, cooking, watching the animals, washing the dishes, visiting friends etc. Figure 5 provides a more detailed overview of needed and wanted light functions. It is clear that light is needed for a multiple of functions.

The participatory filed research led to the following main conclusion: the new light device should be a completely substitute the kerosene lamp. The poor quality of the light, the flammability and health hazards as well as the highly volatile fuel prices are the main drivers. In addition the lamp should be portable. Different rooms are to be lit, and most households cannot afford more than one lamp. Furthermore, a dimmed light during the night was needed, to orientate in the dark and to feel safe while saving energy at the same time. The dimmed light only has to last for a few hours per night. About three hours of full light are needed during the evening. In addition, the inventive character of the Cambodians and the completely improvised style of their houses called for a flexible product that people could use as they wished, without too many restrictions. The product should provide enough luminosity to be able to read. Last but not least, the lamp should be shock, water and dirt resistant. Incorporating all these requirements would create a specific added value for the rural BoP Cambodian households.

Figure 5: The current as well as wanted use for light in rural Cambodia



Technological challenges

Parallel to the participatory field context and user needs research the IDP team executed technical 'lab' research focussing on: efficiency, reasonable purchase costs and low total costs of ownership. For the energy supply of the system, two options were possible:

- A battery charging system powered by photo voltaic (PV) cells with low initial costs (for the user) but higher running costs. The batteries are taken out the of the products and charged by a local entrepreneur by PV.
- A totally independent system with higher initial costs but no running costs for the end-user. The product is directly charged by the PV-cells (integrated in the product or connected thru a cable with an external PV panel).

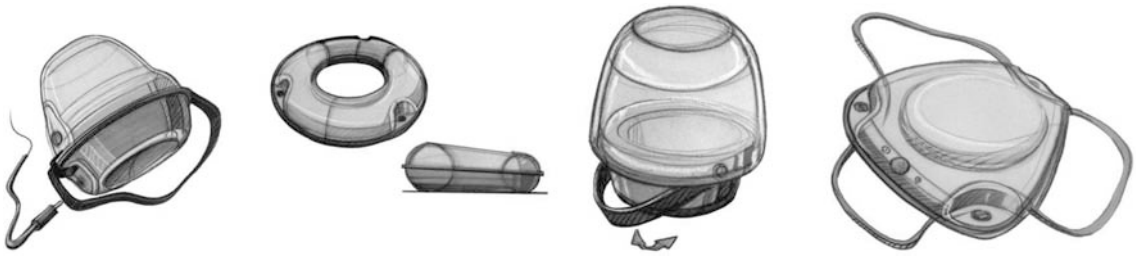
The decision was taken to continue with the last option and to design an independent PV white LED-light system. To keep the product simple and the cost as low as possible it was decided not to integrate the PV-cell into the lamp, but develop a separate lamp and PV panel. Simply said, a PV-LED light product consists in that case of one or more LEDs, a rechargeable battery and a small PV module. However from former studies it was concluded that electronics play a crucial role to provide a series of necessary functions. The electronics have: (1) to match the solar power to the battery characteristics; (2) to control the charging and discharging of the battery and (3) to control the power to the LED ('driver').

As a result of the electronics, the light device will be more energy efficient, perform better, will have a longer life time and will be more convenient to handle. This way the Kamworks light products can provide more constant quality, reliability, higher performance and added value to the end-user compared to the cheaper (often made in China) PV lamps. Quality and performance are the most important selling points in the rural Cambodian BoP (Rijke 2008)

Co-development

Based upon the inputs of the extended participatory local context research, the competences of Kamworks, as well as the technological development, four concepts were developed (see figure 6). This is in line with the 'normal' product development as in any other market.

Figure 6: Four concepts for new light devices for rural Cambodia



In order to come to appropriate design solutions, which really fit into the BoP context of Cambodia, local stakeholders were intensively involved in the concept development, so–called co-design. Co-design can be defined as cooperative, contentious process bringing everyday people together with design professionals to find new and better ideas for daily life (Simanis and Hart 2008).

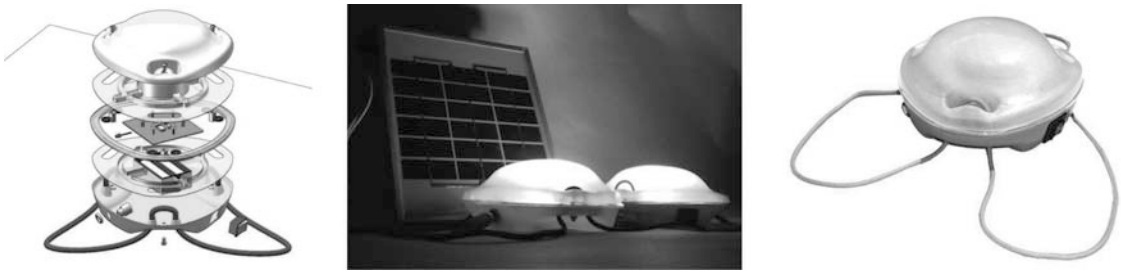
Potential end-users as well as potential sales channels like micro-entrepreneurs were confronted with product ideas in an early stage (see figure 7). The direct feedback from the field led into practical as well as socio-economic and cultural driven suggestions for improvements of the concepts.

Figure 7: Co-development with local stakeholders

The final product: the Moonlight

The final design is called MoonLight ("Ampoul Preahchan" in Khmer). It has a triangular shape and includes a cord that is attached at the three corner points (see figure 8). It can be hung from wall or ceiling, carried by hand or hung around the neck. It has 6 wide-angle LEDs, which is equivalent to the light output of about four kerosene lamps. It comes with a 0.7 Wp solar panel, which can be fixed to a bamboo pole with a standard clamp. This option was chosen as several people had stated during the interviews that they were so afraid of the solar panel getting stolen they would prefer to keep the panel inside all day, leaving a window open for charging. Currently, this 'anti-theft' technique is used for TV antennas, in other words this technique is not new to the people.

Figure 8: The 'moonlight', exploded view, 3D rendering and in practice



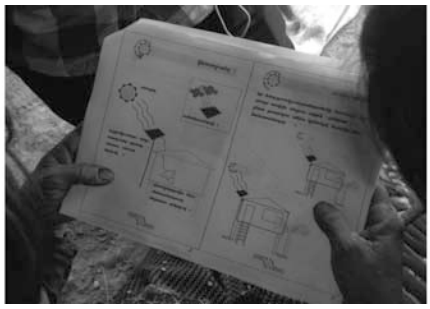
The product mainly consists of two injection-moulded outer shells and two also vacuum-formed blisters that hold the electronics together and buffer them at the same time for possible shocks. As a result it can be produced easily locally and create income for local entrepreneurs.

The strap represents the most crucial handling feature allowing to wear it comfortably around the neck and need to easily connect the product to building constructions. The upper shell is semi-transparent to diffuse the bright LED light, hiding at the same time inner components such as the batteries and electronics. The light has three settings: bright (reading/work), medium (eating/socializing), low (orientation/safety). Using it at full power the product delivers about 42 lm by 6 low efficacy LEDs (7 lm per LED) during 3.5 hours. In dimmed mode it produces diffuse – amenity – light for 6 hours. The expected lifetime is 5 years.

Feedback from the field

Several prototypes of the MoonLight have been made at the local workshop of Kamworks and were tested by the IPD team with families in rural Cambodia in night- and daytime. The final user tests pointed out that the product is indeed an appropriate solution for the local context. The product was appealing to them and the usage intuitive: People could easily understand and use the product: hanging it around their neck and placing it at the walls and ceiling of their houses (see figure 9). Most of the families of the final user test were enthusiastic and even willing to buy the prototypes on the spot.

Figure 9: Field tests in rural Cambodia with working prototypes


Extended field tests

Based upon the positive feedback from the potential end-users, it was decided to do a more longitudinal test. Ten 'MoonLights' were produced which included a 'data-logger' to record the charging as well as the using behaviour. These MoonLights were used and observed during one month in ten rural households at two different locations. These participants were off-grid households in the lower income segment of the BoP and were not confronted with the product before. In addition tests were done with the batteries, PV panels, LEDs and printing circuit boards in the local context to test their efficiency and duration. The outcomes of this field tests led to several inputs for improvement of the MoonLight.

In the perception of the local people the MoonLight is better solution than a kerosene lamp since it provides more light, will not go off in the wind, no risk for fire and no running costs. Nine out of ten of the test households would like to buy the product. Based upon the positive consumer and technical feedback form the field it was decided to go for production. Currently the production is being prepared and the product is expected to come into the market fall 2009.

Costs

The market price of the MoonLight including the accompanying PV panel is less than US$ 20. However compared to a kerosene lamp of US$ 1 it's still a relatively high initial investment for a low-income family. On the other hand compared to CFL based PV lanterns which cost about 60 to 80$ such as LED lamp is reasonably affordable.

A LED PV powered MoonLight has higher initial costs. But on the short term these costs can be overcome and light will be cost-saving for the household. The expected pay-back time is one year compared to kerosene lamp.

Sales and distribution

For the dissemination of the MoonLight and the other Kamworks PV products, a network of vendors – micro-entrepreneurs – is being established by Kamworks. The current strategy to sell the products is two fold (see figure 10):

1) Peri-urban with container kiosk

The Kamunasal solar shop is an adapted shipping container. Inside the shop a displaying cabinet contains a show and try-out model for each item. As rural customers and micro-entrepreneurs in Cambodia prefer to have stock placed visibly, and to keep a clear overview for the micro-entrepreneur, each product type is placed in a separate compartment, together with additional stock (Rijke 2008).

2) Rural mobile solar kiosk

For this purpose a mobile kiosk has been developed which enables micro-entrepreneurs to make a daily move around the villages (Reitenbach 2007). The mobile kiosk has been designed as a carrier bicycle with a softly shaped polyester box. Because of promotional objectives the mobile kiosk is equipped with lighting and sound equipment powered by a small solar panel.

Figure 10: The two sales channels, mobile solar kiosk and solar kiosk

3. Conclusions

Because of the upcoming importance as well as interest in the needs of people living at the so called Base of the economic Pyramid, design professionals and educators should invest more in research and education for 'Designing for the BoP'. As this project illustrates, providing lighting to the people of Cambodia – that they love to use and is affordable – is not simply 'designing' a product. This project is a challenging example of a transdisciplinary approach, needed for a successful development and introduction of PV-powered lighting. By using input from different design knowledge domains like sustainability, user context, technology and business a locally fine-tuned solution is developed.

User context research

In participatory design methods have proved to be essential in these for western designers and enterprises unfamiliar contexts. The sequence of steps – observation, focus group selection/day mapping during the analysis phase, co-design with potential end-users and sales people during the concept development phase, small-scale field tests with prototypes, improvements, extended field tests with zero-series (N=20) and final adaptation for first series (N=2000) is quit common in product- and service-development all over the world. But the steps have to be carefully elaborated because of the unfamiliarity of the designer/developers with the specific socio-cultural context. Involving and educating local people like Kamworks is doing, is an important requirement for establishing this context research.

Business development

The strength of Kamworks lies in the offering of sustainable solutions of high quality fitted to the local needs. It is not just a product, but also the services like education, communication about PV-technology, financing & after sales of the lighting solutions. These services make them competitive with the low-prized imported products offered in local shops. The services make it possible to build up a long-lasting relationship with their customers.

Sustainability

Kamworks is a very interesting experiment of devoted people into sustainability. All the dimensions of sustainability are addressed by the work of Kamworks; The social aspects by providing education, employment. The economic aspects by generating new business development locally and regionally, by providing the low-income people of Cambodia a possibility to cut their budget for lighting

The environmental aspects to reduce the use of non-renewable energy sources and to improve the indoor climate. This commitment towards sustainability is motivating already a considerable amount of students from all over the world to contribute to the fulfilment of Kamwork's ambitions.

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the Learning Network on Sustainability

Introducing Design for Sustainability in Vietnam

Results from seven D4S industry projects

Marcel Crul
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Nguyen Hong Long
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One of the most prominent needs of Vietnam today is the accessibility of its citizens to healthy, safe, environment-friendly and socially responsible products, or in other words, sustainable products. The common opinion is that sustainable products are not yet feasible in the current level of development, and the market for these products is too small. However, the experience with the first Design for Sustainability projects in Vietnam show that the time is right to switch to more sustainable products in Vietnam already now, and certainly in the near future.

This paper shows the feasibility of D4S in Vietnam and proposes recommendations to build a more sustainable consumption and production society.

Background

The Need for Design for Sustainability in Vietnam

In the years before the global economic crisis of 2009, economic growth in Vietnam always remained above 7% – and 2009 still showed 5 % growth. However, this economy was mainly based on a low economic efficiency and low value products, or in other words, development with increased use of capital, labour and natural resources. Domestic products do not show the commitment of being environment-friendly, safe to health and other socially responsible characteristics. Export products just occupy a small benefit ratio in the whole value chain. In VNCPC's investigation conducted with more than 100 enterprises, this ratio is only 5-15% (VNCPC 2009b) The process that brings the biggest added value is design, yet product development and delivery are mostly controlled by the foreign partners.

When the global crisis occurred, the Vietnamese economy showed its own weaknesses. A lot of small and medium-sized enterprises, craft villages had to change their businesses, went bankrupt and lost work. Quang Nam Rattan, Bamboo and Leaves Association is an example, from the 33 former enterprise members, only 11 continue to exist. Low competitiveness and unsustainability of the economy has become an important issue, mentioned in many mass media. For continued and strong development, there needs to be a model with more value-addition, more "brain" and less human workforce, or in other way "greener" – greater resource efficiency and less environmental impacts per product unit. In the domestic market with the third biggest retail sales growth in the world, the opportunity of a large market share for domestic enterprises is considerable. In addition, with greater openness towards world and region, enhancing export and reducing trade loss are decisive to the national sustainable growth. These two strategies need the development of high value-added, environment-friendly and high socially responsible products.

One of the important tools to achieve these requirements is D4S – Design for Sustainability. This concept is also known as "Design and development of Sustainable products" or "Sustainable Product innovation". Consecutive Global guides on D4S are published by the Design for Sustainability Program of Delft University of Technology in cooperation by the United Nations Environment Program UNEP (Brezet and van Hemel 1997, Crul and Diehl, 2006, Crul et al, 2009).

VNCPC is the leading organisation in implementing and promoting Design for Sustainability in Vietnam and in the region. In 2008-2009, the CP4BP project (Cleaner Production for Better Products, an EU ASIA-INVEST project) in which VNCPC partnered with UNEP, TUD, the Asian Institute of Technology in Vietnam (AITCV), Phnom Penh Small and Medium Industry Association (PSMIA), and Lao National Chamber of Commerce and Industry (LNCCI) has been successfully implemented in Vietnam, Cambodia and Laos. In April 2010, a follow-up and upscaling project in 500 companies called SPIN (Sustainable product innovation) started in the framework of the EU SWITCH-ASIA programme.

This paper focuses on describing the seven case studies and the lessons learned from the CP4BP project in Vietnamese enterprises, and suggests a number of recommendations for future activities. Before that a short introduction is given on the adapted D4S approach for Developing Countries

Design for Sustainability in Developing Economies

Many of the available D4S approaches and tools have been developed in Western Europe, based upon European experiences. However, in developing economies needs are different and more immediate. Also the characteristics of the local companies and product innovation approaches differ because of specific local social, economic and industrial development aspects. In 2006, the Design for Sustainability (DfS) program of the Delft University of Technology in collaboration with the United Nations Environment Program (UNEP) has published a Design for Sustainability manual targeted at especially SMEs in Emerging and Developing Countries (Crul and Diehl, 2006). Based upon the experiences of DfS and UNEP with Design for Sustainability in universities and companies in, among others, East Africa, Central America, India and South-East Asia an adapted approach and set of tools has been developed which fits better into the context of small and medium sized enterprises in developing economies. This approach was used during the CP4BP project, and after the project an adapted Vietnamese version of the manual was published integrating the examples and experiences of the project.

The manual consists of 3 main parts: What is D4S and why do it, How to do D4S in practice, and Reference information on D4S. In addition there is a set of worksheets available for providing training to SMEs.

The part on *How to do D4S in practice* is the backbone of the approach. It explains practical, step-by-step approaches to execute a D4S project in a company.

The *D4S Redesign* approach, as the name implies aims at redesigning an existing product made by a company (or by a competitor) from a sustainability point of view. D4S Redesign is of particular interest for developing economies because this incremental type of product innovation involves smaller risks and investment, follows a structured and predictable process and is known to be economically and commercially as important as more radical approaches such as development of completely new products. Because the focus of D4S Redesign is an existing product, the market and manufacturing conditions specific to the product are already known. Its improvement potential can be determined from easily accessed information – such as feedback from the sales department, user experiences and testing and market investigations. In addition, the existing production facilities are usually suitable for manufacturing the redesigned product and, hence, investments costs would likely remain within reasonable boundaries. The risks connected with the redesign effort are lower compared to more radical D4S innovation strategies. The approach outlines a 10-step schedule to carry out a D4S Redesign project, each step reflecting a phase in the product development process.

Connected to the Redesign approach, the *D4S Benchmarking* approach is presented. It is especially suitable for those companies that develop products based upon imitating existing products. D4S Benchmarking is a structured approach to compare the environmental performance of a company's products against competitors' products and to generate improvement options. Since individual competitors often use different solutions to resolve the same design problems – like a different product architecture, components or technology – D4S Benchmarking offers a reflective approach and advises learning from others' products. Experience shows that, in practice, no single product scores high on all criteria and against all other products. This means that benchmarking improvement options can always be generated. An important element of benchmarking is the concept of best practice: 'those practices that please the customer most'. The goals of a benchmarking study should be based on customer needs, whether the customers are internal (departments within an organisation, higher management levels, or employees) or external (consumers, citizens, regulators, legislators, local and national environmental groups or investors).

The redesign and benchmarking approaches are complementary to each other and can be used in combination.

Seven D4S Projects in Vietnamese Enterprises

Seven Vietnamese enterprises, belonging to 3 sectors: handicraft, furniture and food processing (sea food) have successfully implemented Design for Sustainability projects during the CP4BP project.

Case Study 1: Truong Thanh Furniture Corporation (TTFC)

Truong Thanh is a leading Vietnamese company in wood product manufacturing and exporting. It is constituted of eight factories employing a total of 9,000 employees.

97% of their products are exported to: UK, France, Germany, Finland, Denmark, Greece, Australia, New Zealand, Spain, USA and Japan. TTFC has a total of 23 designers which design 80% of their products in house and have a sales staff of 30 people. The company has its own research and training unit and produces 40% indoor furniture, 50% outdoor garden furniture, and 10% flooring. Whilst it is very successful in sales, management thought that there was potential in improving product design and development (PDD), hence the companies were interested in participating in the CP4BP project.

One product was selected for D4S demonstration; the Venice Folding Barbeque (BBQ) bar Market research noted that in many of the countries where this product was being exported, consumers enjoyed spending more time outdoor organizing various social events which combine outdoor entertaining with dining. The Product Innovation Team together with the CP4BP experts decided to redesign the Venice Folding Bar into a convenient and fully utilized bar and kitchen stands for barbecue parties. This product was subject to the following improvements:

- 40% of this product is currently made-up of leftover wood from other production processes;
- Use of wood in the product has been reduced;
- All wood used has Forest Stewardship Council Certificate;
- The BBQ functions have been increased and accessories added to increase the utility and therefore the value of the product;
- the size of detailed parts was reduced; and
- Excess parts exposed on the outer part of the BBQ have been reduced hence limiting the damage to the packaging.

Figure 1: BBQ bar to be benchmarked

Figure 2: BBQ after project implementation

In addition to the work made on the BBQ, 10 types of packaging methods were reviewed and improved reducing the overall packaging costs.

Case Study 2: Truc Xinh (A Chau)

Truc Xinh is a brand name of bamboo products (furniture) of the A Chau company in Vietnam. This is a small company with 80 employees. Its products are made mainly from "*tam vong*" – endemic bamboo in the south of Vietnam and "*luong*" (bought from Thanh Hoa). It also produces furniture made from rattan, water hyacinth and sedge which are outsourced. Most of company products are exported. Its main markets are Japan and Europe. Beside the potential of applying D4S to products, it was found that production process of Truc Xinh could greatly benefit from adopting Cleaner Production (CP) principles in many stages in order to reduce emissions and increase process efficiency.

The company's interest towards participating in the CP4BP project was driven by the need for increasing its exports to the EU market by improving its design and product innovation capacity which would therefore hopefully create new products.

Two products were selected for D4S demonstration -- beach and picnic chairs. These were objects in a redesigning effort which resulted in chairs which combine working and relaxing functions (3 functions in one product). These products are now ready for being marketed. Packaging design was also reviewed in order to decrease use of packaging material.

Before redesign

After redesign

Case Study 3: Hung Ca

Hung Ca is a newly established Vietnamese company which originates from a famous aquaculture centre in the Mekong area. It cultivates and processes fish and shrimp, its main products being *Pangasius* fish, both whole and filleted. To date, the Company does not produce by-products from fish oil, head or skin but sells these to other companies as raw materials. The company currently has 1,200 employees and mainly exports to Japan and Europe.

Pangasius is a unique fish product of the Mekong Delta. Through the support of the CP4BP project, Hung Ca has plans to promote natural pangasius products. Hung Ca has a modern production line which has good potential for applying Cleaner Production (CP) concepts such as separating waste streams to reduce treatment needed for its current waste water, saving energy and optimizing the use of equipment. Ultimately the company is interested in expanding its clients to Europe by improving its market niche.

The Project Innovation Team was made-up of nine company staff members who were divided into two groups: One group was specialized and focused on improving production processes (CP) at the factory in Dong Thap and the other was responsible for market research, marketing and product innovation in Ho Chi Minh City. The two groups/departments met once a month and were in continuous contact with each other.

Five CP4BP experts worked with Hung Ca's Project Innovation Team. After assessing the company's activities the following measures were recommended for the Company to implement:

- Application of CP in all steps of production processes, from the selection of fish variety, to cultivation and processing, by reducing the consumption of water and the amount of discharged waste water into the river;
- Reduction of material and energy consumption by optimizing and controlling the freezing process, and reducing consumption of treated water;
- Optimization of production process by not using equipment with a high level of electricity consumption during in peak periods, by stabilizing the provision of electricity, which would hence reduce electricity cost and avoid the use of generators;
- Use and processing of fish and shrimp by-products; and
- Optimization of packaging reducing cost for materials and making the product presentation more attractive.

CP4BP efforts concentrated on packaging design and electricity consumption:

- Design of packaging changed to accommodate more fish as well as to allow boxes to be stacked easier on each transport pallet. By reducing and optimizing package size the company increased the amount of product per container by 2.2.% achieving a cost reduction of USD24 per pack/container. This also facilitated transportation and handling of products;

- The company has implemented CP concepts for electricity consumption; an electric and water meter system have been installed. Good housekeeping methods have been applied. This has achieved a reduction of water consumption by 32.4% and electricity consumption by 4.9%.
- The company has also bought integrated software for production management to support process optimization.

Results and experiences will be applied in the company's new factory which will be built in 2010.

Old box: 50*27.5*8
New box: 49*27.5*8
By reducing material by 22% the company saved 0.36USD/box

Old box: 40*28*21
New box: 38*26*24
By reducing material by 24% the company saved 0.1USD/box; increasing number of boxes per container by 100.

Case Study 4: UTXI

UTXI is a big Vietnamese company with 3,000 employees. It specializes in shrimp products collected in the Mekong River Delta. Founded at the end of 2002, UTXI currently has five factories and bases its business on cultivation, processing, and exporting seafood products, buying and selling of aquatic breeds, and on providing chemicals and feeds for aquatic culture. They also produce ice and rent cold-storage. UTXI was selected due to its good relationship with aquaculture farms which can have an impact on the farming process through sustainable procurement. UTXI mostly sells to other businesses; its company's brand name does not appear on the package. The company is eager to enhance its market and clientele and directly reach supermarkets.

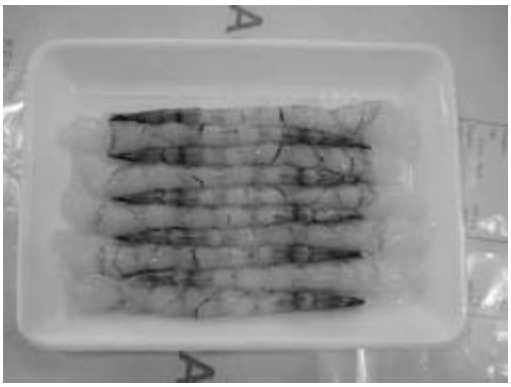
CP4BP efforts focused on (1) Packaging innovation and packaging design; (2) Cleaner Production (CP) Assessment for Hoang Phong Factory; and (3) Design and development of a more sustainable product.

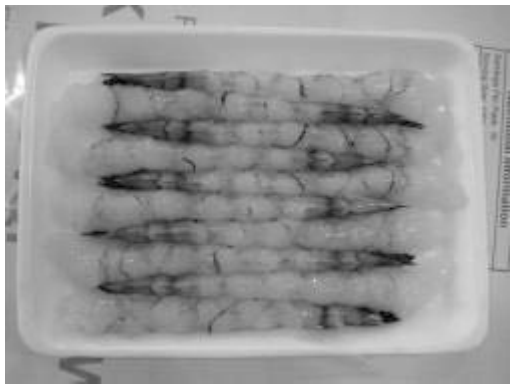
To date the company has developed a new product named: "slashing shrimp with powder round", which resulted from a D4S review of former products.

Slashing shrimp which is made of locally available ingredients and skewed shrimps

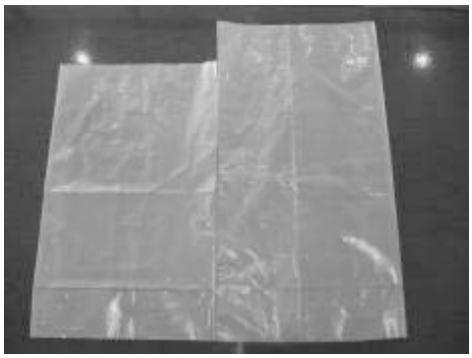
In addition, packaging innovation was carried out on cardboard boxes reducing material by 51.3%, PE bags reduced PE material by 8.4% and porous trays reduced by 34.4%. As for Cleaner production aspects, the project has done a preliminary CP assessment of the Hoang Phong plant.

Polystyrene trays:





Before project intervention **After project intervention**



Before – after project intervention

Before project intervention

After project intervention

Case study 5: Hoa Son

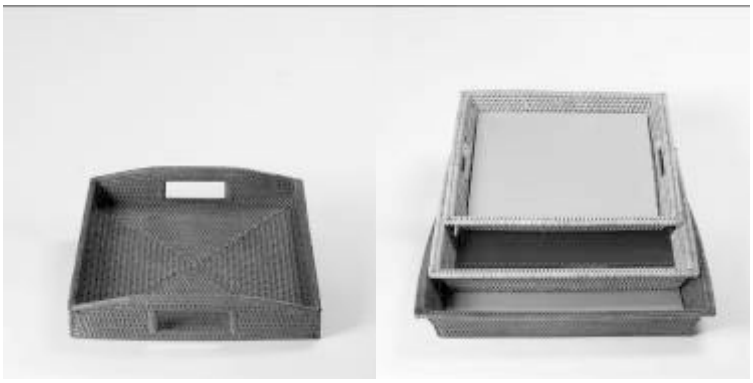
Hoa Son is a small-sized company located at Phu Vinh village, Vietnam, where the handicraft tradition is 500 years old. Hoa Son products are primarily rattan, bamboo, fern woven objects. Its craftsmen are entirely sourced locally with around 125 employees who dedicate part of their domestic time to this job. Hoa Son exports its products to EU, Japan and USA. Hoa son products are made from natural material; however, chemicals are still being used for material pre-treatment and product finishing. Popular chemicals are colour dye-stuffs, paints (PU and colour paints) and sulphur for material pre-treatment and preservation. In the past, the traditional products were made without chemicals. However, due to the advantage of shortening the production duration and costs, chemicals use was preferred above natural dyeing and processing methods. By participating in the project, Hoa Son intends to enter new markets by improving design capacity and including environmentally sustainable principles during production and thereby boosting its marketing capacity. The Project Innovation Team was made-up of four company staff members which also included the company director. Eight CP4BP experts worked with Hoa Son's Project Innovation Team. After assessing the company's activities the following measures were recommended for the Company to implement:

- Reduction of material and energy consumption by utilizing machines which minimize material wastages;
- Reusing wastes, such as rattan cover and broken rattan pieces, for the production of new objects;
- Development and implementation of environmentally-friendly and non-toxic materials by using traditional natural dying and water-based paints;
- Use of different recycled materials such as plastic rag-bags and straws for the production of its bags, baskets, pockets, desks and chairs;
- Mitigation of impacts on health by reducing paints and increasing natural and unbleached colours, and looking for materials to replace rattan which is becoming a scarcity; and
- Improvement of working conditions: better lighting and ergonomic seating positions

The project assisted the company in building up their capacity for product development. Ten new naturally dyed colour samples were created successfully. The team also experimented in combining different natural colours with chemical colours (in the case of particular colours) for dying purposes.

The CP4BP team jointly improved five existing product samples with the aim of reducing the packaging and transportation costs. As a result, the new products can easily be stacked and transported.

Product redesigned – stackable for better transport



In order to reducing the use of rattan which is becoming a scarce resource the base of the tray is now made in lacquer;

An additional five new product samples were produced and piloted in Europe and Australia in trade fair exhibitions. These products used less materials, used less or no water and no pre-processing chemicals, such as unbleached rattan products. These products were labelled with the company logo and have drawn the attention of Australian customers.

Brand new products

Improved lighting conditions for workers were also achieved.

Hoa Son will be involved in an Asia SWITCH project in the rattan sector implemented by VNCPC in cooperation with WWF and will be able to continuing sustainable product development activities and CP option implementation.

Case study 6: An Do

An Do is a small scale handicraft company producing ceramics in northern Vietnam, where the workshop produces 3,000 pieces per month. The company has six permanent employees, whilst additional workers are hired depending on the demand. The structure of the Company is flexible; each person may be involved in different tasks. The director and designer are responsible for product design and strategy. At present, the company designs 80% of their products. Most of its products are exported to EU and Japan. Currently however, its clients are importing companies; An Do is therefore not exporting directly.

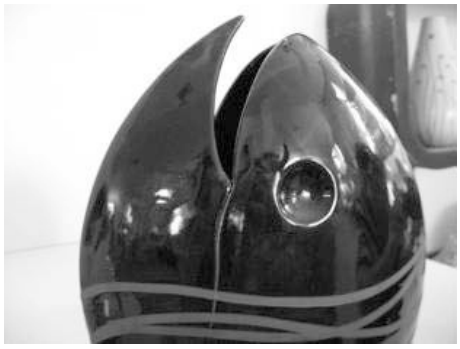
Most of the Company's products are produced in households or in other small companies at the Bat Trang traditional ceramics village, a 700 year-old village specializing in producing household and construction products. Bat Trang ceramics is unique in its natural glaze, traditional colour, soil and decorations with agricultural culture style of the Red River Delta. Bat Trang pottery products have been described in folk poems, music and literature and are closely connected to the life of Vietnamese people.

An Do's motivation in participating in the project is driven by the need to meet international market requirements by applying sustainable development criteria into products and production processes. The Project Innovation Team was made-up of five company staff members which also included the company director. Eight CP4BP experts worked with Hoa Son's Project Innovation Team. After assessing the company's activities the following measures were recommended for the Company to implement:

- Reduction of use of raw materials and energy consumption by design improvement: *i.* Reducing thickness and shape of the product; *ii.* Avoiding the use of the gypsum mould; *iii.* Elimination of concentrated pressure;
- Improvement of the baking process to reduce cracking and peeling of product;
- Use of less toxic materials during glazing;
- Replacement of iron buckets and tools with stainless steel equipment;
- Improvement of the working area by improving lighting, ventilation and ergonomic seating; and
- Mitigation of impacts during the life span of the product, making it easier for cleaning and avoiding elements which could scratch table surfaces.

The project assisted the Company in building-up their capacity for product development. Existing products were reviewed and five new products were created. The CP4BP experts also supported An Do with the presentation of 20 new potential product designs. The project resulted in:

- 20% Reduction of 'false product', i.e. cracked products due to design which were discharged (as not recyclable) in the river bed;
- 20% Increase in use of natural materials. Although opted for mixed use of chemical and natural products for glazing (natural materials alone did not produce required quality and were too expensive);
- Workers conditions have been improved; and
- 15% product increase and reduction in air bubbles due to mechanization of the casting process.



Before: sharp angle of mouth caused product to often cracking during firing

After: Angle of mouth was rounded, reinforcing it.

The new products

Case study 7: Xuan Hoa

Xuan Hoa has been one of the leading companies in Vietnam's industrial sector since the Soviet era. Xuan Hoa started off as manufacturer of bicycles; today it has expended its activities into furniture production, employing 890 workers.

Harnessed with leading-edge technology and equipment originating from France, Italy, Germany, Japan and Taiwan, and qualified and experienced people, the company has continuously made high quality products through a variety of designs and models renowned for their practical and comfortable characteristics. It is the reason why its products have been recognized as "High Quality Products Made in Vietnam" for many consecutive years and awarded many medals at international and local trade fairs and exhibitions. Xuan Hoa's brand has also received the "DatViet golden star" prize, which was setup by the Centre for Young Business Association to recognize Vietnamese companies.

Xuan Hoa has been working with the Vietnamese National Cleaner Production Centre for several years. The company's interest in participating in the CP4BP project was driven by the vision to increase exports to international markets by integrating Product Design and Development capacity with sustainable criteria as well as improving awareness and skills in product innovation throughout its factory.

The Project Innovation Team was made-up of 12 company staff members divided into two teams. Eight CP4BP experts worked with Hoa Son's Project Innovation Team. After assessing the company's activities the following measures were recommended for the Company to implement:

- Reduction of raw material and energy consumption via adopting a simpler design which would use thinner material;
- Increase the use of local products for packaging paper, accessories (plastic buttons, bolts, screw nuts, clamping devices, etc.), hence supporting the domestic and local accessory industry;
- Use of environmentally-friendly and less toxic materials by substituting electroplating with electrostatic painting products, using MDF materials and sustainable glues;
- Exploration of new materials such as bamboo plank and compressed woven bamboo;
- Reduction of faulty/defected products by improving designs;
- Optimization of product packaging;
- Employment of local labours instead of workers coming from other cities such as Hanoi; and
- Mitigation of environmental impacts produced during its industrial activities also given the fact that it is situated in proximity of a tourist destination (Dai Lai Lake).

The project assisted the Company in building-up their capacities in sustainable product development. Although the up-take of the concepts was slow, the company dedicated itself to developing a new line of product (14 pieces) adopting a modern style and making use of advanced technology. These new products target the younger client in developing countries who mostly works from home. Working in parallel with the latter, two existing product lines – desks and wardrobes have been improved significantly, thus, reducing costs and improving quality. In addition to product design and development, the company also has also made great efforts to improve the packaging of some products. Care for package design has been taken into account whilst developing the design of the new line of product.

The company is now undertaking studies to promote its new product lines for the foreign market.

Some products in the Home Office Furniture family

Recommendations

A small project like CP4BP just can establish the very first foundation for the next efforts to implement Sustainable Product Design in Vietnam towards a sustainable production and consumption society. From the results, experiences and lessons learned from the preparation and implementation of the project, the following recommendations are derived (VNCPC, 2009a).

Until now, there is no national and comprehensive action plan focusing on product design and development that contributes to the country's sustainable development. Such an action plan is very necessary to ensure the consensus of stakeholders, the optimization in using resources as well as the attention of all social levels.

According to our evaluation, a national action plan of D4S in Vietnam needs the following components:

1. Raising social awareness: awareness change is the first step that leads to the self-demand for change. Initial focus may be on policy-makers, governmental agencies at all levels, enterprises' management level, associations, education and training units, and consultancy offices. Awareness change in these groups can create the foundation for the next changes, especially in policy making and competence building. Next step is changing awareness for all people in the society about the core issues in D4S, economic, environmental and societal impacts of products during the whole life cycle. For example, the comprehensive assessment of product safety, especially for food products. Social awareness change will create a great motivation for a market push in the direction of more healthy and sustainable products.
2. Issuing coherent policies, both encouraging and restraining: The State prohibition of exporting round wood has created a strong development for the wood processing industry, encouraging

such a large increase of exporting finished wood products that 80% of raw materials are now imported. Other policies like removing the price support for electricity, oil, coal can lead to higher resource efficiency and environment-friendly production, as well as create market for the products that use less energy in production and use. Tax priorities and limitations play a role in "rectifying" or promoting product development towards sustainability. Taxes on the usage and discharge of natural resources as different waste kinds are the encouragement to increase added value in each resource unit, especially for non-renewable resources. Note that if the policies are not coherent, enterprises will focus on manufacturing according to short term feasibility, investments following the policy changes, and they will give up long-term production and branding strategies which are the foundation for a competitive economy and sustainable consumption and production. There need to be connections and relevance among all planning, programs or policies relating to products of different sectors. The connection between the relationship of rice-shrimp and rice-fish in Cuu Long River Delta when there is a strong push from domestic and abroad market is a typical example. Support policies for exploiting niche markets should be enhanced, for example, the fair trade sector or the CDM greenhouse gas reducing market.

3. Developing the competence of product design and development for enterprises: Due to the limited vision and the unsuitability of mechanism-benefits, State-owned enterprises and SMEs often have the tendency towards "random manufacturing", focusing on short-term strategies and approaches (short-term marketing, PR, production innovation know-how) forgetting all long-term strategies. Product innovation is often neglected. Even the product development department, if any, cannot reach the management board, therefore the accessibility to necessary resources is limited. One thing to be noticed during CP4BP implementation is all the attending companies have great revenue but are not yet leading in product innovation. There are many business leaders famous and prestigious in the marketing field, but their awareness of product innovation is still low. Processing for foreign companies seems to have priority, at least during the global economic crisis. Developing D4S competence for enterprises is not an easy task. This process must begin with opening a door which is locked form the inside: persuading and changing a company's management concepts and ideas. However, with the activeness and sensibility of Vietnamese businessmen, when the awareness has been built, the next steps in the process can be achieved quickly, even beyond expectation.
4. Developing the competence of product design and development for consultants: There are now a lot of consultancies relating to products in construction, architecture, seafood, entertainment, and art. The number of these enterprises is growing due to the market demand resulting from changes in society. However, these enterprises still focus much on their own short-term profits. Socially responsible and environment-friendly issues are not integrated well in consultancy services. It is therefore recommend to establish a national agency or centre with a focal point of supporting competence development, promoting and multiplying sustainable product design and development in consultancy, as well as advising the government about product policies.
5. Developing the competence of product design and development for education and training sector: the subject of product design and development is only taught in a few universities or occupational schools in Vietnam. Even in the universities where this subject is taught, the connection among universities, production and market is not good enough for the graduated students to be well-trained. Subject and graduation project, sustainable product design contests mainly focus on the appearance of the products. It is questionable whether the board of examiners is actually qualified enough to evaluate the projects. Sustainability issues and life cycle assessment are not expressed. To improve educational quality, competence for the trainers must be developed through projects, international cooperation, especially cooperation among enterprises basing on market relations.
6. The cooperation and consensus among development projects and programs: Many foreign organizations and programs in Vietnam are very active in promoting sustainable product development in Vietnam. Among these Non-Governmental Organizations are: GTZ, DANIDA, SECO, JICA, and next to this, there are governmental programs focused on products, such as SWITCH ASIA program of the EU. However, there is no close cooperation among these organizations and programs to optimize aid towards a common target. The existence of a national focal point can support this cooperation and consensus. In addition, there needs to be expertise offices, "overcoming" short-term focus to discover and solve "system errors". For example, vegetable-origin

packaging materials (water-fern, chaff, coconut fiber and banana leave…) are available in Vietnam, but almost all of these packaging materials have to be imported. The reason is that both the economic and technological potential is not high enough to develop technology for mold and insect treatment.

7. In order for D4S implementation to be successful, simple techniques should be applied in the very first step, resulting in quick and direct outcomes. These techniques are for instance improved product packaging and product redesign with less and better materials. These techniques can be successfully applied in almost all companies.

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Experiences and proposals on product design for sustainability

the Learning Network on Sustainability

Finding the 'Green Nomad'

A study into the design sustainability of Chinese RV industry

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This study is based on the joint- doctoral research topic between Tsinghua University, China and Monash University, Australia. Currently, the subject is concentrated on the Recreational Vehicle (RV) design innovation and sustainability research.

China's RV industry is currently in an embryonic stage, which is mainly engaged in the simplistic manufacturing and assembly of vehicles for export purposes. But with the increase of private car ownership in China, RV travel is likely to grow substantially in the near future. This new consumer trend will develop the Chinese RV manufacturing industry and make this enterprise role-transforming from production to innovation, which will have a considerable impact on outdoor travel and consumption patterns and the environmental protection in China. In this transformation process, using a sustainable design approach and strategies will help to avoid damaging the environment by the increase in RV consumption and usage. The new design should not only take into account fuel consumption, material/energy consumption during production but also be concerned with direct impact of large volumes of RV users moving into regional china.

Introduction

Globalization and environmental challenges

There is no doubt about the importance of sustainable design. In fact, to some developing countries, it is imperative to embrace environment sustainable design. Since 2001, a perfect storm of environmental, geopolitical, and economic realities have combined to drive the fact that our world faces an increasingly uncertain energy future. Global climate change, regional conflicts in the Middle East, natural disasters in the Gulf of Mexico, and extraordinary economic growth in China and India are driving serious concerns about energy supply, the environment, sustainable growth, and even national security (Joseph Fiksel, 2009).

Yet, over the last several hundred years, during a period of dramatic industrialization, innovation, and global expansion, we humans have not only taken the natural environment for granted, but we have literally plundered and abused natural resources to server our growing appetites((J. Ehrenfeld, 2008). Driven by economic interests and the pursuit of greater profits, globalized industry has been extended to emerging economies, like China, which bring strong productivity and inevitability ignore other side of the issue: the depletion of natural resources and environmental damage. To the Chinese RV industry in particular, these problems are mainly summed up thus:

- As a new manufacturing base: environmental pollution caused by rapid expansion and inadvertent management in the manufacturing process of the Chinese RV industry.
- As an emerging consumer RV market: the destruction of natural tourism resources caused by Chinese consumer and their lack of the experience of RV and cultural differences.

Design responsibilities

In fact, environmental sustainability is compatible with economic development. Just as growth is essential to living organisms, growth is also essential to a healthy society, especially in developing nations afflicted by widespread poverty (J.E. Stiglitz, 2002). But to achieve global sustainability, we need to radically redesign our industrial systems to create more value with fewer resources (Joseph Fiksel, 2009).

Obviously, design is the only deliberate way out of the unsustainable dominating and addictive patterns of individual and social behaviours that have become the norms in the United States and in other affluent consumerist societies (J. Ehrenfeld, 2008). This inherent property of design poses new dawn to those developing country plagued by economic development and environmental pollution. As designer and researcher, we have more opportunity and more potential to influence sustainability than many others, by implementing environmentally responsible design and work processes. In order to reach these sustainable goals, innovation is an important mechanism. Through strategic implementation, sustainable design research can promote the RV industry and emerging domestic markets to establish such environmental awareness.

Design for Environment is the systematic consideration of design performance with respect to environmental, health, safety, and sustainability objectives over the full product and process life cycle. The concept of Design for Environment (DFE) originated in the early 1990s, largely through the efforts of a handful of private firms that were attempting to build environmental awareness into their product development efforts (Joseph Fiksel, 2009). Typically, the scope of DFE includes the following objectives:

- Environmental protection-assurance that air, water, soil, and ecological systems are not adversely affected due to the release of pollutants or toxic substances.
- Human health and safety – assurance that people are not exposed to safety hazards or chronic disease agents in their workplace environments or personal lives.

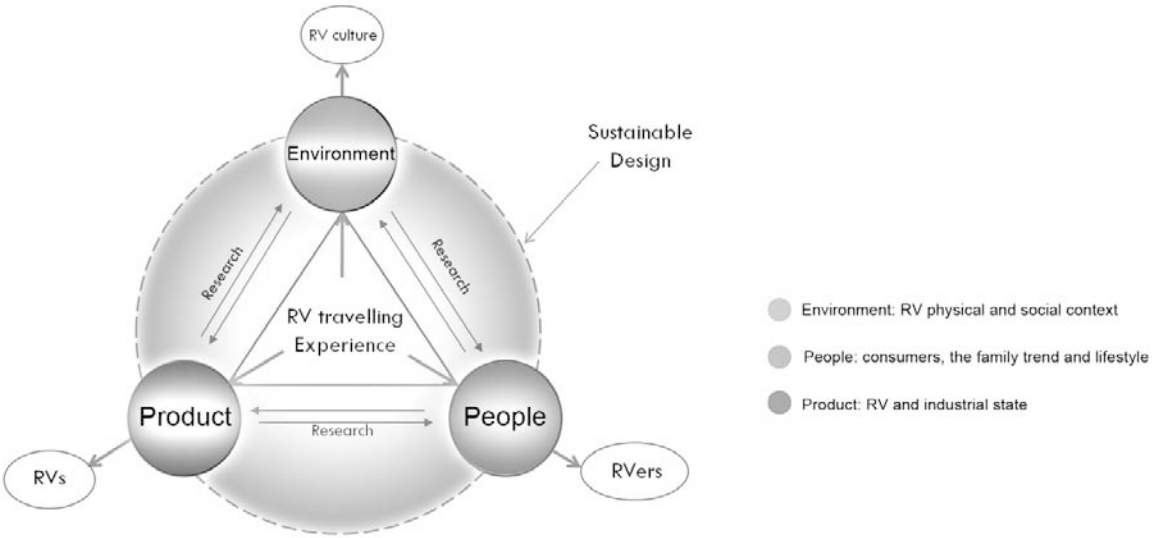
Based on this systematic consideration of design, there are three key elements involved in the Chinese RV sustainable research (Figure 1).

- Environment: RV physical and social context
- People: consumers, the family trend and lifestyle
- Product: RV and industrial state

This research is to study the relationship between the three factors, and how, and eventually to promote sustainable design.

Figure 1: Research Frame for RV sustainable design

Source: Wang xiaolong, 2010



The Development and Challenge of RV Industry

The term recreational vehicle and its acronym, RV, are generally used to refer to a vehicle that combines transportation and temporary living quarters for travel, recreation and camping. A recreational vehicle normally includes a kitchen, a bathroom, a bedroom and a living room. In some countries the terms caravan or camper van are more common, and the vehicles themselves vary, generally (Wikipedia).

RVs are intended for everything from brief leisure activities such as vacations and camping, to full-time living, for which they are often parked in special trailer parks. RVs can also be rented in most major cities and tourist areas. Furthermore, they are occasionally used as mobile offices for business travellers and often include customizations such as extra desk space, an upgraded electrical system, a generator, and satellite Internet.

In the early years, this vehicle mainly had been used by the nomad people for practical purposes rather than recreation. However, after World War II, new materials, technology have greatly increased the utility, comfortable and conveniences of the interior. Moreover, with the RV industry matures, RVs services system, like clubs and camps parks, equally developed a professional, systematic industry. They offer a wide range of affordable, quality accommodation options, top class facilities and are usually in the best scenic locations close to major tourist attractions, which really help this travelling to be a typical Western culture and lifestyle.

Figure 2: The development of RV and lifestyle

(a: RV in an early form, b:The RV icon- Airstream, c:RVers in Europe 60's, d:RVers in Australia now)

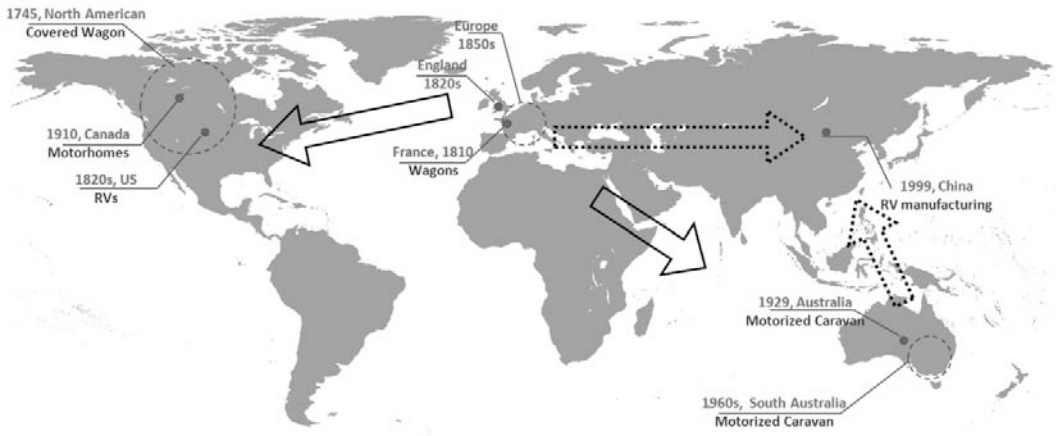
Source: Wang xiaolong, 2010

Lifestyle trends continue to spur demand for RVs

Today, with the globalization, the RV industry has been spread worldwide, from developed to developing countries (Figure 3). This shift not only promoted the transfer of manufacturing industry, but brought new outdoor lifestyle into emerging markets, such as China.

Figure 3: General development of RVs worldwide

Source: Wang xiaolong, 2010



Through the map above we can see such an interesting phenomenon: why in the long term, China, as a country with vast territory and rich tourism resources, has the vacancy in RV culture? Obviously, the blank in RV cultural background mainly come from two aspects: first of all, as a historical legacy of defending nomad people in North Borderland in China, Chinese tradition have conflicted with "nomadic" lifestyle for a long while, and later formed a tradition "roots" culture, which cause the RV lifestyle stagnation for a long time. Secondly, the development of RV is inseparable with the development of automotive industry, highway, and the corresponding legal system. Apparently, yet there is still the lack of objective conditions for Chinese RV development.

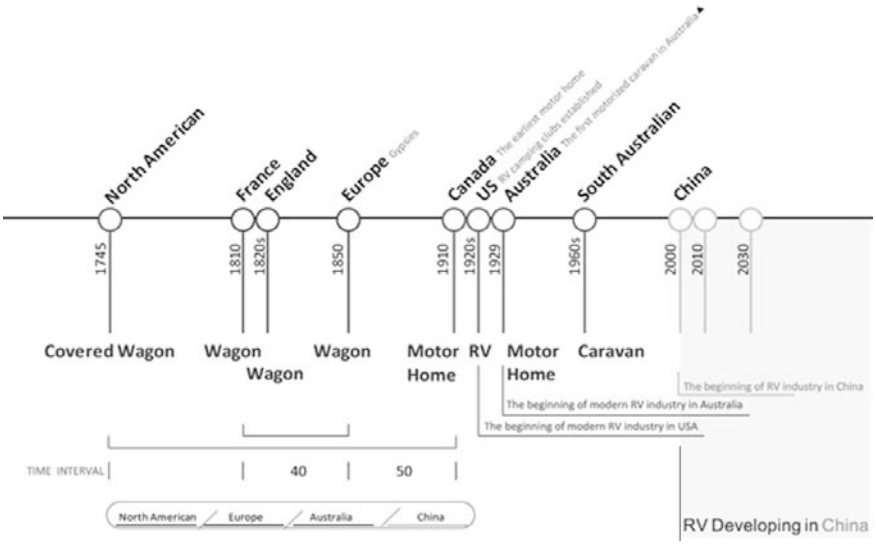
However, because of fast growth in economy, the ardent pursuit of luxurious living and the Western lifestyle, currently the rapidly rise of Chinese RV industry will bring more blindly or excessively comparisons, which has fundamentally different with the Western RV culture. At this stage, that was originally popular cheap out-door travelling in Western countries has been defined as a spokesman for luxury living standard in China.

The compare about RV in Australia and China

Chinese RV industry just has only a decade the development process, which is restricted with the development of automobile manufacturing industry in China, and the number of private passenger cars as well (Figure 4). However, with the increase in income, improvement of living standard and individual needs of the outdoor tourism, RVs travel has became a new growth point of Chinese tourism industry. Moreover, faced this trend, we must post such question: as a developing country, does China really ready to follow the Western countries to develop this outdoor tourism? If billions of Chinese enjoy the same lifestyle, what will happen?

Figure 4: The RV's history and the process of globalization

Source: Wang xiaolong, 2010



A case study into the Australia RV

Based on this thinking, the study takes Australian as a reference, to make comparative research with Chinese RV. The Aim is to find out the difference between these two countries and then provide useful guideline to the sustainable research. As a comparative study of the object, the Australia, as one of the main RV consumer and producer for nearly 50 years of experience, has formed a mature consumer market "Gray Nomad" and the services system. Because of different cultural, historical development, social system and lifestyle, there is a big difference about RV usage between Australia and China, which can be seen clearly by the following table:

Table 1: RV comparative research between Australia and China

Source: Wang xiaolong, 2010

	Australia	China
RV Culture or History	● A typical lifestyle in Australia ● A typical lifestyle that each ordinary people can enjoy ● 50 years of experience in mass manufacture	● A new way of outdoor travel just 10 years ● A new attempt for a few wealthy class ● 10 years of experience in OEM manufacture
RV Industry Status	● About 105 manufacturers ● Labor intensive industry ● Volume of production:18,900(in 2008) ● About 1700 camp parks ● Custom engineered to suit the requirements of the local consumer ● 96% of all RVs are manufactured in Australia with the remaining 4% imported from other country ● "Grey Nomad"- retired people	● About 20 manufacturers ● labor intensive industry ● Volume of production:600(in 2008) ● About 20 camp parks ● custom engineered to suit the requirements of the international consumer ● 80% of all RVs are manufactured in China for exporting to other country ● "urban middle class"-young people, white collar
The feature of consume	● RV purchase(from 4000 – 50,000 AUD) ● In holiday (from 2 days to half a year) ● Parking in their home (backyard)	● RV rental (from 800 -1500 RMB per day) ● In weekend (from 2 days to a month) ● Parking in purpose parks
Organization /association	● Industry Association (RVMAA ● Professional clubs ● Appointed Dealer Networks ● The majority of manufacturers are Members of CIA	● voluntary organization or Civil Group
Policy or Regulation	● Comprehensive legal and regulation system	● RV- driving in high way are prohibited in some cities ● Lack of insurance for RV

Based on data collection and organization, the survey shows general characters in the Chinese RV context:

- Population and demographic trends favour fast RV market growth.

- New lifestyle trends continue to spur demand for RV.
- RVs are attractive to young buyers.
- RV ownership is still a deep-rooted culture embedded in the community.
- Camping infrastructure facilities need to be improved to match the improvements of RV industry
- Relevant laws and regulations need to be revised and formulated.
- Comprehensive and flexible dealer network

Apart from data collection, field researches have been made in China and Australia separately. The aim is to find out how do RVers' behaviour make the visible impact to environment. After all, most RVer's activities related with environment pollution usually are displayed in the process of outdoor travelling.

Figure 5: The field research in the issue of sustainable during the RV camping (a: in China, b: in Australia)

Source: Wang xiaolong, 2010

Table 2: environmental issues involved in the process of RV camping

Source: Wang xiaolong, 2010

Environmental Problems	Phenomenon
Environmental destruction and pollution from Camp construction	• Construction camps will choose the scenic places • Construction of fixed and temporary buildings will destroy the existing harmony, natural ecosystems
Air pollution	• Automobile exhaust • Camp activities, such as barbecue, bonfire
Water Pollution	• Camp activities, such as diving, boating, surfing, motor boats • Legacy of waste, oil, chemical cleaning agents and high-quality residual
Noise pollution	• Bring the car noise to the original ecosystems and people's psychological, physiological impact

In addition, based on different context, for the awareness toward RV, usage habits, and environmental awareness, the Chinese RVer still remain big gap with the Western people. As a part of the RV culture, environmental awareness is the inner spirit of this means of travel. In Western countries, currently the rise of GREEN-RV-DIY driven by the RVer, can be seen the embodiment of the environmental awareness.

The general characteristics of Chinese RVers

Figure 6: the survey about Chinese consumers' concern and purchase possibility about the RV

Source: www.sina.com, 2010

Generally, Chinese main RV customers focus on wealthy people and RV design meet a demand or requirement of luxury for them. Even, sometimes RV is regarded as a sign of status (a particular power or quality or rank), which beyond the real meaning of casual living lifestyles. However, with the economic strength of the upgrade, the popularity of private cars, more and more working-class people are joining this travelling. Moreover, the government is also actively promoting the construction of the camping parks in countryside. Under this situation, we need to ask: was this blind expansion trend based on in-depth study about the local consumer behaviour and outdoor tourism resources? If it was, innovative models are the necessary to be implemented instead of just copying Western RV models.

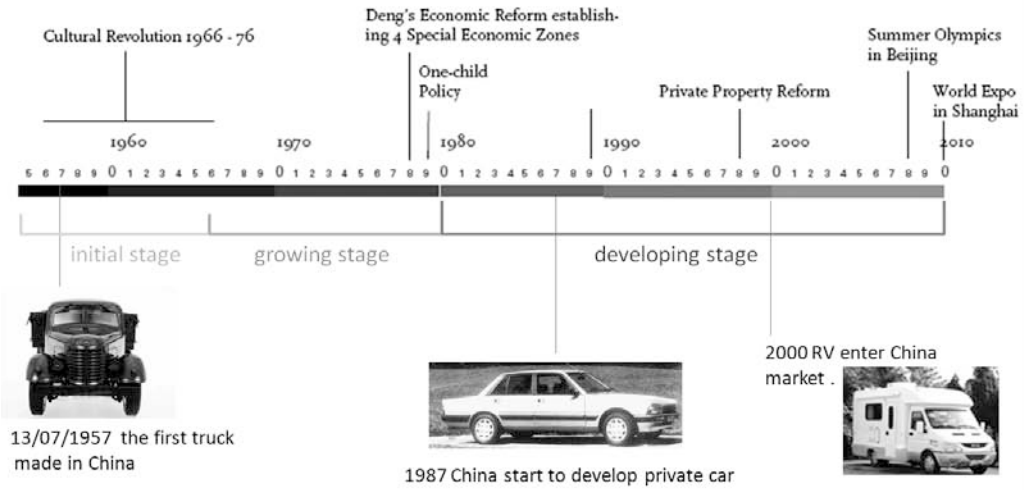
Chinese RV industry's bottlenecks and the issue of sustainable

Although the development process is short, rapid and drastic changes have been taking place in the Chinese RV industry recently. There are following reasons for RV industry growth:

- Export boom and the huge potential domestic market
- Lifestyle trends continue to spur demand for RVs
- Low Technology barrier : many auto industry into the area surrounding
- Policy support
- Small and Medium enterprises: flexible marketing strategies
- labour-intensive enterprises to take advantage of China's rich labour resources
- RV manufactures are innovating to give consumers an array of product choices

Figure 7: development of automobile manufacturing and RV industry in China

Source: Wang xiaolong, 2010



After experienced 10 years basic manufacturing industries, Chinese RV industry is going through two changes: the first is the industrial restructuring which will change from OEM to independently innovation. Another change is the target market changed from export market to domestic market, because of the upgrading of domestic consumption. Therefore, a new serious disequilibrium has occurred in the balance of development and environment protections. The following are the several characteristics:

Table 3: Chinese RV industry development issues and design strategies

Source: Wang xiaolong, 2010

Bottlenecks and Issues Of Sustainable	Design Strategies
limited history of RV travelling and manufacturing	Enhanced RV design and cultural exchange and understanding
The Restrict by Traditional ideas about the nomad lifestyle	To combined the local traditional culture with consumer future trends
The lack of RV camping to restrict China's outdoor industries	To promote sustainable design in the role of camp construction
RV Relevant laws and regulations are not perfect	Adaptive design strategy
RV production technology and energy consumption	Design Innovation and Value Engineering
The lack of RV design expertise and research	The development and searching about design resources worldwide

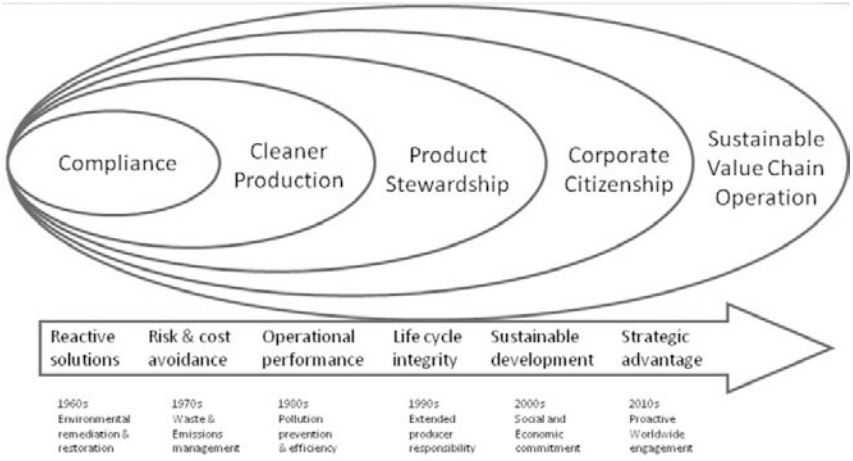
A much greater challenge is to integrate sustainability thinking into a company's business processes to achieving significant, lasting change. In particular, to perform Design for Environment consistently and effectively is challenging for several reasons:

- The necessary environmental expertise is not widely available among product development teams, including marketers and engineers.
- The complex and open-ended nature of environmental phenomena makes it difficult to analyse the effects of design improvement.
- The economic systems in which products are produced, used, and recycled are much more difficult to understand and control than the products themselves.

Design strategy: building an sustainable system to industry

Figure 8: the scope of environment responsibility has extended beyond compliance and the enterprise boundaries

Source: Joseph Fiksel, 2009



Principles, design rules and guidelines

Build upon past experiences to assemble a portfolio of design strategies that can be codified, communicated through training, and systematically applied by your design teams. This will encourage a repeatable and consistent innovation process rather than anecdotal successes based on individual ingenuity. There has been a great deal of knowledge developed worldwide about DFE strategies, including many useful design rules and guidelines, suitable for various industries and product categories. For example, Anastas and Zimmerman published a set of general principles for green engineering, shown in Box1, which can be applied from the micro to the macro scale (Joseph Fiksel, 2009).

Box 1: Twelve Principles of Green Engineering

Source: Joseph Fiksel, 2009

- Designers need to strive to ensure that all material and energy inputs and outputs are as inherently nonhazardous as possible.
- It is better to prevent waste than to treat or clean up waste after it is formed.
- Separation and purification operations should be designed to minimize energy consumption and materials use.
- Products, processes, and systems should be designed to maximize mass, energy, space, and time efficiency.
- Products, processes, and systems should be “output pulled” rather than “input pushed” through the use of energy and materials.
- Embedded entropy and complexity must be viewed as an investment when making design choices on recycle. reuse, or beneficial disposition.
- Targeted durability, not immortality, should be a design goal.
- Design for unnecessary capacity or capability (e.g., “one size fits all”) solutions should be considered a design flaw.
- Material diversity in multicomponent products should be minimized to promote disassembly and value retention.
- Design of products, processes, and systems must include integration and interconnectivity with available energy and materials flows.
- Products, processes, and systems should be designed for performance in a commercial “afterlife.”
- Material and energy inputs should be renewable rather than depleting.

The continued growth in RV demand has led to increasing concerns about potential impacts on the environment, public health and safety, and quality of life, raising questions about how existing transportation systems can meet today’s mobility needs without compromising the welfare of future generations. This prompted the World Business Council for Sustainable Development to launch a program in 2002 called “Sustainable Mobility,” sponsored by leading global companies and focusing on road transportation. Completed in 2004, the study proposed incremental solutions that assumed continued growth in private vehicle use but did not examine scenarios under which global mobility patterns might be fundamentally altered (Joseph Fiksel, 2009). A follow-up study focused on solutions to mobility problems in cities around the world.

From a holistic perspective, the transportation industries have access to a broad portfolio of technologies that can be deployed to satisfy future societal needs for mobility. The choices include different modes of transport, such as air, sea, rail, and highway; different fuel sources-fossil fuels, bio-fuels, electricity, and hydrogen; and different infrastructure configurations. Yet we have only a vague understanding of the potential social, economic, and environmental conditions. These conditions will vary enormously among developing and developed nations, between urban and rural settings, and across different geographic and climatic settings. Nor do we understand the full ramifications of technology choices upon economic vitality, ecological integrity, or community well-being under various future scenarios.

There is active ongoing research in sustainable mobility, which same with RV, addressing two main facets:

- Technological innovation, including alternative materials, vehicle designs, energy sources, propulsion systems, and transportation networks that are safer, more effective, and more environmentally benign.
- Technology assessment to determine the feasibility, eco-efficiency, sustainability, and resilience of alternative mobility technology combinations under various future scenarios, providing a sound scientific basis for public policy formulation and R&D priority-setting.

Actions of promoting sustainability from industries

Around the turn of the twenty-first century, corporate sustainability initiatives began to grow phenomenally, as more and more companies recognized that sustainability was an essential factor in their continued competitiveness.In search of strategic advantage; companies are expanding the scope of their sustainability initiatives to their full value chains.

One of the key factors reinforcing this trend is the expansion of multinational companies into developing nations, where they must confront poverty reduction and quality of life issues. At this point, environmental responsibility becomes inseparable from social responsibility. At the leading edge of corporate sustainability, companies are exploring how they can assure safe and ethical labour practices in developing nations and how they can partner with communities at the "base of the pyramid" to create viable new businesses (E. Simanis, 2008).

Figure 9: Examples of prominent eco-labels around the world

Source: Joseph Fiksel, 1996

RV manufacture covers a broad range of industries, including the manufacture of vehicles and transportation equipment, the supply of fuel and replacement parts, and the operation and maintenance of roads, railways, and transportation services. Transportation systems and the RV industry in particular, have an enormous impact on both the economy and the environment.

The environmental impacts of transportation systems are extensive and highly visible, ranging from atmospheric pollution and greenhouse gas emissions to the accumulation of solid wastes, such as tires and scrap plastics from obsolete vehicles. Other adverse impacts include noise, traffic congestion, and highway fatalities.

The rising awareness of sustainability concerns has led government and industry leaders to address these environmental impacts. Transportation industries are among the most highly regulated, with requirements governing occupant safety, operator certification, equipment inspection, hazardous material transport, fuel efficiency, and many other issues. For example, the Roaming Times Green RV Award has prompted manufacturers to implement design for recovery programs; some companies like Earthbound, had anticipated these programs and developed advanced recovery technologies.

Box 2: The Earthbound travel trailer

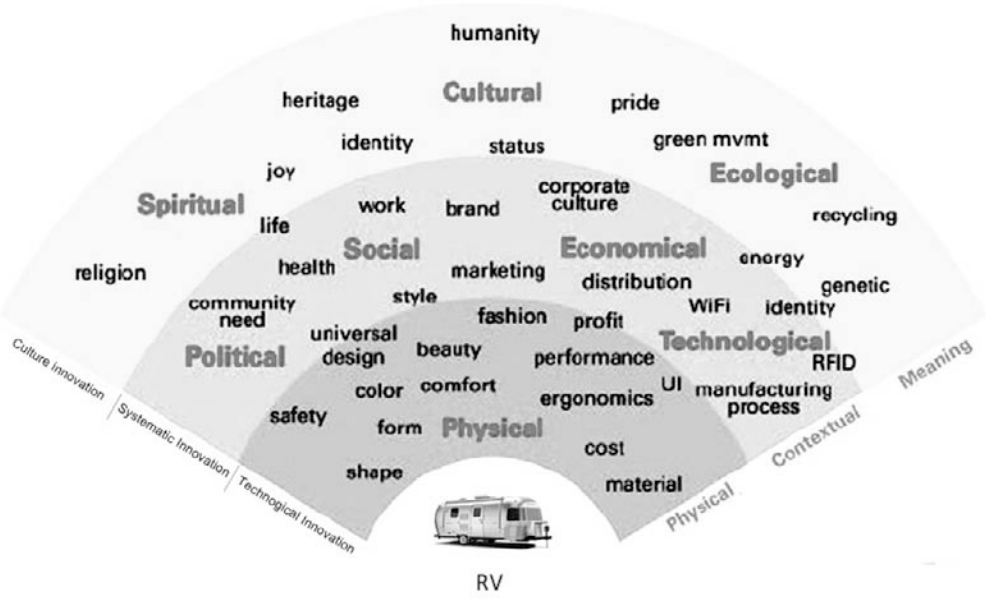
Source: The Earthbound, 2010

> Roaming Times, the world's leading RV review and RV consumer report website for more than 10 years (www.roamingtimes.com), has announced the 3rd annual Roaming Times Green RV Award. The purpose of the Roaming Times' Green RV of the Year selection is to recognize and highlight innovation in the RVing industry that supports environmental factors for the world in general, and the RVing, travel and leisure industries in particular.

Conclusion: The Road Ahead

Figure 10: RV sustainable strategies in Chinese context

Source: Wang xiaolong, 2010



No doubt, it is not easy to let the RV enter into every household in China. And the reason, I think, lies in the complicacy of the RV travelling and industry. Particularly in China, it is not just a simple process of product localization, but a long way for the establishing sustainable systems which is connected with the Chinese social structure, family trends, tourist resources and industrial structure. There is no shortcut to success but there are steps. To Chinese RV sustainable research, it is necessary to study the complicated system, which cannot be going beyond in this initial period.

With the readjustment of the Chinese RV industry, the design research should take more social responsibility than just be the product promoters. Establishing a sustainable target for both industry and outdoor tourism environment, will not only benefit for such developing countries, like China, but more importantly, create an innovation systems to redefine this travelling pattern prevailed for a century. Finally, the real beneficiaries will belong to the more and more "green nomad" worldwide.

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the Learning Network on Sustainability

Design of sustainable toilets for rural and urban India

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Sanitation is the most crucial factor that takes care of environment and human health. There is a massive demand for proper sanitation in India, as 650 million people are deprived of water and access to toilets making it awkward and unsafe, especially for ladies. Making sustainable sanitation a hygienic pleasurable experience as well as an income generation mechanism was always unrequited. The sustainable toilet was designed keeping in mind the various factors such as – available resources, sanitizing and reusing the waste; emphasizing on the usability, cost, returns etc. The ecological design comprises of toilet as well as bath area. The toilet has been designed such that the urine and faeces are separated at the source; stored separately to dehydrate and convert them in to fertilizers. The simple to operate mechanical levers eliminate usability drawbacks of existing toilets, making them hygienic and comfortable. Once the faecal containers are filled, they are stored in a translucent black box to accelerate the dehydration process of faeces, making it safe and hygienic. The huge demand for Sustainable Toilet serves dual purpose of economic viability; due to low production cost of toilets and revenue generated by selling huge quantity of converted fertilizer. The safe and enclosed toilet helps to solve gender and slum area issues making it socially acceptable. The reduction in usage of clean water for flushing and less pollution makes it environmental friendly. Thus the design meets the three aspects; environmental, economical and social to achieve overall sustainability.

Abbreviations

•	CAD	Computer Aided Design
•	CLTS	Community led Total Sanitation
•	DEWATS	Decentralized Waste Water Treatment System
•	ECOSAN	Ecological Sanitation
•	MDG	Millennium Development Goals
•	PDS	Product Design Specification
•	QFD	Quality Function Deployment
•	RIR	Relative Importance Rating
•	TSC	Total Sanitation Campaign
•	UDDT	Urine Diversion Dehydration Toilet

Introduction

"Health is wealth". We keep on reading this proverb in our daily activities. It means that if the body and mind is healthy the person becomes wealthier. This is very true. Sanitation plays a very important role in keeping a person healthy. It is a very basic right of every citizen of the nation to have an access to safe sanitation. But in my own country, India, still many people do not have the access to safe and secure toi-

lets. Almost 650 million of Indians have no access to toilets [1]. Improper toilets lead to different health issues and diseases. In addition, safe and potable water also becomes a problem. India has already been predicted as water scarce nation by the year 2016 [2].

At the start of a day, toilet is the first place which is visited by majority of the people. In villages, open defecation has been practiced for long. The villagers do not have access to safe toilets. Often, ladies have to hold till it becomes dark and relieve themselves far away from the village, in open spaces. Thus safety is a big issue for ladies. Talks about toilets, urine and faeces have always been considered as taboo and are never discussed. Toilets were never designed to make them user and environmental friendly. Furthermore, after the use of the toilets, nobody even thinks about wastes and the end result of the wastes. As the population will keep on increasing the wastes and pollution are also going to increase.

Literature review

Introduction

Sanitation and hygiene is the biggest necessity for human welfare. Today, 86% of the population in urban India has access to an improved water source, but only 33% has access to improved sanitation. In rural areas, the respective shares are 83% for water and only 22% for sanitation [3]. Community-led total sanitation (CLTS) was an innovative methodology for mobilizing communities to completely eliminate open defecation. It was supported from the people side and thus was one of the successful methods. CLTS is said to have great potential for contributing towards meeting the Millennium Development Goals, both directly in water and sanitation. To solve the problem of sanitation and hygiene, Total Sanitation Campaign (TSC) was restructured in 1999 and made more demand-driven and people-centered [4].
But still the results of TSC were not satisfactory and only 59% of rural people have access to a toilet [4].

Water is the fastest disease spreading medium and 5 out of the 10 top killer diseases of children aged 1-5 years are mainly caused by poor sanitation, inadequate water supply and poor personal hygiene [5]. Around 550 million toilets are required in India and there is a need for a contextual product design for toilets.

Millennium development goals [6]

In the year 1999-2000 eight goals were set by the United Nations for the development of the globe. The 8 MDGs were:

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria and other diseases
7. **Ensure environmental sustainability → sub-goal: water & sanitation**
8. Develop a global partnership for development

Thus the 7th goal and sub-goal was related to this project and paper.

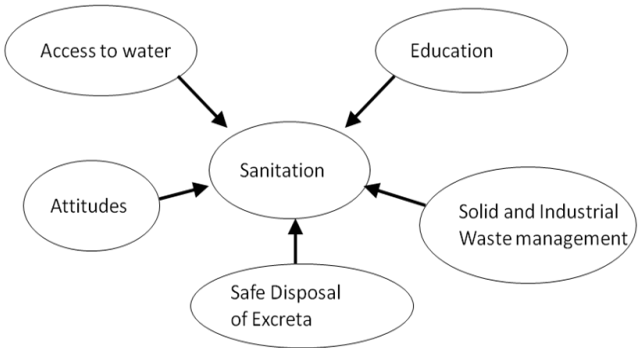
Sustainability[7]

Sustainability can be defined as the continued ability of a society, ecosystem or any such interactive system to function without exhausting key resources and without adversely affecting the environment. It is the concept of living within the capacity of supporting eco-systems. Sustainable development is the development with low environmental impact, while maximizing environmental, economic and social gains.

Sanitation[8]

Sanitation is not only about safe disposal of excreta, but also about access to fresh water, educating people about safe habits. It also includes solid and waste management and changing the attitude of people towards the sanitation. Thus sanitation depends wholly upon the user. The figure 1 below shows different aspects of sanitation.

Figure 1: Sanitation



Conventional toilets[6]

To solve the above problems, long ago, conventional toilets were designed and used. The conventional toilets were water based. Human beings urinate, deposit the feacal matter and then use fresh, potable water to flush down. A lot of water is used in the toilets.

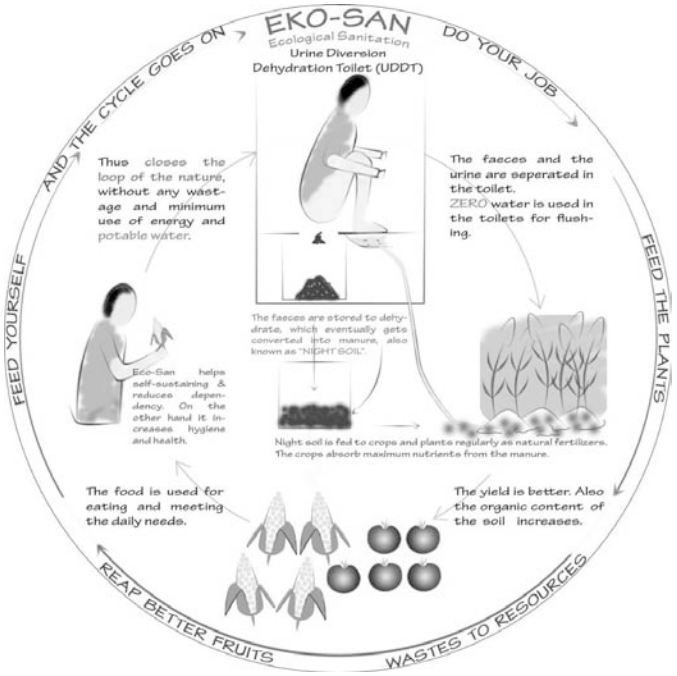
> Assume, a person uses a toilet thrice a day,
> 10 litres of water is flushed to keep the toilet clean
> This, 4 persons family uses 10 x 3 x 4 = 120 litres of water, just for flushing in 1 day. [1]

The flushed water might be going to the sewage treatment plants or directly to the rivers and seas. A survey shows that 70% of waste is untreated and disposed directly to the nearby water bodies [9, 10]. Huge amount of domestic wastes congregate with the rivers every day. Later on, the same water is used for different activities by human beings [11]. To solve these issues at local level, leach pits were introduced. Leach pits are deep pits where the toilet wastes are deposited and the liquid wastes are absorbed by the soil. But if the ground water table is high, the leach pits start leaking and then the ground water gets affected. Also as the time passes the walls of the pit may start leaking and the wastes start spreading. Thus, diseases spread.

Ecological sanitation[12, 13]

It is the art of separating the liquid human wastes (urine) and the solid human wastes (faeces); with minimal use of water in the toilet and store the human wastes to convert it into fertilizers. These converted fertilizers can be then used for kitchen garden, farming etc. It has been studied that the human wastes have a big potential of fertilizers if treated well before applying. Thus NPK rich organic fertilizers can be applied to the crops and plants. The faecal matter contains pathogens. Pathogens are very dreadful and maximum disease carrying germs. Pathogens can survive in the faecal matter only till the moisture is present. Once the pathogens are removed from the faeces the faecal matter acts like a very rich fertilizer. The faecal matter can be stored to dehydrate and thus the pathogens in the faecal matter will peter out. The figure 2 gives a pictorial view of the working of ecological sanitation.

Figure 2: Ecological Sanitation



DEWATS and reed bed[14]

DEWATS helps to clean the grey and black water. This system helps to clean biological wastes in the water and reuse them for secondary applications. The grey water typically contains soap and has large amount of nitrates and phosphates which remain untreated in the DEWATS. Thus it can be passed through the reed bed and where the phosphates and nitrates are taken up by the reeds and the cleaned water can be used for secondary purpose.

Data collection and analysis

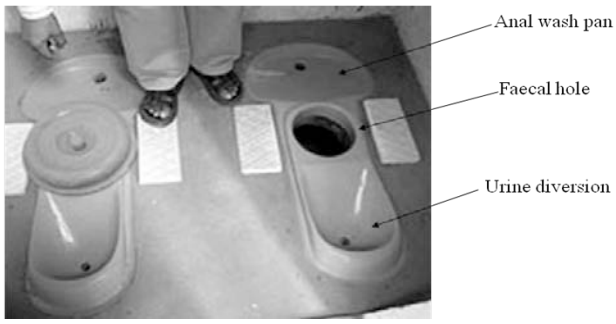
User study

Very few people had used the toilets based on ecological sanitation. A questionnaire was prepared and the questions were asked with prime intention to make people aware about ecological use of water and toilets and at the same time get more information about the water usage pattern of people in different cities, countries etc. The survey helped to understand the target user better; their emotions and wishes.

Product study

The products in the present market have been made from ceramic or fibre reinforced plastic. Each toilet has two storage vaults and thus two pans to use. Each pan has been divided in to 3 components, viz. faecal deposition hole, urine diversion and the anal wash pan. A lid is provided over the faecal deposition hole which has to be opened on every use. After each use a handful of ash, saw dust or any drying material is to be poured over the faeces. This helps to keep away the insects and flies. The lid has to be put back over the faecal deposition hole to prevent entry for insects and flies. The urine gets diverted in the urine diversion pan. For washing the anal, a person has to shift behind over the anal wash pan and then can complete the job. The wash water and the urine can be diverted using pipes and can be applied directly to the plants and crops nearby. Once the faecal vault gets filled, the other pan should be used. Till then the faeces in the earlier vault will dehydrate and convert in to fertilizers or night soil. The figure 3 below shows one of the configurations for toilets based on ecological sanitation.

Figure 3: Product Study of ECOSAN toilet



Especially in the rural areas, very few people had bathrooms. Most of the bathrooms were temporary structures made from locally available materials which were a bit away from their houses. (Figure 4) Thus privacy and safety was a big issue.

Figure 4: Open Bathrooms

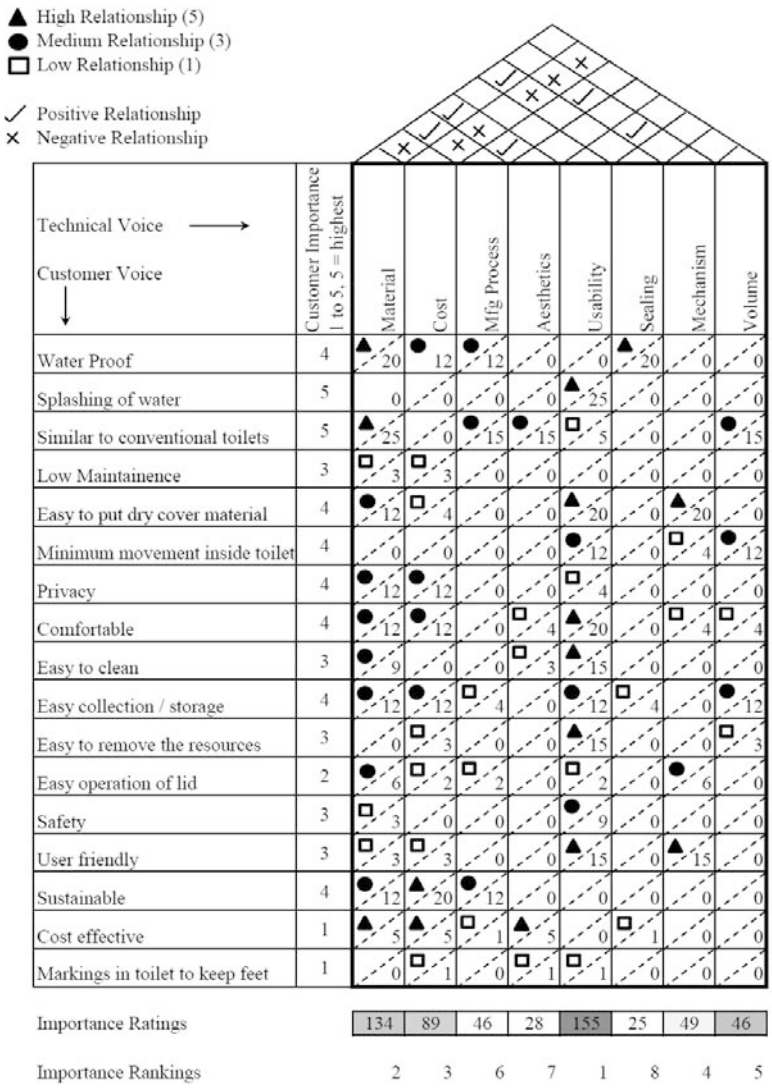
Problems found out in user survey

- Need of Bathrooms
- Different usability issues in UDDT
- Cost
- Reutilization of wastes
- Storage and Treatment of waste water

QFD chart

The collected data was analyzed and synthesized using the QFD chart. (Figure 5) The maximum priority was found out for usability followed by material and cost.

Figure 5: QFD Chart



PDS

Based on the QFD chart PDS was defined. (Table 1)

Table 1: PDS Chart

Category	Specifications
Dimensions (max)	4300 x 1800 x 2400 mm
Material (Pan)	Plastic
Storage of Material	Containers with wheels
Usability	Easy, High
Manufacturing (Pan)	Plastic Moulding
Appearance	Similar to conventional
Colour	Soothing and Fresh
Sealing	Leak proof

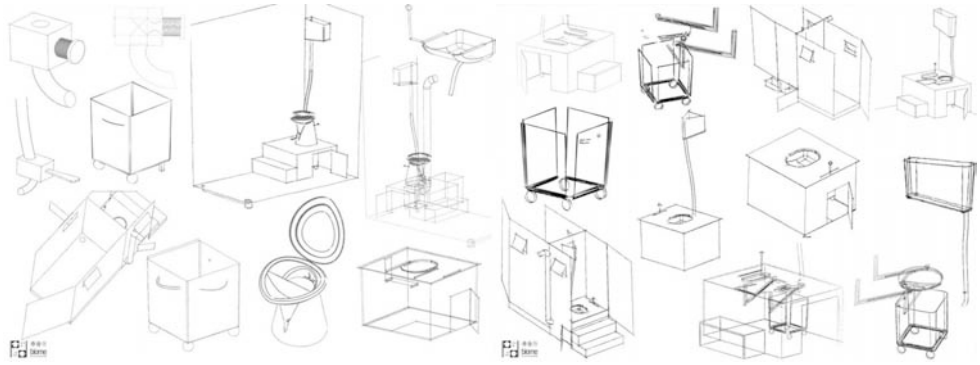
Category	Specifications
Dehydrating agent	Ash or saw dust
Ash/saw dust capacity	15-20 litres
Ash/saw dust dispenser	Manual switch/lever
Maintainance	Easy to clean
Cost (Pan)	< Rs. 2500

Concept generation and selection

Concept generation

Concept generation was based upon 2-3 techniques like TRIZ, brainstorming method, morphological analysis etc. Many ideas were generated to mix and match to create new products. The ideas were generated by doodle sketches. (Figure 6)

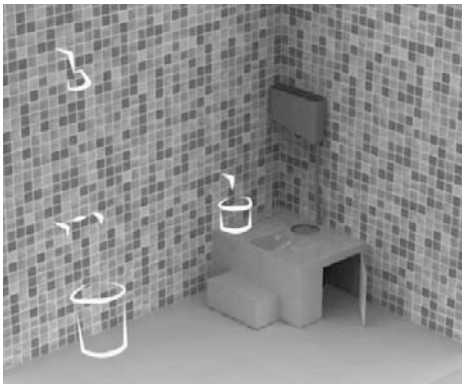
Figure 6: Doodle Sketches

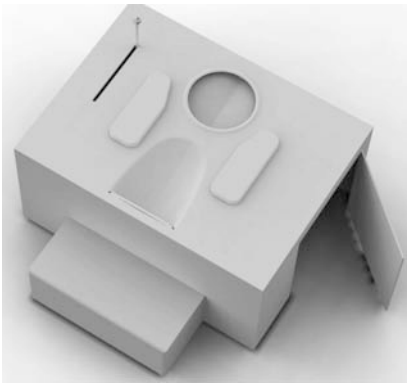


Concept 1

Toilet for Urban India with squatting or Indian style of toilet pan. The figure 7 below shows the concept 1. This is a typical urban toilet of 1800mm x 2400mm dimension. The toilet has been provided with an ecological sanitation toilet pan on a platform. Containers are provided below the platform to store the faeces and urine. The bath area has been provided with low water dispensing taps and showers.

Figure 7: Concept 1



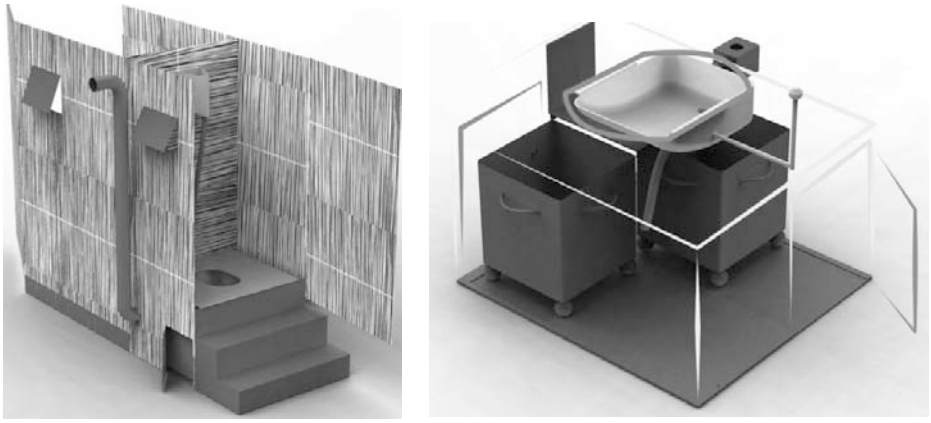


The figure 7 also shows the detail view of the toilet pan. There are 2 main components in this pan. A urine diversion in the front and a faecal deposition hole cum anal washing tub. The faecal hole lid and the washing pan has been merged together. A handle has been provided to slide open the lid.

Concept 2

Toilet for Rural India with squatting or Indian style of toilet pan. The toilet and the bath area have been kept different as most of the people in rural areas do not like to combine them. The figure 8 shows the toilet and bathroom. The bottom structure is made from RCC while the super structure has been made in bamboo to reduce the costs. The design of the toilet, bathroom and the pan has almost been kept similar to the conventional ones, to increase the acceptability of the concept.

Figure 8: Concept 2



The figure 8 also shows the details of concept2. The urine tub and washing tub have been merged together. This tub has to be slid opened for faecal deposition. Thus it acts as a faecal deposition hole cover. A mechanism has been provided for ash / saw dust deposition. While using the toilet pan, the user has to slide the urine / anal washing bowl in the front with help of the handle provided.

Concept 3

Toilet for Urban India with sitting style or western commode toilet. The urban crowd has been always westernizing. Thus the lifestyle and products are also changing to the western world. The bath area and the toilet have been combined together. The grey water from the bath area and the black water from the toilet are taken commonly to the DEWATS for further treatment. The figure 9 below shows the western type of sitting toilet or the commode in the form of ecological sanitation. The commode sits over a platform below which the containers can be stored.

Figure 9: Concept 3

The front part is the urine diversion while the hind part is the faecal deposition hole. Anal washing tub and the hole cover have been combined together. (Figure 9)

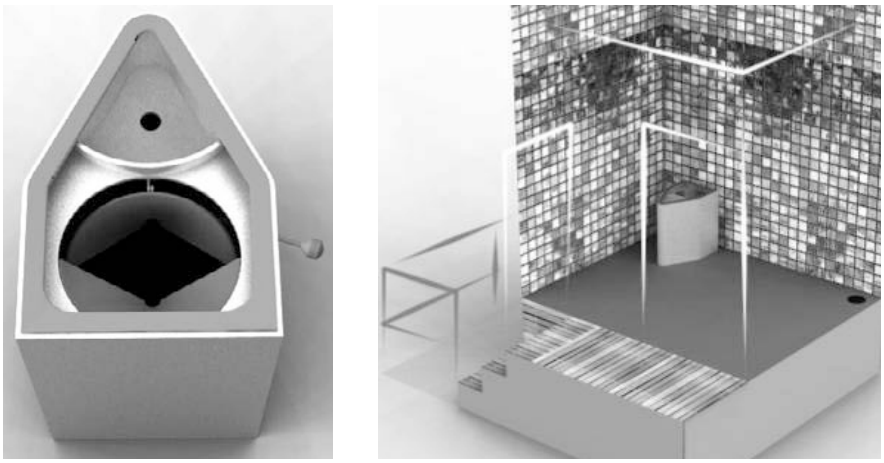
Figure 10: Black box concept

Interesting feature of this concept is the addition of black box. This black box comes out of the wall of the house in to a duct or where sunlight can fall over it. This helps to attract heat and the dehydration process gets accelerated. (Figure 10)

Concept 4

Toilet for Urban India with sitting style or western commode toilet. This is a unique concept where there is change in the building architecture. The toilet can be at the floor level whereas the access to the containers will be from a dry terrace which is next to the toilet. The figure 11 below illustrates the dry terrace.

Figure 11: Concept 4



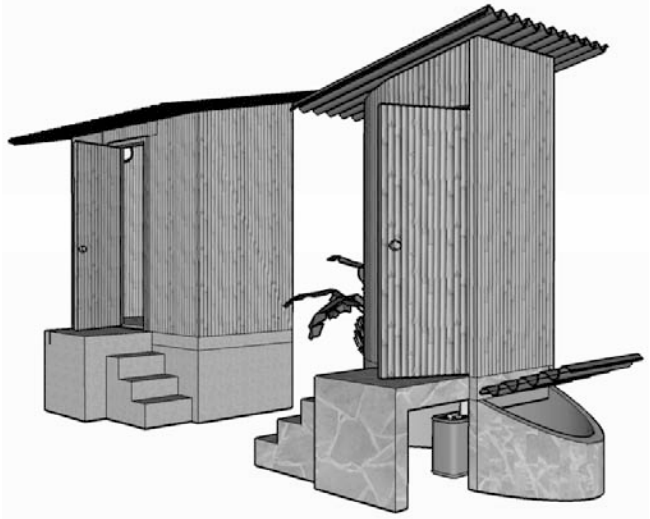
This is a new trend in the urban areas and thus can help to accommodate toilets based on ecological sanitation. There is human psychology or rather phobia for faeces. Nobody wants to know that there are faeces stored below the toilet whenever the lid is opened. To overcome this phobia the concept 4 was designed. (Figure 11) In this concept a starch based paper bag is used for each use. This bag has a layer of urea which helps to dehydrate the faeces faster. The user puts a paper bag in to the funnel type of faeces disposing area. Once the faeces are deposited the lever provided on the commode can be pulled to open the funnel. Thus the faeces bag drops in to the container. In this case the anal can be only wiped and not washed. The paper has to be dropped in to the container below. The lever can be then pulled back to normal position for closing the funnel. The ash can be dispensed using the ash lever.

Concept 5

Separate toilet and bathroom for Rural India. The toilet and bathroom have been intentionally kept separate, as few of the villagers do not accept the attached toilet and bathroom or one with a common wall.

(Figure 12) The grey water coming from the bathroom is passed through the reed bed and then applied to crops / plants in the kitchen garden or farms. The old ecological sanitation toilet pan is used in this toilet with few modifications. The usability of the toilet remains similar to the earlier toilet pans. The anal wash water is applied directly to the plants which require water often.

Figure 12: Concept 5



The urine is collected in a container and can be stored to increase the NPK level. After few days the urine jar, can be taken to field to apply it directly. The faeces are stored in containers and not in faeces vault. This makes the handling of the faeces an easier job. Even if something goes wrong while handling the faeces, it can be in controllable limits. A black window has been provided to increase the dehydrating rate for the faeces. A lock can be put to the window so that kids or animals do not fiddle with it. Once the faeces are converted in to fertilizers they can be taken out to apply it in the farms or gardens.

Concept 6

Modification of older Ecological Sanitation Toilet. This concept was generated by brainstorming and keeping in mind about cost reduction for the rural area. In the user study and visit to rural places, it was found that there was huge demand for safe bathroom next to the house. This concept was modification of the earlier ecological sanitation toilets. The earlier toilets had 2 toilet pans in each toilet which had 2 faecal vaults below to store the faeces. Only one pan was used at a time till the faecal vault gets filled. Once the faecal vault is filled the other pan is used. Thus half the time one of the pan was not used. It was a huge investment of money as well as space. Thus modifications were made in the existing toilet to incorporate toilet as well as bathroom in the same space. The figure shows the concept 6.

Figure 13: Concept 6

One toilet pan is taken out from the space and converted into bath area. A partition is provided between the toilet and bathroom. Thus the toilet and bathroom can be used by different persons individually. (Figure 13) The toilet has been provided with a wheel below the platform on which containers can be stored. Once the container is filled the wheel has to be rotated such that the next container is fixed below the faecal deposition hole. At the same time the filled container shifts and is exposed to the sun heat under the black window.

Concept selection

The concept selection was done with the help of weighted ranking method. (Table 2) The relative importance rating (RIR) was set for each parameter and the concepts were rated side by side.

Table 2: Concept Selection

Features	RIR	Concept 1	Concept 2	Concept 3	Concept 4	Concept 5	Concept 6
Usability	**5**	7	8	7	7	6	5
Sealing	**2**	7	8	7	7	7	6
conventional toilets	**4**	6	7	8	9	6	5
Ash dispensing mechanism	**4**	6	8	9	8	6	5
Comfort	**4**	7	7	8	8	7	6
Lid opening mechanism	**3**	7	7	7	7	5	5
Dimensions	**3**	7	6	7	6	5	6
Maintenance	**4**	7	7	8	8	6	7
Aesthetics	**2**	5	6	6	7	5	5
Drying area/Dehydrating box	**3**	3	5	8	7	8	4
Total		**4.2**	**4.7**	**5.1**	**5.0**	**4.1**	**3.6**

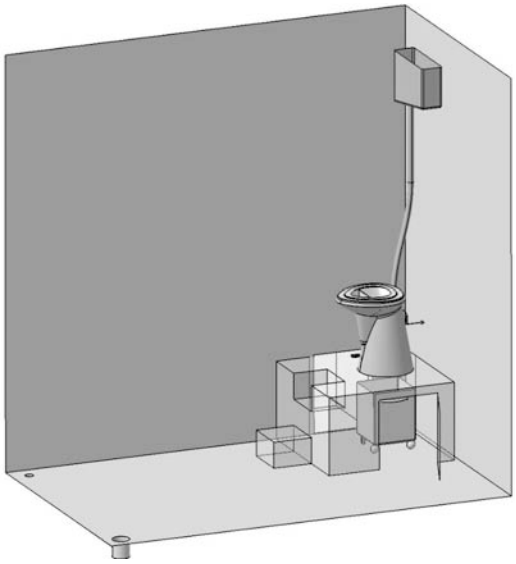
Thus concept 3 was selected as the best concept according to the weighted ranking method. **Concept 3** scored maximum points of **5.1** followed by concept 4 (5.0) and then by concept 2 (4.7)

Detail design and mock up model

Concept detailing

The concept detailing started with ergonomic study for the model. A physical true scale model was prepared from card board cut outs. This model was assembled to study the usability of the selected concept. Few problems were found out which were solved in the detail design stage. A final CAD model was prepared with all the dimensions. (Figure 14)

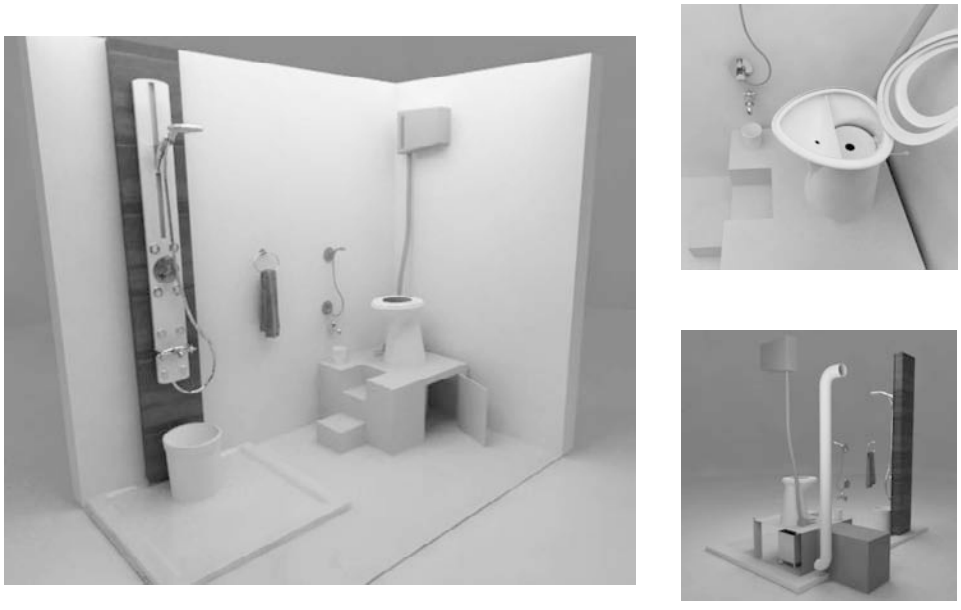
Figure 14: CAD model



Rendering

Rendering helped to visualize the CAD model better before making the mock-up model. It helped to understand the overall dimensions, form and aesthetic and how it would fit in to the real world. Below figure 15 shows the rendered views.

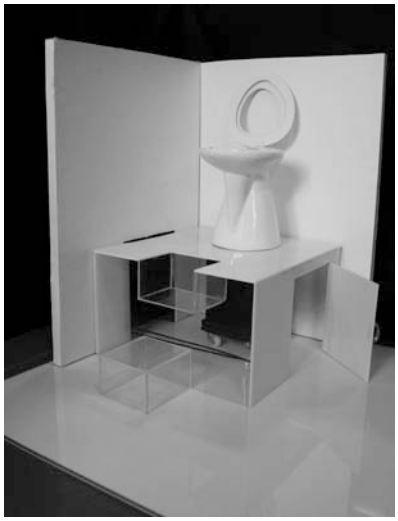
Figure 15: Renderings



Mock up model

The mock up model was made in a sustainable way by reusing and recycling the material wherever possible. The commode was made in Plaster of Paris while the platform was made in acrylic sheets to demonstrate the model. The other components of the model were made by reusing scrap materials. The figure 16 below shows the final mock up model.

Figure 16: Mock up Model



Design validation

The concept was validated in the detail design stage as a full scale cardboard model was prepared to study ergonomics. The mechanism was tried and tested several times to make it run successfully. Each and every usability aspect was considered for different components. The whole product was made modular and could be fixed at home by a common man. The actual product can be made in fibre reinforced plastic and screws can be provided for easy assembly.

Conclusion and future scope

Conclusion

The ecological sanitation toilets can be surely used in the urban environment if the usability and handling of faecal matter is made easier. This will definitely reduce the burden on the environment and also the wastes can be reutilized in a better way. To make a new concept acceptable in the market, a proven design methodology has to be followed. The emotions and wishes of the target user should be carefully understood to design the best suitable product for the target customer. Thus reutilization of wastes and making toilets eco-friendlier is surely a design centric activity. The biggest learning from this project was **'Wastes are not wastes until they are wasted'**.

Future scope

The world is moving towards sustainability and green design. It is an upcoming trend and lifestyle of people, where they are ready to accept greener products. The sustainable toilet surely has a future if it is easy to use. People will not mind to take an extra effort if it is going to give good returns for the future.

This version of the toilet is totally mechanical and every movable part of the toilet has to be controlled physically. More research and work can make some of the tasks (semi)automatic. Thus this will make the toilet experience much comfortable and pleasurable one.

Sustainable sanitation has got a big future. Recently there was an article in *Times of India*, Pune edition ("Now, you too can have your own kitchen garden", March 1st, 2010) stating more people are getting engaged in kitchen garden and are cultivating their own crops in apartment terrace or gardens.

Thus organic fertilizers will have increased demand and the fertilizers converted from human wastes can be easily used. Sustainable sanitation can generate new jobs. Agencies can be appointed to maintain the toilets and they can take away the converted fertilizers to sell them. This will surely help to generate green jobs.

Return on investment

A small exercise was performed to check the Return on Investment (ROI). Assume a 4 person family installs the toilet kit.

Table 3: Total investment cost

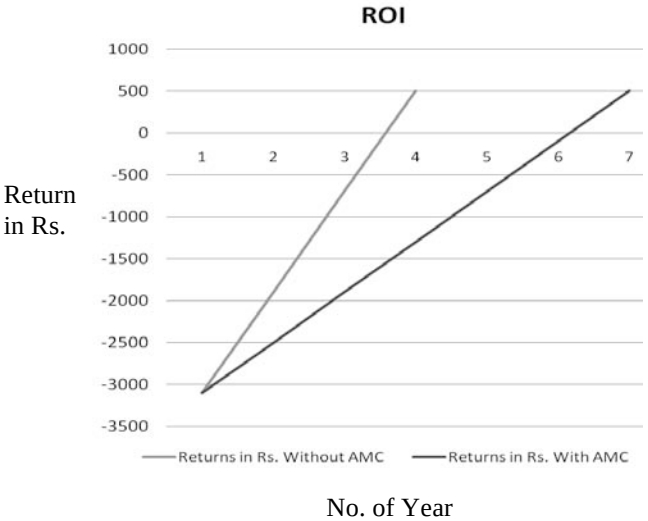
Component	Cost in Rs.
Commode	1000
Platform	700
Containers & trolleys	600
Black box (dehydration)	200
Handles	200
Installation	500
Ash dispensing set	500
Annual Maintenance (Rs.50x12) optional	600
Total investment cost	**4300**

Table 4: Returns

Component	Amount
No. of person in family	**4**
Family faecal collected / annum (50kg / head)	200 kg
Family urine collected / annum (500litres / head)	2000 litres
Market cost of organic fertilizer / kg	Rs. 5
Market cost of urine fertilizer / litre	Rs. 0.10
Money earned from selling fertilizers	**Rs. 1,200**

Thus Return on Investment can be calculated from the graph. (Figure 18)

Figure 18: Graph of Return on Investment



Return in Rs.

No. of Year

Thus it will take around 6 years to achieve the break even point for the user with the Annual Maintainence contract being used. If the AMC is not used the ROI can drop down to 3rd year. Thus this product is very much viable even for a middle class Indian user.

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About the author

Parag Deshpande, a freshly graduated Master in Product Design from M S Ramaiah School of Advanced Studies, Bangalore (affiliated to Coventry University, U.K.). A creative think tank with basic educational qualification of mechanical engineering makes him a perfect blend of artistic engineer. His passion and dedication for environmental well being and green design made him choose the topic “Design of Sustainable Toilets for Rural and Urban India” for his final year Master degree project. He is now looking forward to work in the field of strategic design management for sustainability.

the Learning Network on Sustainability

Evolution of sustainable design

An analysis of sustainable design awards

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Sustainable design evolution mirrors development of priorities in sustainability in society and in design profession. Design researchers chronicle evolution mainly through scholarly writing as published in peer reviewed journals. A different method of tracing evolution is to trace the importance attached to a new concept within the profession. Design profession embraced the concept of sustainable design relatively recently in its evolution. Any new area within a profession, like sustainable design within the design profession, gets recognition when government or professional bodies constitute awards specific to this new emerging area. At present, the design profession across several countries promotes and incentivizes development of sustainable design through specific awards directed at designers creating sustainable products/designs/services. These awards evolve over time reflecting changing societal interests as well as professional goals. In addition to monetary part of the awards, prestige and recognition ensures that designers want to compete and win these awards. Prestigious awards announcement is a culmination of several processes that ensure the prestige of the award. Composition of the committee to decide on the awards, the award categories, criteria for eligibility, short-listing and final selection, the profile of individuals or organizations selected as winners, the kind of products/designs or services selected together illustrate the nature of evolution of a profession. The same can be the case with sustainable design awards. This paper attempts to analyze three major sustainable design award competitions across three continents in the world. The paper will use the various dimensions (mentioned above) to analyze the awards. The goal is to trace the evolution of sustainable design across categories over the recent past. The analysis also can throw light on the differential emphasis (if any) on the components of sustainable design across continents..

Sustainable design awards (Sung et al., 2009) provide a glimpse of how design practitioners have taken to sustainable design. Organizers of these competitions provide the basis on which designers can compete and earn their reputation. Contests for awards provide opportunity for corporate sponsors to understand current thinking in sustainable design community. It also helps display their designs for institutional/individual consumers. The award jury would represent individuals who have spent considerable time in practice/research. Thus, awards and competitions provide apt platform (Sagalyn, 2006) for understanding latest developments in sustainable design. The word" sustainable' is of recent usage compared to green, eco, or environmental. The idea of this paper is to find the extent of sustainability incorporated in the sustainable design awards. This helps in tracing evolution in practice of this discipline. The objectives of this paper are threefold. First is to distinguish between the different interpretations of sustainable design. Secondly, tracing sustainable design evolution through awards/competitions/contests across continents and finally to understand changes in evaluation criteria/categories used for these awards.

Interpretations of sustainability

Sustainable design rests on three dimensions namely environmental, economic and social dimensions. Product/service design that takes care of all three dimensions optimally caters to sustainable design. Researchers and practitioners use sustainable design as a concept increasingly in built-space context(Garde, 2009). Here, sustainable design refers to low-cost buildings that use natural resources like ambient air, water and sunlight, efficiently. Low energy/materials use and minimum damage to natural environment surrounding the building are major focus areas. Green buildings and LEED certification have become the norm for sustainable built-environment(Garde, 2009).

Environmental sustainability has exceeded other sustainability dimensions in its significance in sustainable design. Economic and social sustainability (Pitt and Lubben, 2009) have not received the desired importance. A growing field of literature emphasizes on systems approach in design (Findeli, 2008). This view considers product-service system as the right entity for understanding sustainability. Service oriented view is replacing product-centric view of design. Here focus is on how services from a single product can reduce product ownership, proliferation and waste. An example is neighbours sharing small power tools that they individually use infrequently. Literature discusses less of sustainable services (Coley and Lemon, 2009) compared to sustainable products.

Sustainable product design emphasizes materials use reduction, renewable materials reuse and product recyclability. Sustainable services lay stress on economic/social sustainability. Researchers value affordability/social effects in measuring service sustainability. Sustainable design relates to also lesser energy use, using fewer limited resources, not depleting natural resources, not directly/ indirectly polluting environment, and products reused/recycled at the end of their useful life(Mclellan et al., 2009). Environmental health, economic profitability, and social/economic equity are the new aspects getting prominence in sustainable design. In a sustainable building design, protecting occupant health and improving employee productivity, reducing waste/pollution and environmental degradation is important (Marshall, 2009). At a higher level, sustainable urban planning takes care of buildings, mobility and waste disposal for an entire area. Sustainable urban planning has become crucial, as analysts project that more than 50% of world's population would live in cities in another 25 years

A key constraint due to these interpretations of sustainability is tracing the evolution of the discipline.

Tracing disciplinary evolution

Scientific research as published in professional journals, philosophies of great thinkers and changes in practice over a period help us in tracing evolution of any discipline. Thus, common modes of evolution tracing are analyzing journal articles within a discipline or articles written in the popular press that reflect opinions and practice (Ruhl, 1998). In the design discipline, new designs are a combination of research, philosophy and changes in practice. These designs as entries for competitions thus reflect cutting edge of discipline and its growth. Tracing awards/competitions in sustainable design therefore acts as the right method for evolution of this relatively new discipline.

The concept of sustainability developed in three waves (Findeli, 2008) . The first wave was during the 1960-70 when emphasis was on energy efficiency and use of recycled material. In the 80s, green and eco-design became prominent where products' environmental impacts were the focus area. The Brundlandt report introduced the word sustainable development. Design became global in this stage. Moreover, emphasis shifted from only products based design to systems/services design. Social and ethical concerns added to sustainability dimensions. These two new dimensions of sustainability got greater scope and focus in the Kyoto protocol.

Design competitions

Competitions are a method of bring out the best in any discipline. They provide awareness about a new discipline. For private sector players, competitions provide ideas about future professional thinking for a product/service or in the discipline. For participants, competitions provide a platform for displaying their talents. It presents an opportunity to create awareness about their creations to a broader audience. Recognition through prizes in competitions can help in developing participants' careers. Contest organizers can

be different organizations. A professional organization holding a competition for a long period can help in tracing changes in the profession. Established contests can facilitate analyzing changes in participant profile and criteria that reflect professional developments.

Design competitions have been in vogue for a long period. Many design competitions were earlier either based on building or product design. However as the sub disciplines in design grew, there have been competitions for different categories under design individually. One can classify design competitions into different types based on a combination of factors that define a competition.

Types of design competitions

Design competitions are of various types. They differ based on the following

Design fields – Several design competitions have different categories corresponding to the different sub fields of design like industrial design, graphic design etc. In sustainable design, design could represent a product/building/ concept/system.

Participants – Nature of participants (Sagalyn, 2006) decide the intensity of competition. Student competitions can be less rigorous compared to competitions in which professionals or organizations can participate. Team participation representing an organization compared to individual participation can result in a different level of competition. Competitions open to the public have larger participation if competitions permit a less rigorous evaluation of the design and greater prize money.

Presence on the net – Competitions that provide information access on internet facilitate better information access. This is especially true as search and retrieval is better from the net. Moreover, many miss award deadlines if they do not track competitions regularly on other media like print/audio visual media. Another advantage is access to archives. Competition organizers providing nominees/ prize winners information of past years on the net along with criteria and other rules of participation help in attracting quality participation.

National/ international – competitions can be national or international depending on the sponsors or objectives of competition. National competitions help in identifying national talent. Nevertheless, if international participation enhances competition's prestige(Sagalyn, 2006), with adequate funding, international contests become popular. It helps in benchmarking local with international designs. It brings out various cultural and social factors that can have an influence on design.

Objective – Objectives of competition can vary (Fu and Lu). It could be sourcing ideas to award the best design. It may be a one-time contest aimed at identifying the best design for a building/ logo for a corporate entity. It could be a professional organization's regular effort at highlighting professionals and their designs every year. It could also be to develop a repository of designs representing different views on a theme. Objective of the competition tends to broaden or narrow the scope of competition.

Promoters – Several organizations such as government, industry, academics and, professional associations can sponsor /promote competitions. Competition sponsors/promoters (Sagalyn, 2006) align them to their organizations' objectives. Government/ quasi-government organizations may promote design as a way of encouraging local/international design talent. Industry/professional association may also view commercial propositions from sponsoring competition. Associations may monetize ideas available with design competition entries. Facilitating good design is also possible with the clubbing of final awards ceremony with industry/ professional gathering. Academic organizations like design schools are interested in sponsoring design competitions to provide an opportunity for students to interact with professionals in their field. Thus, students get an opportunity to learn first hand through face-to-face interaction with competing participants on design development.

Prizes awarded – Competitions awards monetary and non-monetary incentives (Yanco, 2002). Large monetary incentives and high prestige attached to getting an award spur potential competitors. Thus, incentives make a difference on the quality and quantity of participation.

Jury – Jury can judge competitions using multiple types of evaluation(Yanco, 2002). There could be initial screening based on publicized criteria. In some cases, awards committee does not transparently reveal evaluation criteria. In many cases, several different jury members (Sagalyn, 2006) like members representing industry, professional design associations and academics along with a selected audience/general public can choose awardees. Thus, judging process and jury make a difference in awards

Methodology

A Google search using the terms sustainable design awards, contests, competition, green, environmental and eco design competition yielded a list of entries. In addition, the top 22 design award programs (Sung et al., 2009) for product design were considered. A list of awards in the ICSID website for design also was matched . From the final list of competitions arrived from each of these sources, three competitions were selected based on the following criteria

1. They must be industrial/product design and not building design alone as many sustainable design competitions deal with building/architectural design
2. A history of at least 5 years for the competition to be included
3. At least one competition that represents each developed world region.
4. Competitions that have a specific sustainable product/service/system design award and not ones that include sustainability as one of the criteria.
5. Archival information is available on the internet freely accessible.

Based on these criteria, three competitions namely Japanese G mark awards European business awards for the environment and United States Environment protection Agency (EPA) P3 awards were chosen.

Analysis and Findings

Japanese G mark

Japan Industrial Design Promotion Organization promotes the Good Design Awards. This award was instituted in 1957. Interestingly, this award system came from the confidence that design can be a solution to poverty. Good Design Awards receives approximately 3,000 submissions from more than 1,000 companies and designers every year. About 70 design experts, are involved each year in award selection process

The G mark awards started with two categories of prizes related to sustainable design namely social conscious product and a special prize for an ecology conscious product in 1995 and continued in 1996. In 1997, this award was termed the ecology design prize and it continued until 1999. In 2000, G mark introduced two new categories related to sustainable design namely social use product and new territory design. While the former was for a product, the latter was for a futuristic service system that was sustainable. In 2001, G Mark brought in a change again. Product category/family use and new frontier design were the new categories. While G Mark did not make these distinctions in 2002, awards in each category differed from 2003 to 2007. In 2008, the award introduced the term sustainable design award. Three products received this award and the same continued in 2009.

G mark uses humanity, honesty, innovation, aesthetics and ethics for its basic screening of entries for the awards. In addition, emphasis is also on creativity, insight, conceptual abilities, imagination and intellect. There two levels of screening for the award, while the first level is based on the information presented in the entries. The second screening is based on jury interacting with designers whose products/services/concepts are on display. A key advantage is the clarification of all the award process stages on the website.

An aspect that clearly comes out from the changes in the award is that sustainability was a social and ecological concept right in the beginning but was divorced from each other. Later importance of social consciousness waned and environmental dimension became dominant. From year 2000 onwards, in the new millennium, social consciousness is visible back again. Another development is acceptance of product service system with introduction of an award for new frontier/territory design. The awards use the specific term sustainable design only for the past 2 years.

European business awards for the environment

The European Business Awards for the Environment recognize business organizations' contributions to sustainable development. They reward sustainable policies, practices, processes and products of business in the European Union. The awards are in four categories: Management, Product, Process, International

Co-operation and Sustainable Development. These awards are for business organizations in European Union. They are being awarded from 1990 onwards, biennially.

In 1990, there were three categories of awards namely good environmental management, clean technology, eco product and environmental technology transfer. In 1992, awards had an additional category namely waste recovery. In 1994, awards added one additional category namely chairman's special recommendation. In 1996, awards committee renamed categories as cleaner technologies, eco-design, managing towards sustainability, recovery of waste and partnerships for sustainable development. They retained the chairman's special recommendation. While other category awards remained, there was no chairman's special award in 1998. In 2000, again, the committee renamed categories as management, product, technology, international cooperation awards for sustainable development. In 2002, the awards had a change of category name from technology to process. The award categories have remained the same for the last 3 years.

Each of the categories of the award has a independent jury and for the international cooperation award, the entire team evaluates the entries. The criteria for selection are different across the 4 different categories. The common criteria for product, process and management categories are commitment, social, economic and environmental benefits and replication potential. In the case of international cooperation, the criteria include planning and resource allocation, synergy, and equity.

As is the case with Japanese awards, initially environmental sustainability remained main stay of the award. However, by 1996 itself we see introduction of the term sustainability. Chairman's category was a new category for rewarding exceptional cases, which awards in the regular categories could not accommodate. Waste recovery represents a significant focus on waste in sustainability discourse during that time. The theme of awards across years however has remained the same namely management, product, process/technology and partnership.

Unites States Environmental Protection Agency (EPA) P3 competition

P3 means benefiting people, promoting prosperity, and protecting the planet. P3 Award is a student design based competition. It has been active since the year 2005. American Association for the Advancement of Science (AAAS) judging panel gives final ratings for student design and recommends them for the award. EPA takes the final decisions for the award. The award operates in 2 phases. Phase1 involves submitting a project proposal for a grant of $10,000 by a student team for a sustainability project along with a faculty advisor. After developing product/service based on the project, they are displayed in the National Sustainable Design Expo organized by EPA. The jury (at least two of them) evaluates each of the displayed products. Winning the P3 Award and receiving additional funding ($75,000) constitutes Phase II of the P3 program. Phase II provides support to further develop designs, implement them, and move them to the marketplace.

The projects are across seven categories namely agriculture, built environment, eco systems, energy, information technology, materials and chemistry and water. Most of the entries at the phase1 or phase 2 stage for the past 5 years have dealt with problems in sustainability from an environmental perspective and also as an educational tool as per the requirement of the award. They are either designed as products/processes solutions increasingly solving problems in developing countries. This indirectly represents social and economic dimensions of sustainability.

Conclusions and Directions for further research

Three different continents represented by USA, Europe and Japan have different approaches to sustainability. Though the competition represents different target segments namely designers in general in Japan, businesses in Europe and student teams in USA, their common theme is sustainability. The G mark system is product based but has increasingly started encouraging services and frontier areas in sustainability. Awards for future product-service systems and concepts exhibit this approach. The European awards have been special in recognizing the international cooperation dimension. This helps in cross-fertilization of ideas and helps in reducing duplication of efforts. On a global basis, this award helps in fostering global solutions to sustainability problems rather than local or country specific solutions. A student driven

competition fostering cooperation with developing countries and focusing on sustainability is a useful effort in instilling sustainable values. The US EPA P# competition achieves this objectives

The brief history traced of sustainable design through competition shows that sustainability is still mainly product-oriented and physical environment effect focused. Recent years have seen the change towards inclusion of the social and economic components of sustainability. More specifically social dimensions of sustainability have been either considered indirectly or not explicitly in great detail.

This paper analyzed three sustainability contests targeting dissimilar segments across three continents. Another limitation is that it considered information available only on the web with archival information for the past 5 years. An extension of this work could be analyzing all the design competitions and understanding when sustainability crept in as one of the criteria for evaluation. Representations of more contests, countries and a longer period will add greater depth to this research. Comparing similar competitions across the globe can also throw light on the exact time period of the shift to different levels of sustainability.

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the Learning Network on Sustainability

Application of ecodesign strategies amongst Australian industrial design consultancies

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By promoting and applying ecologically sustainable design (ecodesign) strategies in the product planning stage, industrial designers can have significant influence on reducing the environmental impacts of products. Despite this potential, there remains little quantitative analysis of the awareness, application and influence of ecodesign praxis amongst industrial designers. This paper presents a comprehensive content analysis of the websites of 96 industrial design (ID) consultancies in Australia, probing for evidences of ecodesign application in each company's capability statement and project portfolios. Our study found that that less than half of consultancies visibly promote their ecodesign activities on websites.

Reducing the environmental impact of our consumption through the development of appropriate products is one potential facilitator for a necessary shift towards a truly sustainable society (Schmidt-Bleek, 1999). A considerable body of literature is available for product developers who are willing to consider ecological aspects. Industrial designers are significant actors in most product development processes; therefore they have significant potential to contribute to the reduction of the environmental impact of new products. The ecodesign manual by Brezet and Van Hemel (1997) which is addressed, amongst others, to industrial designers, offers 8 strategies and 33 sub-strategies to improve the environmental performance of products throughout their lifecycles (see Table 1).

The literature suggests that early integration of ecodesign during product development guarantees the best economical and ecological outcome (Giudice, et al., 2006; Tischner, et al., 2000). The product development process can be divided in two major phases: the product planning phase and the strict development phase (Melgin, 1991; Roozenburg & Eekels, 1995). During product planning the goals, strategies and policy for the product development are formulated, and ideas for a new product or business are generated and selected; on the other hand the strict development phase involves designing the product and developing plans for producing and marketing the newly designed product.

There is ambiguity in the role of industrial designers in this process; studies suggest that they can ably contribute to both phases (Bakker, 1995; Roozenburg & Eekels, 1995). Bakker (1995) differentiates those industrial designers who work on product planning tasks as taking on a "strategic" role while those in strict development activities are engaged in an "operational" role. She stresses that the particular role industrial designers play in the product development process is crucial to the extent they can implement ecodesign. Lofthouse (2004) asserts that the majority of designers perform operational roles. However Weiss (2002) observes that industrial design (ID) consultancies are increasingly taking over strategic tasks. To what extent they do so is unclear and will be explored in this paper.

Table 1: Ecodesign Strategies

Source: Brezet and Van Hemel (1997)

	Strategy	Sub-strategies
@*	New concept development	Dematerialization, shared use of product, integration of functions, functional optimization of product components
	Product component level	
1	Selection of low impact materials	Cleaner materials, renewable materials, lower energy content materials, recycled materials, recyclable materials
2	Reduction of materials usage	Reduction in weight, reduction in transport volume
	Product structure level	
3	Optimization of production techniques	Alternative production techniques, fewer production steps, lower/cleaner energy consumption during production, less production waste, fewer/cleaner production consumables
4	Optimization of distribution system	Less/cleaner/reusable packaging, energy-efficient transport mode, energy-efficient logistics
5	Reduction of impact during use	Lower energy consumption during use, cleaner energy source, fewer consumables needed, cleaner consumables, no waste of energy/consumables
	Product system level	
6	Optimization of initial lifetime	Reliability and durability, easier maintenance and repair, modular product structure, classic design, strong product-user relation
7	Optimization of end-of-life system	Reuse of product, remanufacturing/refurbishing, recycling of materials, safer incineration

* This strategy has been given the symbol '@' because it is much more innovative than the seven other strategies

Australian context for ecodesign

Like most industrialised countries, Australia has a vivid ID community. Eleven universities offer courses in industrial design or product design. There are over 90 Australian ID consultancies providing local and global manufacturers with expert design advice and directions. Several design festivals and international trade exhibitions are clear indicators of an active design scene.

From 1994 to 1997, the Australian Government funded the EcoReDesign™ program, which brought together Australian designers, researchers and businesses to rethink products for a greener market. Coordinated by the Centre for Design (CfD) at the Royal Melbourne Institute of Technology (RMIT), the program explored the application of life cycle assessment, design for assembly and cleaner production techniques in order to optimize the environmental and economic performance of products. Seven Australian manufacturers participated in the program, which resulted in a series of products demonstrating that the environment can be viewed as an opportunity for creative yet sustainable activities, and not as a threat (CfD, 1997). Even though the EcoReDesign outcomes were perceived as a success by its participants (Sweatman & Gertsakis, 1997) and mentioned as positive examples in ecodesign literature overseas (Tischner, et al., 2000), the program did not continue beyond its 3-year funding. Reflecting on the program's success a decade after its launch, Ryan (2003) concludes that the EcoReDesign™ program did not have a significant impact on the design of mainstream Australian products, blaming this mainly on a weak legislative framework.

Ecodesign praxis

Reports about the state of application of ecodesign in Europe and Asia (Charter, et al., 2003; Lindahl, 2007; Mathieux, et al., 2001; Tukker, et al., 2001) support Ryan's (2003) conclusions about the importance of a progressive legislation as a powerful driver for ecodesign. All conclude that ecodesign praxis has not yet reached maturity. The studies mainly focus on management and engineering departments of manufacturing companies and do not pay specific attention to ID practitioners or ID consultancies.

Ecodesign literature specifically addressing the ID discipline largely focuses on information needs of industrial designers and/or suggests tools and strategies for practising ecodesign (Bakker, 1995; Datschefski, 2001; White, 2004; White, et al., 2000). Some exceptions to this trend are described below.

Studies from the UK and Japan dealt more with the actual state of ID involvement in ecodesign praxis. Sherwin (2000) and Lofthouse (2004) investigated in the role of industrial designers employed at Electrolux in ecodesign. Other research from the UK, based on surveys, conducted in the mid-1990s, showed little ecodesign awareness and praxis amongst ID practitioners (Sherwin, 2000). They survey of Ueda et al (2003) among Japanese industrial designers, mostly employed in product design departments of manufacturing firms (and some working in ID consultancies), identified a gap between the designer's personal attitude towards ecodesign, described as proactive, and their actual actions, classified as reactive, to the strong Japanese guidelines. Furthermore the Japanese designers showed little awareness of ecodesign sub-strategies expressed in the literature. Tools like LCA (life cycle assessment) did not find broad application. Japanese industrial designers focused on "operational decisions such as production, material and disposal, yet no strategic decisions" (Ueda, et al., 2003). The most prominent drivers for ecodesign identified in this study are feelings of social responsibility towards the environment and market opportunities.

No study was found specifically considering the role of the ID consultancy as different to the role of employed industrial designers. Specifically for Australia there was no research found that attempts to quantify the extent of ecodesign praxis in ID consultancies.

Research Aims & Methods

This paper aims to clarify the extent to which Australian ID consultancies practice and promote ecodesign. It will also investigate the role that industrial designers have within the product development process in general as well as in implementing ecodesign.

To achieve these aims the contents of the commercial websites of Australian ID consultancies were analysed in depth and interpreted. This involved firstly compiling the web addresses of the ID consultancies from Google searches and from international and Australian databases as www.core77.com, www.yellowpages.com.au, www.dia.org.au and www.australiandesign.org.au. ID consultancies without a website and companies not focused on product development services were excluded. Ninety-six websites were considered valid for the study.

Commercial websites are a key vehicle for communicating the corporate profile (Capriotti & Moreno, 2007). These give insight into the services that the design consultancy offers and the arguments used for advertising these services. A limitation of the website based approach is that the website is not the only way for ID consultancies to advertise their services. Portfolio presentations by consultancy representatives are likely to deliver a more complete picture. However, as Capriotti and Moreno (2007) point out, companies usually extensively communicate corporate responsibility issues such as environmental action on their website.

It has been discussed earlier that the activities conducted by industrial designers can be seen to fall in two major phases of the product development process (Roozenburg & Eekels, 1995). These phases served as the framework for this paper. To locate the role of the ID consultancy in this process, the services described on the websites were compared with this framework. Building on the terminology introduced by Bakker (1995), consultancies offering services for the product planning phase are labelled as strategic and those who engage during the strict development phase are termed operational. For those consultancies that offer services in both phases, the terminology holistic is used.

To identify the involvement of the ID consultancies in ecodesign, their websites were checked for 7 criteria, summed up in Table 2. Application of the various ecodesign strategies and sub-strategies [Table 1] outlined by Brezet and Van Hemel (1997) were noted in the work examples displayed on the websites, as well as in consultancy's statement of capabilities. Moreover, affiliation with any environmentally conscious designers' coalitions was noted.

Table 2: Checklist for ecodesign involvement

Criteria	Measure
Indication of awareness about ecological sustainability	Yes / No
Explicit mention of ecodesign strategies as a capability	Yes (Specify which) / No
Examples of work that have been designed using ecodesign strategies	Yes (Specify which) / No
Ratio of ecodesign examples to overall products shown in portfolio	Ratio
Support/tools used for practising ecodesign	Yes (Specify which) / No
Affiliation in environmental conscious associations for designers	Yes / No
Arguments for promoting ecodesign	Yes (Specify which) / No

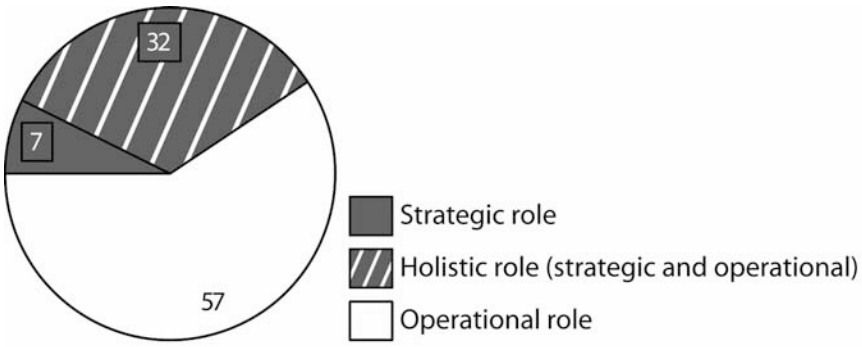
Findings

Not all the links to Australian ID consultancies found in the online databases were usable for the data collection. Sometimes ID consultancies were registered several times, and in some cases the website no longer exists. Out of 160 entries at www.core77.com only 56 websites were acceptable. In total 96 valid websites of ID consultancies were found.

The role of Australian ID consultancies

A little over half of the investigated ID consultancies (n=57) only offer services for the strict development phase and are therefore classified as working in an operational role. Thirty nine ID consultancies who offer services in the product planning phase were found. Seven of those do not offer services for the strict development phase and are hence classified as working in a strategic role. The other 32, who offer services for both product development phases are classified as holistic [see Figure 1].

Figure 1: Roles taken by industrial designers in consultancies



Ecodesign praxis

Almost half of the ID consultancies (43/96 = 45%) indicate some aspects of promoting their environmental awareness. Three of them also communicated their engagement in social sustainability. How the ID consultancies expressed their environmental awareness is indicated in Figure 2. Nineteen showed examples of their ecodesign projects in their portfolio, but do not specifically point out ecodesign as one of their company's capabilities. A further thirteen showed ecodesign examples as well as explicitly mentioned ecodesign strategies in their service offerings. Notably the ecodesign strategies from the capability statements do not always match the ones applied in the examples. Nine consultancies alluded to ecodesign strategies in their capability statement but do not show any examples. Two companies highlighted their environmental awareness, without showing evidence of environmental projects in their portfolio or mentioning ecodesign strategies in their capability statement. One of those two claims to be car-

bon-neutral. Among those who showed ecodesign examples in their portfolios, the average ratio of conventional products to ecologically designed products is 25:3.

Figure 2: Indication of environmental awareness in websites

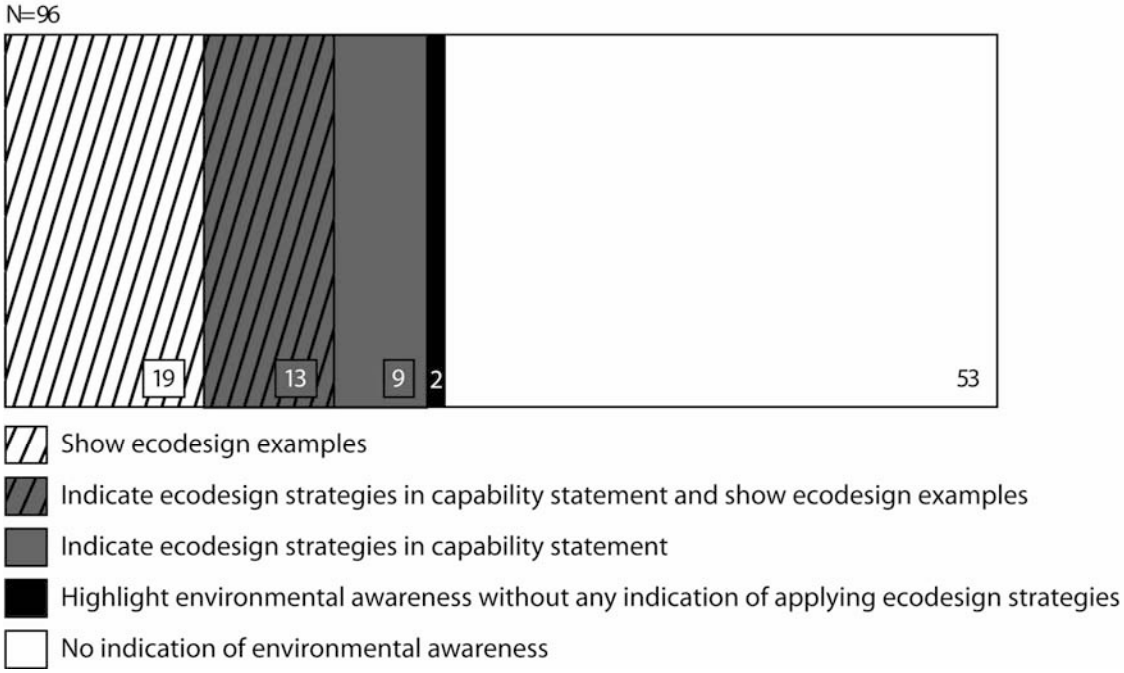


Figure 3 shows the number of ID consultancies that advertise and/or apply a specific ecodesign strategy, as indicated by the overall bar lengths. The structure in the bar gives insight on how evidence for them was found on the websites:

- The dark grey section indicates those only showing examples of a particular ecodesign strategy.
- The white section represents those who advertise each ecodesign strategy in their capability statement
- The light grey section denotes those that advertise a certain ecodesign strategy and actually apply it in an example exhibited in their portfolio.

The study did not find a single ID consultancy that covers all the 8 ecodesign strategies in its capability statement. Keywords related to the strategy “new concept development” to reduce the environmental impact – such as dematerialization, shared use, functional integration or optimization – were never mentioned. However, examples on four websites show new product concepts to fulfil a consumer’s need in a less environmental harmful way. Adding the ecodesign strategies applied in examples and those advertised in the capability statements, only one ID consultancy was found to communicate coverage of all ecodesign strategies. The most popular ecodesign strategy is “selection of low impact material”. The other widely used strategies are: “reduction of impact during use”, “optimization of end-of-life system” and “optimization of initial life time”. A selection of the descriptive statements used to communicate these prevalent strategies is shown in Table 3.

Figure 3: Application of ecodesign strategies

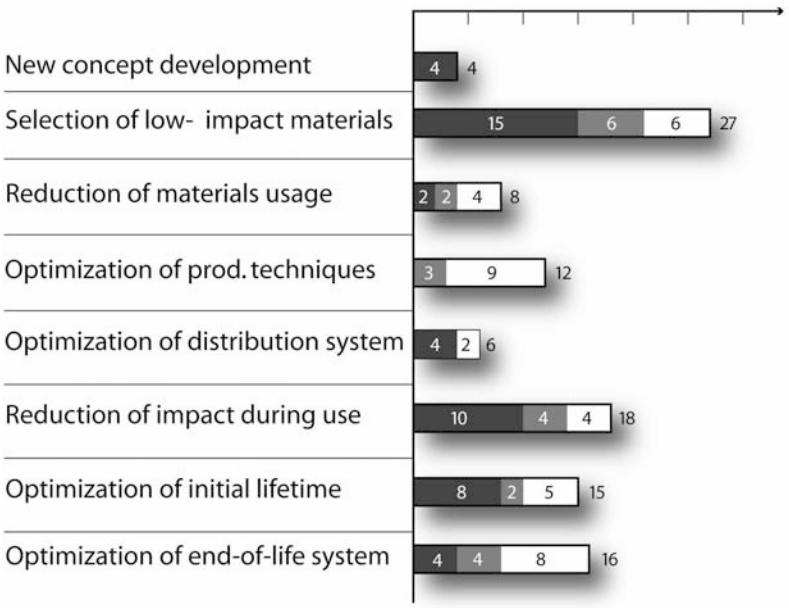


Table 3: Language used to communicate use of ecodesign strategies

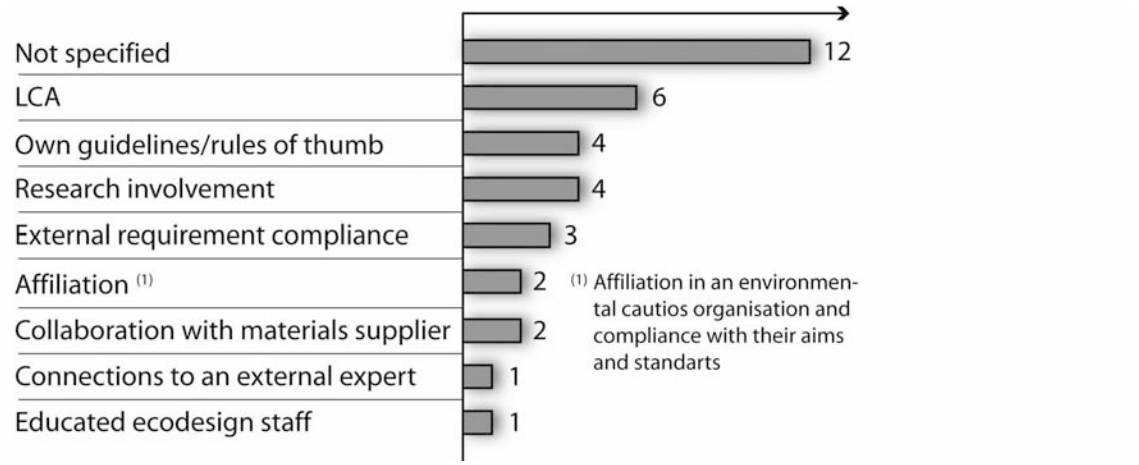
Ecodesign strategy	Examples of quotations
Selection of low impact material	"made of bioplastics from a variety of renewable resources" "made from virgin and recycled wool" "made from 100% recyclable polymer" "created from 100% post consumer recycled content" "made from recycled cardboard"
Reduction of impact during use	"solar powered LED light" "inbuilt solar panel for extraordinary battery life" "uses an energy efficient fuel cell" "uses a halogen energy saver" "the burner was designed to burn efficiently"
Optimization of end-of-life system	"designed for disassembly" "will degrade once you put it on a landfill" "can be broken down into raw materials for recycling quickly and efficiently" "made from 100% recyclable polymer" "using high quality poly carbonate makes the glasses... 100% recyclable"
Optimization of initial life time	"stainless steel, being a durable material" "components are repairable rather than replaceable" "scratch resistant" "physically durable" "personalising ... would encourage people to 'own' and re-use"

Ecodesign support/tools

The ID consultancies that only showed ecodesign examples on their websites do not specify the support/tools they use for practising ecodesign. Therefore the data about the support/tools was collected only from the 22 ID consultancies who explicitly mention ecodesign as one of their capabilities in their service offering statements. The number of Australian ID consultancies using various support/tools is indicated in Figure 4. The majority do not give evidence of any support/tool. The most popular tool, mentioned by 6 consultancies, is LCA (life cycle assessment). One design office works with an external expert for its LCA needs. Two ID consultancies use the Greenfly LCA tool (www.greenflyonline.org) developed by the Centre for Design at RMIT. Ten consultancies are members of the Designers Accord (www.designersaccord.org), an international agreement among designers, educators and business leaders to catalyse innovative and sustainable problem solving throughout the creative community. Two of them

point out that their concordance with the Designers Accord principles helps their efforts in ecodesign. Involvement in academic research, as a way of fostering ecodesign, was mentioned by 4 ID consultancies. Three of them specify RMIT as their academic partner. Four ID consultancies have developed their own guidelines or rules of thumb.

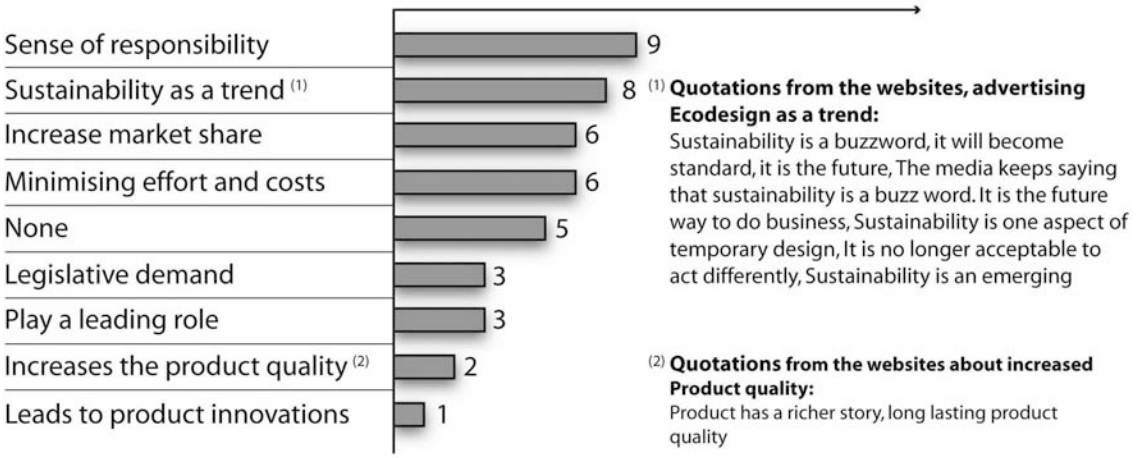
Figure 4: Ecodesign support/tools in capability statements (n= 22)



Arguments for Ecodesign

The information about the arguments used by ID consultancies to promote ecodesign was drawn from the 22 websites that explicitly mention ecodesign as a capability of the consultancy. How many thereby use which arguments is indicated in Figure 5. The most popular argument for ecodesign is "sense of responsibility" towards the environment and future generations, closely followed by highlighting (ecological) "sustainability as a trend". This trend and its implications do not get specified further (see quotations). Legislative demand, playing a leading role, product quality enrichment, and sparking product innovations also surfaced as drivers for pursuing ecodesign activities.

Figure 5: Reasons for pursuing ecodesign (n=22)



Discussion

The role of the Australian ID consultancies

ID consultancies in the United States are increasingly playing strategic roles in the product development process (Weiss, 2002). We did not find comparable data about this trend for Australia. Lofthouse (2004) identified that industrial designers employed in a manufacturing company typically spend 90% of their time focussing on the operational end of design. Our findings show 40% of the Australian ID consultancies represent themselves in a holistic or a strategic role. This can be seen as an indication that ID consul-

tancies can take over a more strategic role in the product development process than industrial designers employed in manufacturing firms. One reason for this may be that the role of ID consultancies as external consultants differs from the one of internally employed industrial designers. Another explanation for this may be the fact that ID consultancies employ not only industrial designers but also specialists from other disciplines. This might give them the possibility to cover a broader range of product development services.

Ecodesign praxis among Australian ID consultancies

In their advertised projects and capability statements, the majority of Australian consultancies did not demonstrate evidence of the broad range of ecodesign strategies and sub-strategies that are discussed throughout the scientific literature. This is similar to another study that concluded that Japanese industrial designers mostly lack familiarity with ecodesign principles (Ueda, et al., 2003). The presence of own rules of thumbs and guidelines for ecodesign on the websites of the ID consultancies insinuate that ecodesign praxis appears disconnected from ecodesign theory. Interestingly the strategy "new concept development" is the most underrepresented ecodesign strategy and completely absent from all capability statements.

One reason for this can be that the new concepts could have been planned by the client without involving designers. It can be noted that of the 39 consultancies who took on strategic or holistic roles in product development – and who are in a good position to suggest new environmentally responsible concepts – more than half (n=23) advertise ecodesign. Some of them even state that reducing the environmental impact of the products they design is one of their core concerns. The absence of the strategy "new concept development" might suggest that they are not aware of their full ecodesign potential. Most ecodesign literature underlines that only those new concepts that fulfil our needs in less environmental harmful ways have the potential to significantly reduce impact (Sherwin, 2000).

Ecodesign theorists stress the importance of early integration of ecological considerations in the design process (Tischner, et al., 2000). By far the most popular ecodesign strategy among Australian ID consultancies is "selection of low-impact materials". Similar findings were obtained by studies covering other industries: Van Hemel and Cramer (2002) highlighted that among the most successful solutions in SMEs were "recycling of material" as well as "recycled material". However, since materials selection happens later in the product development process (Roozenburg & Eekels, 1995), it appears that the suggestion of early integration of ecodesign is rarely followed.

Especially regarding environmentally aware ID consultancies in an either strategic or holistic role this is interesting. It may indicate that their role is rather operational in the context of ecodesign, making it difficult for them to integrate ecodesign in earlier phases of the product development process. Similar findings in Japan show that industrial designers are personally aware of the need to develop new concepts but do not transfer this to praxis (Ueda, et al., 2003). Another explanation for that may be that ID consultancies are simply not familiar with other possible ecodesign strategies, and that the "selection of low-impact materials" is the most obvious to them. For applying this strategy, the use of either recycled or recyclable material was pointed out by most ID consultancies. As theoretically almost any material can be recycled with enough effort (Ayres, 1999), it is questionable how effectively this strategy gets applied.

Nowadays, many products end up in landfill before they actually reach the end of their useful life. To improve this unsustainable situation, ecodesign literature advocate designing for long-term emotional attachment between the user and the product (Chapman, 2005; Mugge, et al., 2008; Van Hinte, 1997). Anticipating and influencing the emotional functions of a product via its form and appearance may be considered as one of the core competencies of the ID profession. However, emotional attachment is only mentioned by two ID consultancies for the strategy "optimization of initial lifetime"; most point out physical robustness and reparability of their products [Table 3]. Certainly durability attributes can be influenced industrial designers, but appear to be more a core competency of engineering disciplines.

Regarding the examples for the strategy "reduction of impact during use", it is in many cases questionable how far the ID consultancy contributed to the product's reduced environmental impact. For this ecodesign strategy, many ID consultancies highlighted the low energy consumption of electrical components in their devices [Table 3]. Davis and White (2003) assert that industrial designers have little influence on the design of internal components like PCBs or electric motors. They may be able to choose from different components or to relocate their position in the product, but it is unlikely that they would actually design less energy-intensive electrical components. For this strategy and that of "optimization of initial lifetime", it again appears that consultancies are unable to seize the full potential that industrial designers can exert in ecodesign. A reduced impact during use can, in many cases, be achieved by positively influ-

encing the product usage and behavioural patterns of the final consumers. The industrial designer can have a major role in planning how users would interact with their designed products, so it is somewhat surprising that this sub-strategy rarely gets mentioned.

Arguments for Ecodesign

The communication of supporting arguments for the consultancy's use of ecodesign appeared unstructured. None of the ID consultancies explicitly listed the drivers for ecodesign that could potentially make their services more attractive to clients. This contrasts with the ecodesign literature, where extensive lists of drivers for ecodesign can be found (Brezet & Van Hemel, 1997; Lewis, et al., 2001; Tischner, et al., 2000; Wimmer, et al., 2004).

Interestingly, the most popular argument used for promoting ecodesign is not minimising effort and costs but sense of responsibility. This matches findings in Japan, where sense of responsibility and market opportunities are listed as the most important motivators for ecodesign (Ueda, et al., 2003). In the United States, industrial designers identified cost analysis as the most effective information to convince clients about ecodesign attributes (Davis & White, 2003).

Compliance with legislative demands such as the WEEE (Waste Electrical and Electronic Equipment Directive) or the RoHS (Restriction of Hazardous Substances Directive) was rarely used to encourage client uptake of the consultancy's ecodesign capabilities. This may concur with Chris Ryan's (2003) assertions that the weak Australian legislative framework fails to support ecodesign. However the portfolios of Australian ID consultancies show many products designed for the global market. For these products, conforming with more rigid environmental legislation in Europe and the USA is an issue. It may be that the interventions possible by industrial designers do not have a significant enough impact on the product's properties that are targeted by the legislative frameworks. Especially for the RoHS this is highly likely. Industrial designers might have high influence over the plastic type that is used but low influence over the additives and flame retardants or toxics in electronic components (Davis & White, 2003).

Highlighting sustainability as an important trend is the second most popular argument used for fostering ecodesign. However, this is done in general, broad-sweeping statements and no tangible benefits of adopting this trend are expressed.

Conclusion

This paper contributes to clarifying the extent to which Australian ID consultancies practice and promote ecodesign.

There is awareness among almost half of Australian ID consultancies about the environmental impact of the products they design and the possibility to lessen this impact through ecodesign. Their approaches to ecodesign are mainly focussed on material selection and the integration of ecodesign appears to happen rather late in the product development process. Ecodesign appears far from being a priority for Australian ID consultancies: even the environmentally aware ID consultancies typically showed significantly more conventional products than ecologically designed ones. The sustainable design strategies are communicated in a rather unstructured way, as statements about capabilities in ecodesign often do not match the ecodesign examples shown on the same website.

We showed that almost 40% of Australian ID consultancies are in a role where they can influence the product planning phase. They therefore are in a good position to integrate ecodesign early in the product development process or even suggest new concepts with a reduced environmental impact. In particular, ID consultancies do not seem to realize their full potential for ecodesign, as the "new concept development" for a significantly reduced environmental impact is the most underrepresented ecodesign strategy. Moreover environmentally aware ID consultancies with less influence on the product planning phase did not seem to fully embrace their possibilities for radically improving the sustainability of their solutions.

One barrier that may be hindering ID consultancies from fully integrating ecodesign in their practice may be the identified difficulty in defining and articulating to their clients the tangible benefits of engaging in more environmentally sustainable business approaches. Furthermore legislation appears to currently have a rather weak influence in pushing manufacturers and designers to strongly pursue ecological sustainability in their product development practices. Another barrier might be a lack of knowledge about ecodesign on behalf of ID consultancies and practitioners. Our findings indicate that they might not be aware of all the possibilities they have for ecodesign.

To clarify if the findings are Australian-specific or may be seen as representative for ID consultancies generally, further research in different countries is necessary. This will be covered through the ongoing Master's research thesis of the lead author of this paper.

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the Learning Network on Sustainability

3R practices for municipal solid waste management in developing countries

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Extraordinary emerging consumption statistics from the developing countries (India, Pakistan and Sri Lanka) has clearly indicated the increase waste generation over the past decades. Most of the developing countries are experiencing solid waste management problem in terms of collection efficiency, disposal facilities, limited financial resources and weak policy interventions. Unlike developed nations, final disposal of solid waste in developing Asian countries is usually a matter of transporting the collected waste to the nearest available space for disposal. Moreover, sustainability of landfills has become a challenge in developing countries due to various considerations such as availability of space, technologies for gas capture and leachate treatment, tropical climatic condition and waste characteristics. Plastic and paper wastes are dominating due to rapid economic development. Treating waste as a resource is the first step towards sustainable waste management and conserving resources. As for the biodegradable waste, feasible treatment technologies such as composting and anaerobic digestion with attractive results have been established. The non-biodegradable waste fractions are to be managed by implementing the 3Rs: Reduce, Reuse and Recycle. This article attempts to give a picture of the ongoing 3R implementation in urban municipal solid waste management in developing countries. It was observed that in most of developing countries, informal activities highly dominate due to lack of funding, government initiation, lapse in policy and public ignorance on waste management issues.

This study contributes to an issue on which consensus was reached more than 25 years ago. At the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil, in 1992, 178 governments agreed upon the need for more sustainable municipal solid waste management in both developed and developing nations. Chapter 21 of Agenda 21, the Rio Declaration on Environment and Development, outlines the environmentally sound management of municipal solid waste, which includes maximising the 3R practice (Reuse–Reduce–Recycle) for safe and sound management system.

World population continues to rise with projections nearing 7.2 billion by 2015 (UNEP, 2005). Rapid urbanization accompanies this trend with an estimated two-thirds of the world's people living in cities by 2025. Infact, urban population in developing countries grow by more than 150,000 people everyday (UNDESA, 2005). Although urbanization itself is not necessarily a problem, haphazard and unplanned growth can result in many environmental problems such as public space, air and water pollution, and solid waste generation (UNEP, 2001). Waste materials generated during the production process and consumption process. Municipal solid waste is the most complex solid waste stream, as opposed to more homogeneous waste streams resulting from industrial or agricultural activities. "The increasing volume of waste being generated would not be a problem if waste was viewed as a resource and managed properly" (UNEP, 2001).

The Agenda 21 for Sustainable Construction in Developing Countries is the culmination of a long process aimed at an improved understanding of the challenges of sustainable construction in developing countries, and the formulation of a research and development agenda and strategy for action to ensure that

the contribution of the construction sector to the physical development of developing countries supports the principles of sustainability.

This article attempts to give a picture of the ongoing 3R implementation in urban municipal solid waste management in developing countries. It was observed that in most of developing countries, informal activities highly dominate due to lack of funding, government initiation, lapse in policy and public ignorance on waste management issues.

Methodology

Stage 1 Determining Waste Generation Factors

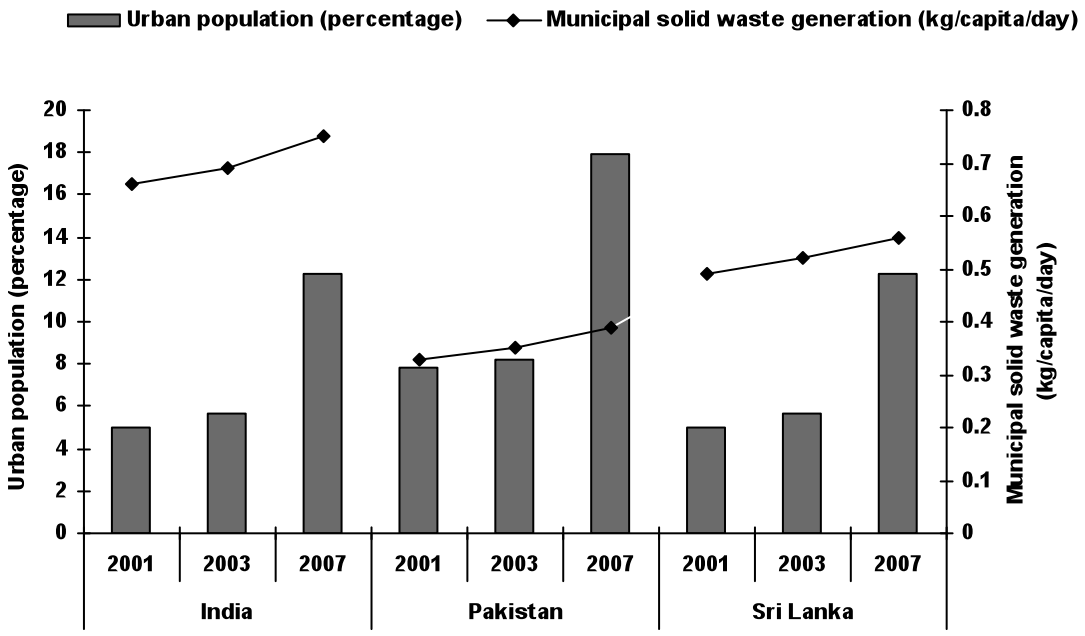
This involved several factors that have significant effect on waste generation. Based upon the past years studies, a relevant set of variables are selected. These are as follows:

Scenario 1 Urbanization

Now days, developing countries are producing MSW at an alarming rate. From the last two decades, the amount of MSW has been rapidly increasing due to increase in population (Census of India, 2001). This is particularly due to the rapid growth of urban areas, rural-urban migration and increase in per capita income (World fact sheet, 2001). It becomes imperative due to ever increasing waste generation resulting from population expansion as shown in Fig.1.

Figure 1: Show the relationship between urban population and waste generation kg/capita/day in previous years.

Source: Census (2001), World fact sheet (2001)

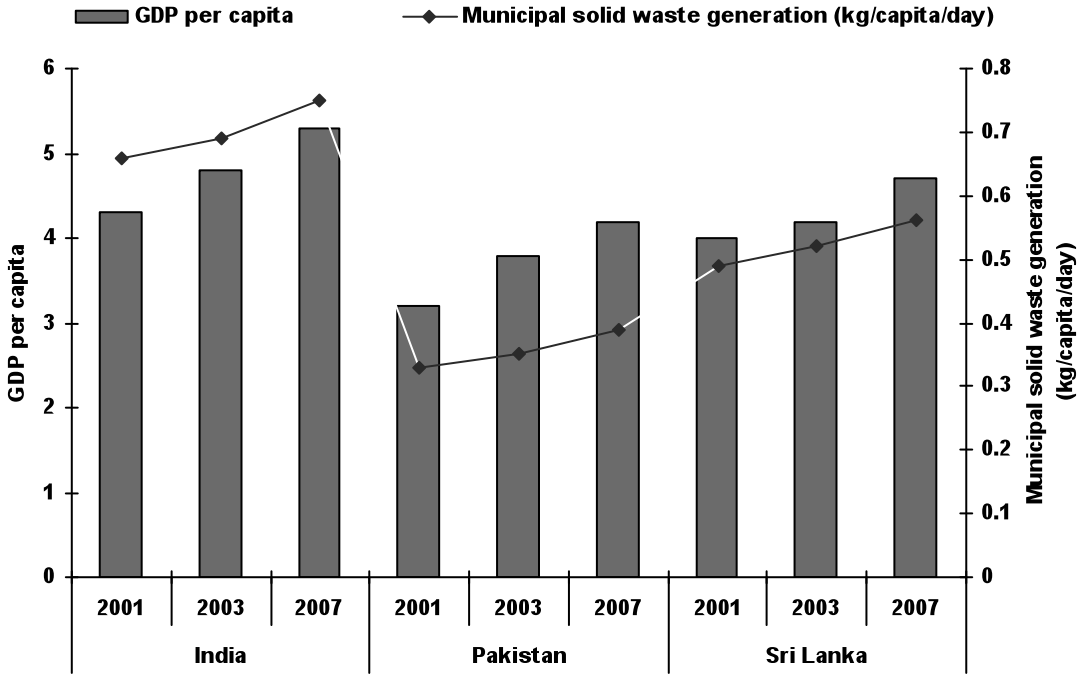


Scenario 2 GDP per capita

The economical structure of the developing country was grown at alarming rate, this economy direct affected living standard of urban population and waste generation. The amount of MSW generation has increased with the growth of economy as shown in Fig.2. The urbanization and economic growth put great pressure to increases or create a lot of MSW (World Bank, 2003).

Figure 2: Show the relationship between GDP per capita and waste generation kg/capita/day in previous years.

Source: World Bank (2003), World Fact sheet (2001)



Scenario 3 Sanitation Services

Increasing urbanization and economy growth push a great pressure to sanitation services, due to the increases of waste. In developing countries, rate of sewerage are very low for rural areas whereas septic tanks and latrines predominate. In developing countries, around 30% of population has access improved sanitation services including (sewerage, wastewater treatment, septic system and latrines). Urban community has also made slow progress in providing wastewater treatment (IPCC, 2007). In addition, infrastructure for sanitation services, must take into account of waste generation.

Scenario 4 Illiteracy/ Level of Public Awareness

Awareness creation should be given the most consideration on waste generation. Rapid waste generation and illegal disposal methods are on high range, because there is no public awareness (Agamuthu et al, 2007). Without awareness, it is difficult to minimize the waste volume. Education program (e.g. school program and media) will have a stronger and lasting effect as to encourage the minimizing waste volume.

Stage 2 Forecasting Waste Generation

Development of mathematical method to determining the future municipal solid waste generation in studied countries. Waste generation is highly correlated with population variable. The calculation is a ultra process beginning with the estimation of future population and then estimates the future waste generation kg/capita of each country.

(1) Formulation to estimate the future population

The population was calculated according to Singh et al, 2004.

$$\text{Population } (1 + \% \text{ growth rate}/100)^{\text{years}}$$

(2) Formulation to estimate the future waste generation kg/capita/day

The waste generation per capita was calculated according to Singh et al, 2004.

(Population) x (Waste generation rate) x (Number of day) ÷ (number of pound per ton)

(3) Calculation of GDP per capita

GDP per capita is the gross domestic product divided by mid year population. The sum of value added by all resident producers in the economy plus any product taxes (fewer subsidies) not included in the valuation output. It is calculated without making deductions for depreciation of fabricated capital assets or for depletion and degradation of natural resources. Value added is the net output of an industry after adding up all the outputs and subtracting intermediate outputs (GDP per capita, 2001).

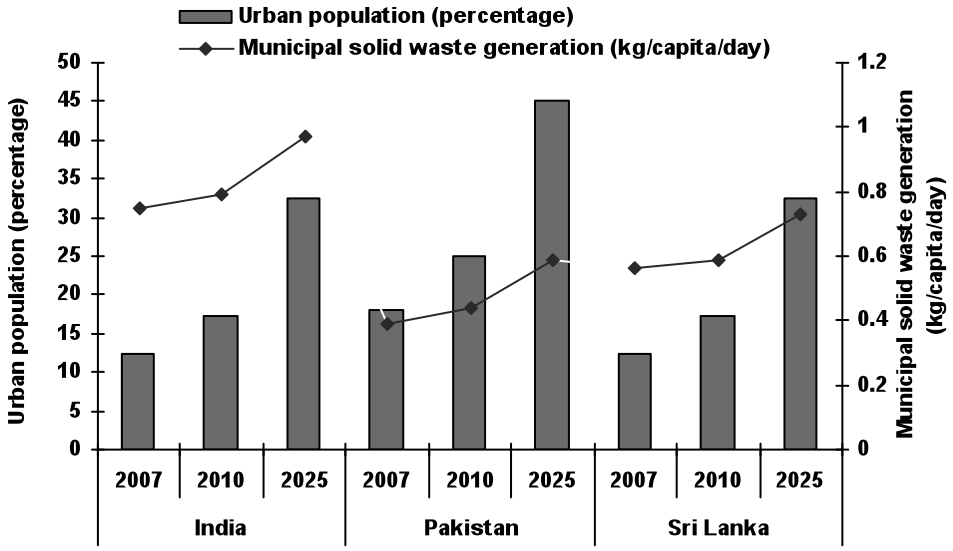
Result and discussion

Urbanization

In the year 2000, about 30% of the population in the Asia region lived in cities. There are, however, major disparities in the pace of urbanization within the region. Fig.3 shows the significant increase in urban population in developing country *i.e.* India, Pakistan and Sri Lanka respectively from 2007-2010-2025 (World Bank, 2003). Rapid increase of urban population is mainly due to the economic disparity among the population. This increase puts more pressure on the partially existing MSWM infrastructure, as shown in similar studies by Brinkhott, T., 2005. Rapid urbanization in Asia has been synchronous with dramatic rate of economic growth as well as severe environmental problem. The changes in the mechanism of urban growth described above can be seen as imparting of huge impact on urban environmental issue.

Figure 3 : Estimated future urban population with waste generation kg/capita/day

Source: Census (2007)



The increase of urbanization and economic growth has improved the living of standard of urban citizens and creating a higher per capita of waste generation rendering the existing MSWM system in effective that put the risk of massive failure. If current trend continue, it may be seems five-fold increase in the waste generation by the year 2025. Some other factors that influence the quantity of waste generation like season variation, frequency of collection, the habits and economic status of people, legislation and public attitudes (OECD, 2004). As a result of rapid urbanization, solid waste generation in Asian countries continues to increase.

Table 1: Municipal Solid Waste Generation in 2007 and the Predicted Relationship in 2010 and 2025 in Asian Countries

Source: Census, 2007 (All country home pages), World fact sheet (2001), World Bank (2003)

	Urban population (% in total)			GDP per capita (%)			MSW Generation per capita (kg/day)		
	2007	2010	2025	2007	2010	2025	2007	2010	2025
India	12.28	17.35	32.43	5.3	6.0	7.0	0.75	0.79	0.97
Pakistan	17.93	25.10	45.00	4.2	4.8	5.2	0.39	0.44	0.59
Sri Lanka	12.27	17.35	32.43	4.7	4.9	5.3	0.56	0.59	0.73

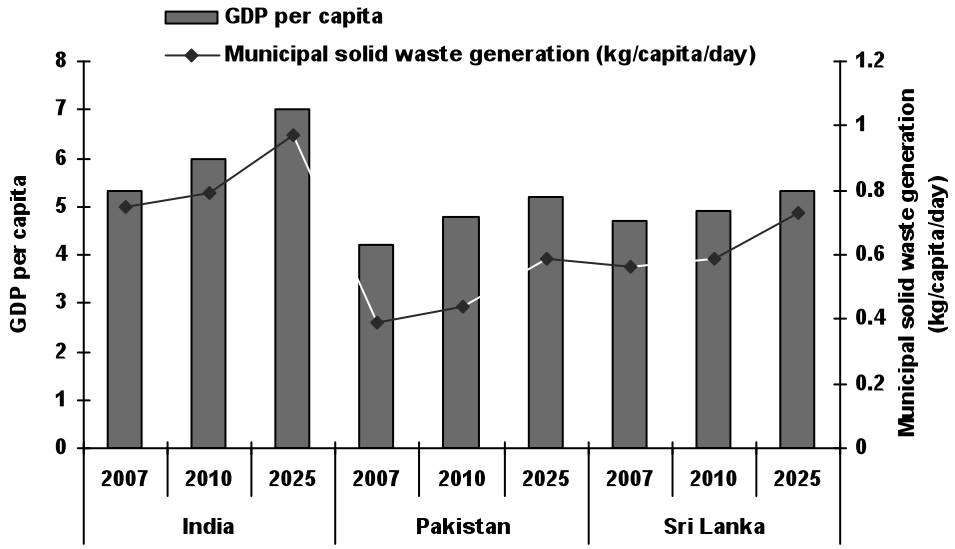
Waste Generation

The per capita generation of solid waste in Asian countries is given in Table 1 which indicates the minimum waste quantities were found in Pakistan 0.44 to 0.59 kg/capita in future scenario and the maximum waste quantity were found in India 0.79 to 0.97 kg/capita in future 2010 to 2025 respectively, in developing countries similar study also observed by Global, 2001. In time series, next outcome can be highly correlated with the current outcome like waste generation coming year is correlated with this year. The level of waste generation goes to be higher due to increased consumption patterns as well as the movement of the people from rural area to urban areas. The quantity of waste generation per capita is correlated with the GDP of each country. Based on population estimates by calculation and the GDP predicted by World Bank, the solid waste is likely to be generated up to 2030 is estimated and presented in Table 1.

Pakistan shows the slow growth in GDP per capita 4.2 to 5.2 from present to future but in Sri Lanka the GDP per capita was observed 4.7 to 5.3 from present to coming years respectively, as shown in Fig.4. The increased consumption pattern as well as rapid urbanization and the rate of economic growth cause the higher value in waste generation per capita per day same observation was studied by Chung and Lo, 2003. In future, the urban population and GDP denoted the increase average income, so they have spent more fund invested in safe disposal technologies and safer environment.

Figure 4: Correlation between GDP per capita and waste generation kg/capita/day in present with future estimation in Asian countries.

Source: World Bank (2003)



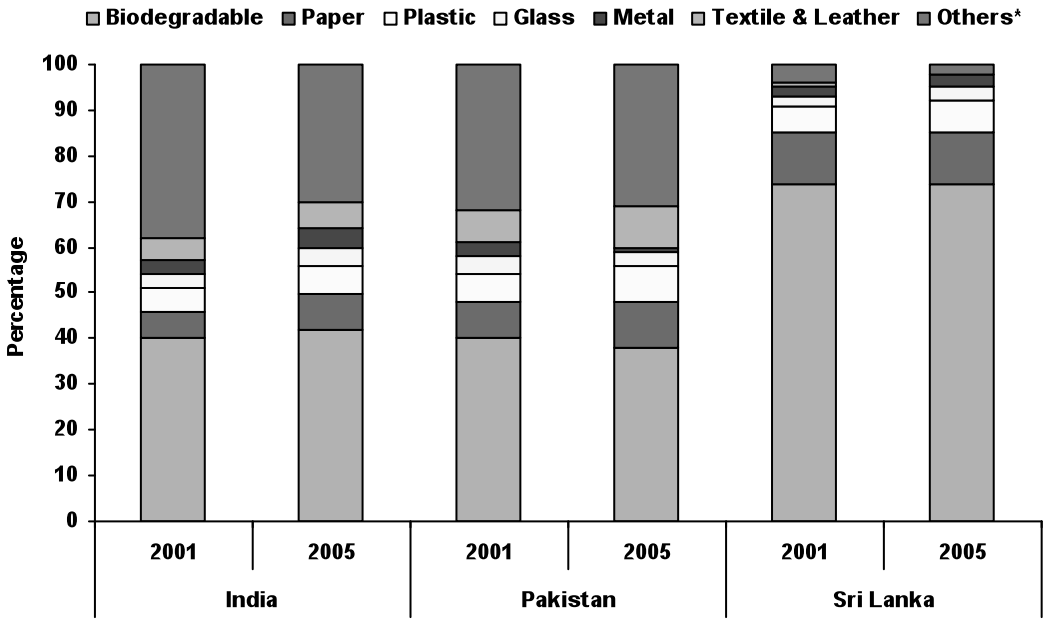
Waste Composition

The inter-related factors contribute to different pattern of waste composition. Compositions of MSW in Asian developing countries in Fig.5, reflects the heterogeneity of the waste stream.

Most south Asian developing Asian countries have high percentage (40–70%) of organic matter in their waste stream with high moisture content, making them unsuitable for incineration similar observation by Agamuthu et al, 2007. Both the quantity and composition of waste vary widely from day to day and season to season and considerable differences may be observed not only between countries but also between neighboring localities. Waste composition generated in these studied countries, is normally dominated by biodegradable portion followed by paper and plastic. Generally the biodegradable portion is mainly in higher proportion due to household waste, Over the years, many plastics and paper wastes had found their way into the municipal waste stream due to the rapid economic expansion as shown in Fig.5, similar studied by Water sanitation programme South Asia, 1999.

Figure 5: Composition of MSW in Asian Countries.

Source: UNEP (2001)



Waste treatment technology

Disposal is the ultimate fate of all waste. Information on characteristics of solid waste is essential for planning of proper disposal. Proper disposal of MSW is a necessity to minimize environmental health impacts and degradation of land resources. A set of technologies have been developed with the increasing amount and complexity of MSW generated by countries.

(A) Open Dumping

Open dumping is the an illegal dumping, which is improper disposal of any waste including household trash, garbage, tires, demolition/construction waste, metal or any other material at any location like along the roadside, vacant lots on public or private property even in parks other than a permitted landfill or facility. Open dumping poses a threat to human health and the environment because it causes land pollution (Zurbrugg, C., 1999).

Open dumping, as distinguish from sanitary land filling. Open dumps create public nuisance, divert land from more productive uses and depress the value of surrounding land. In developing countries, MSW is commonly disposed of by discharging in open dumps, which are environmental unsafe. Most

common disposal methods in studied countries indicate the higher share of open dumping around 60-80% as shown in Fig. 6 similar studied by Idris, A., 2004.

(B) Composting

Composting is relatively simple to manage the organic material in the waste stream including kitchen waste, leaves etc. Composting needs segregation of organic waste at source. But in developing Countries, composting percentage is not so common average around 10-12% respectively, as shown in Fig.6. Whereas Composting is an efficient method of breaking down organic materials into an end product that is beneficial to soil and plants (Sudhir, V., 1997). Compost is used as an organic amendment to improve the physical, chemical and biological properties of soils. Adding compost increases the ability of the soil to hold and release essential nutrients. But composting method is still rarely used because Sorting is not widely practiced by residents in developing countries.

(C) Incineration

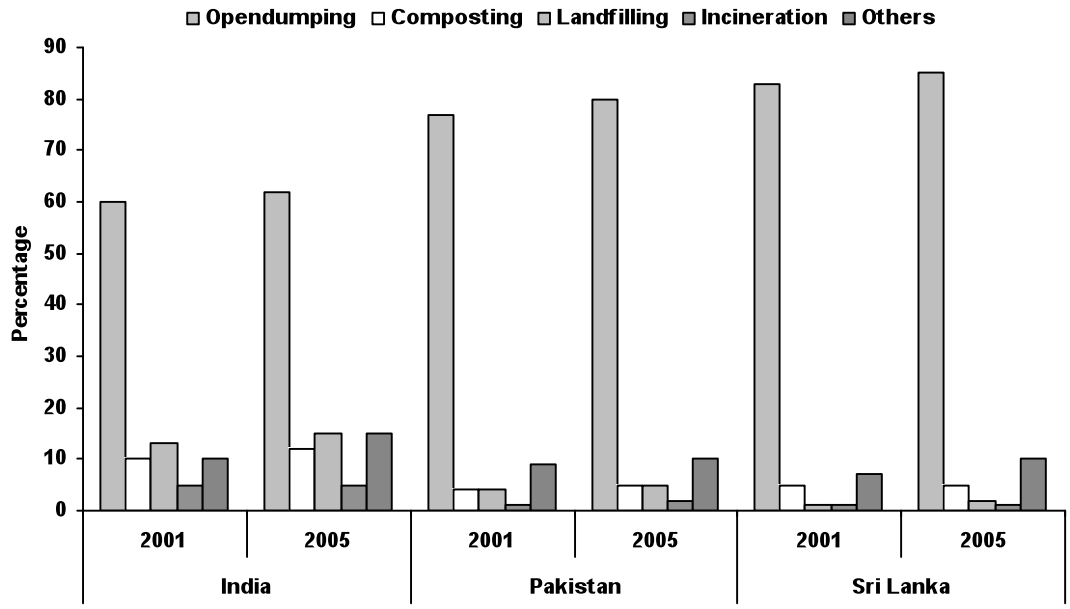
Incineration is a waste treatment technology that involves the combustion of organic materials and other substances. Incineration waste treatment system are described as `thermal treatment`. Incineration of waste materials converts the waste into incinerator bottom ash, particulates and heat, which can be used to generate the electric power. The volume of ash is less than the original volume of waste (Shapkota et al, 2006). The volume of ash produced is usually 10% of the original waste. Finally, the ash is typically disposed of to landfill. Ash has high concentrations of micro and macro nutrients that will fertilize the soil. But in developing countries, use of incinerations is in fewer amounts around 1-5% as shown in Fig.6. Incineration will not be viable disposal option in the near future in developing countries because of its capital cost, high maintenance and installation cost and high moisture content of municipal waste stream (Contrers et al, 2006). Incineration is also a controversial method of waste disposal due to issues such as emission of gaseous pollutants.

(D) Others

In recycling, waste materials are processed for industrial use and then reformed into new or similar products. Waste minimization and material reuse strategies should be started from household waste audits and surveys to enable the identification of “waste-creating activities” by Vlachos, E., 1975. In developing countries, recycling percentage is not as high as 10-15% as shown in Fig.6.

Figure 6: Disposal Method of MSW in Asian developing Countries.

Source: UNEP (2001)



(E) Landfill

The final disposal of MSW is landfill occurs at three categories, which are:

1. Open dump or open landfill, which is most common in developing countries. The so-called landfill is mostly covering refuse in the dumpsite by soil neither with proper technical input nor with treatment of the emerging emission to water, air and soil (Sinha Chhabhi, 1997). In developing countries, such land filling is so common around 15% in India, in Pakistan, 5% and in Sri Lanka 2%, respectively, as shown in Fig.6. Although uncontrolled landfill disposal of solid waste is a pervasive problem causes potential on human health hazards, vegetation damage, unpleasant odors, ground water pollution, air pollution and global warming (Mutasem et al, 1997).
2. Semi-controlled landfill, in which landfill operated at designated site, but every kind of waste is dumped without segregation and is not engineered to manage the emissions of landfill gases.
3. Sanitary landfill, which is practiced in developed countries with facilities for the interception of the leachate generation and arranged for the control of gases from waste decomposition.

Among all three land filling, sanitary land filling is the best option for final disposal of waste.

Concept of Reduce, Reuse, Recycle (3R) in developing countries

Developing countries has embarked on continuous development of a legislative structure geared towards 3Rs, with the emphasis moving to the “front of pipe” or preventative, rather than “end of pipe” solutions to its waste problem. The development of a “Recycling Oriented Economic System” has created new policies and legislation aimed at overcoming the countries severe landfill shortage. All developing countries are revising from a sole focus on hazardous substances management to new phases of greening. Most of recycling waste such as paper, card-board, plastic and metal, are frequently recycled either by household or more often by rag pickers from the informal sector. It is estimated that about 20-30% of the waste generated in cities of Asia Pacific region, is recycled by the informal sector.

In developing countries, resource recovery and recycling usually takes place in all components of the waste management system predominantly by the informal sector “waste pickers”. However, the importance of recycling activities in reducing waste volume, recovering resources and its economic advantages and drawbacks is being acknowledged.

Recent rapid economic growth in Asian emerging nations is bringing higher living standards to many people. However, this economic growth is usually accompanied by severe environmental degradation. Japan has improved its resource productivity through, among other initiatives, reduce, reuse and recycle (3R) programmes, eco-town promotion and green product and service design systems. In order to pursue the path towards a sustainable society, government have to change or update their new policies and engineering practices and enhance cooperative and comprehensive initiatives on a regional scale (Morioka and Helmut, 2007).

Laws and legislation of 3R in developed countries

Like Japan Since 2000, various laws relating to waste management and recycling have been enacted or amended. Many important regulations regarding recycling have been enacted to ensure the proper management and enforcement of waste disposal. These laws are listed as Law for the Promotion of Effective Utilization of Resources, Container and Packaging Recycling Law, Home Appliance Recycling Law, Construction Material Recycling Law, Food Recycling Law and End-of-Life Vehicles Recycling Law.

3R was initiated by G8 Sea Island Summit 2004 based on the proposal of Japanese Government, and officially launched at the 3R Ministerial Conference held in Tokyo, 2005. At the conference, 20 countries and international organizations discussed the importance of 3R in the context of sustainable development, agreed to promote 3R practice within each country, at regional and global level.

Future perspectives and implementation

3R Initiative seeks to cooperate with developing countries in areas such as capacity building, raising public awareness, human resource development and implementation of recycling projects:

- Reduce waste, reuse and recycle resources and products to the extent economically feasible.
- Reduce barriers to the international flow of goods and materials for recycling and remanufacturing, recycled and remanufactured products, and cleaner, more efficient technologies, consistent with existing environmental and trade obligations and frameworks.
- Encourage cooperation among various stakeholders (central governments, local governments, the private sector, NGOs and communities), including voluntary and market-based activities.

Conclusions

South Asian developing countries demands fast, cheap and efficient treatment technology. Processing and treatment should be financial viable, easy to operate and easily maintain by local community. Yet with the increase of population growth the land availability will be a major problem. Because of the very limited landfill capacity for waste disposal and the need to conserve this limited capacity for future, land filling of solid waste in developing countries has been opted as the least desirable disposal method. The main focus should be on Waste minimization, including source reduction, vermi-composting and recycling, has been promoted, which resulted in a reduction of municipal solid waste in future years.

Recycling will benefit the safe and sound environment and helps to attain sustainable society in future. Deposit/refund schemes offer an important option to attain sustainable society. An advantages of this scheme is that products and materials can be individually targeted for removal or reduce from the waste stream. Curbside recycling of metals can save money and improve the environment quality if the collection, sorting and recovery processes are efficient. High public awareness is the basic need for recycle as well as environmental commitment among the producers and consumers is the primary step for sustainable recycling.

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Experiences and proposals on (Product-Service) System design for sustainability

the Learning Network on Sustainability

Feeding New York in New York

Research paper from New York City (Steady) State Book

Terreform Inc
A Non-Profit Organisation, NY, USA

Speakers:
Auptha Surlidev, Shirish Joshi

Is it possible for the city to become completely self-sufficient within the five boroughs? To answer this, Terreform is devising a plan in which the city's ecological footprint and its political footprint are completely co-terminus. The project includes investigations of food, energy, water, building, manufacturing, air and climate, waste, movement, and social economy. The first purpose of the study is to demonstrate that this kind of radical responsibility-taking is actually possible, the second is to compile a catalogue of habits and technologies that would enable this, and the final goal is to investigate the morphological and social consequences for the city.

It is possible for the city to become completely self-sufficient within the five boroughs? To answer this, we are devising a plan in which the city's ecological footprint and its political footprint are completely co-terminus. The project includes investigations of food, energy, water, building, manufacturing, air and climate, waste, movement, and social economy. The first purpose of the study is to demonstrate that this kind of radical responsibility-taking is actually possible, the second is to compile a catalogue of habits and technologies that would enable this, and the final goal is to investigate the morphological and social consequences for the city.

At first blush, supplying food seems improbable. How to provide nutrition to eight million people on a site which is substantially built and in which virtually all open spaces are already devoted to other uses, a site that also holds serious climatic challenges? And, how to do this in a responsible, sustainable fashion that respects the earth, addresses the toxic cruelties of the factory farm system, and provides both sound nutrition and ample choice to eaters?

Big changes in our thinking and habits will be required, as current standards and practices are problematic on several counts. To begin, the industrialized, fast-food regime is dangerous at both ends of the chain. The non-organic basis of this system – with its heavy dependence on mono-cultural industrialized agriculture, fertilizer inputs, pesticides, fossil fuels, standardization, corn and soy hegemony, drastic packaging, long-distance transport, labour exploitation, and other much-criticized elements – must be revised. The logic of "organic" agriculture states that farms should be small, diverse, and near. But bringing food production home to New York will demand solutions other than the return of the well-managed, organically-driven, family farm. This is not to say that much of this farming cannot remain both organic and small-scale, conducted in back-yards, balconies, stairways, and elsewhere. New methods, however, will be essential, as will great diversity.

We are also used to a cornucopia of "fresh" foods in all seasons – kiwis from New Zealand, asparagus from Argentina, strawberries from Mexico, tomatoes from the Netherlands – that are incredibly energy intensive and that are bred to exclude many qualities of nutrition and flavor that a more organic process would provide. This is, in its way, as unsustainable as the vile product of the fast-food empire, itself corrupt at every link of the chain, from farm to consumer. It's nonetheless also true that the reduction of our agricultural insanity to a matter of "food miles" is, like most reductive analyses, not as shiningly obvious as it appears at first blush. The economic rationale requires extensive attention to such externalities as labor-exploitation and the loss of the kind of autonomy that a proposal predicated on the idea of self-sufficiency is devoted to. From the standpoint of energy inputs, moving a cargo ship of apples from the Antipodes can be far more efficient than bringing a few dozen bushels in the back of a pick-up from an orchard upstate.

Even more fundamentally, a simple check-list mentality, like the LEED system, which simply inventories individual inputs (energy, water, fertilizer, resource depletion, climate change) has a tendency to abstract and de-individualize responsibility, de-politicizing the problem.

This proposition offers its possibilities by degrees. Clearly, the idea that the New York City food shed would be completely co-terminus with its political boundaries is at the most radical end of a larger set of possibilities. Indeed, the practicalities of a regional approach have been argued by many and the dramatic rise in the local and slow food movements, the growth of many sites of urban agriculture, the proliferation of farmer's markets, and so on represent a burgeoning "movement." Even an extreme approach to self-provisioning might allow for the barter of local foods with more distant markets that were able to produce foodstuffs that are particularly unsusceptible to home growth. Coffee, a narcotic few New Yorkers can survive without, is something that will be far more difficult to produce locally than chicken or apples, and only under a regime of the most fantastical completeness is it possible to imagine the architectural and agricultural technologies that would enable its local production. And let's not get started on chocolate!

It is clear, in any case, that a self-sufficient diet will demand substantial changes in our daily habits and styles of consumption, most of which are of very recent origin. Any plan for this will require not only attention to the content of the New York diet but to the question of balancing nutrition and coercion. In our polyglot metropolis we support the cuisines of many cultures and depend on the networks of globalization to enable this. A self-sufficient process will, necessarily, result in a certain localization of dietary components and, potentially, a limitation in choices. However, this dependency on the seasons and on local capacities was characteristic of human dietary habits for millennia and, although we seek to design the most variegated system we're able to, we are also in sympathy with a more general impetus to think locally. Indeed, this inquiry is an extreme instance of such thinking: we wish to bring every New Yorker closer to what is on his or her plate.

We believe that this approach can be enormously stimulating to creativity: New York is a global hub of imaginative and multicultural thinking and has the potential to reinvent food culture and the meanings of diversity at many levels. We will not consider this problem "solved" if the outcome fails to provide the equivalent of the satisfactions of variety and choice New Yorkers currently enjoy. As we intensify local and smaller scale styles, introduce new modes of production like aeroponics and hydroponics, we will intensify more local and smaller scale styles that will be dramatically juxtaposed spatially. The fact that spatial specialization – thousands of square miles isolated for beef, thousands for corn, thousands for wheat – will disappear suggests not simply the logical synergies of rotation but that this system will be conducive to new culinary synergies and complexities as well. We believe implicitly that proximity and engagement with the sources of food are essential to cultivating progressive environmental consciousness.

However, in providing a system of self-sufficiency for eight million people on a territory that – even if entirely devoted to traditional agriculture – would only support an order of magnitude of a million, (modern agriculture supports around 1000 people per km2 of arable land) we beg the question of novel means of production. To begin, such a system must engage a range of technologies and media that are disengaged from the surface of the earth. Whether in the verticalization of farming via stacks of growing areas or the use of walls for farming, the use of hydroponic and green-house techniques, or even the use of "test-tube" technologies for growing "meat" without animals, providing enough food for New York's population will oblige the employment of techniques that bear little resemblance to the Arcadian image of the family farm.

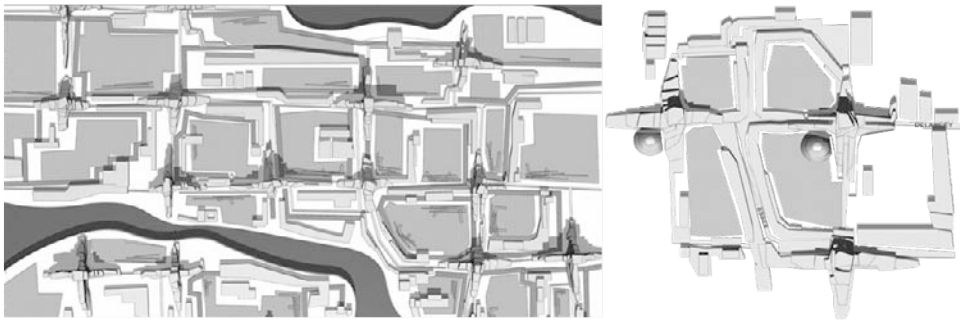
On the other hand, the need for such demanding ingenuities need not necessarily result in the complete industrialization of our agriculture. The panoply of small-scale techniques of the urban farmer will be indispensable. Every available space must be engaged, ranging from the retrieval of the surfaces beneath the streets, the use of roof-tops, the grafting of window-scaled greenhouses to existing buildings, the conversion of yards to gardens, the use of cellars and basements, even the dedication of a portion of every apartment for aeroponic cultivation. Our parks must support agricultural productivity as must our waterways. We envision dramatic morphological shifts in the figuration of the city as a whole. There is ample precedent for this, ranging from the small-scale intensification of urban agriculture in war-time to the recent, and similarly shortage driven, proliferation of agricultural production in Havana. In all of these cases, dramatic increases in output have been achieved within the context of fixed basic urban morphologies.

One more transformational prospect for New York is the possible consolidation of the least dense areas of the city into far more compact forms of settlement which will free-up large portions of the "outer" boroughs for farming. Likewise, we imagine that in a self-contained system such as we propose, the nature of the figure / ground relationship can be dramatically transformed. As the city disengages

from the automotive system in favor of walking, biking, and public transport, the area of street space required for mobility will contract substantially. We imagine that in many parts of the city, this space can be occupied by building and that buildings themselves will grow narrower, encouraging cross ventilation and solar access. This will mean that the area at the interior of our blocks (we do propose to retain the block organization that is native to our urban culture) will be substantially greater, yielding a much increased area for agrarian activity. Among other solutions, we imagine the possibility of a complete "figure-ground switch" in some parts of the city. Here, buildings will occupy the area now given over to roadways, leaving the present entirety of the blocks they define available for green uses.

Figure 1: New Figure-Ground Switch

Source: Terreform Inc. Project : Louisada 2030



Any serious attempt to build agricultural self-sufficiency within New York City will seriously compromise the traditional relationship of city and country, with its commingled suspicion, reverence, dependency, and symbiosis. Raymond Williams has been one of the most lucid voices in investigating the cultural polarities of country and city that have developed over time. Marx, of course, wrote famously not simply about the alienation of the city but about the "idiocy of rural life." A transformation of New York City into a new type of urban condition will clearly beg not simply technical and organizational questions but social and ethical issues as well.

Box 2: Cultural polarities of cities

Quote by Raymond Williams

> *"On the country has gathered the idea of a natural way of life: of peace, innocence, and simple virtue. On the city has gathered the idea of an achieved centre: of learning, communication, light. Powerful hostile associations have also developed: on the city as a place of noise, worldliness and ambition; on the country as a place of backwardness, ignorance, limitation"*

We locate the ethical vector in this investigation not in questions of cultural difference or in questions of cruelty, nonetheless important, but in the ethics of distribution. Above all, this work is predicated on the practices of acting locally on behalf of global thinking: we seek to show the pathways of responsibility, to set a radical precedent, to raise expectations, and to goad dramatic invention. Scarcity is not an absolute but is defined in the relationship between available resources and the demand for them. But this relationship is not entirely straightforward. Availability is very different for a millionaire in Manhattan and a subsistence farmer in Botswana. And, demand is itself a cultural construct, something very different than the idea of need. Thinking globally encourages a more egalitarian ethic, recognition that, as far as food supply is concerned, the game really has a zero sum. In the larger scheme of things, my gluttony – and my access to the concept and the possibility of achieving it – do diminish the prospects of my sisters and brothers in Botswana. The ethics of this proposition are therefore very much lodged in the idea of a just median. If we take care of ourselves without imposing demands on others, we begin to address these problems. But we must also be aware that if the system produces surpluses beyond some rational mean, we are confronted with another ethical dilemma in deciding about whether they should be distributed to those on the down side of the curve or whether they should contribute to the satisfactions of our own enlargeable personal desires.

This study approaches the question of distributive justice and inequality via the idea of bearing capacity. Part of the reason that our agriculture is so widely distributed springs from the uneven global dis-

tribution of soils, water, climate, and species. The soils of New England support a population of grazers; the Midwest is suited to its role as granary; the slopes of Tanzania are superb for coffee. But cultivation is not "natural" in the sense that it is the automatic result of the convergence of climate, culture, and necessity. Cultivation is always formalization, management, distortion. In the end, it is more important to shorten the chain and reduce inputs than to preserve some fantasy of the "natural" that can only be sustained with air-freight and petro-chemistry.

Finally, and non-trivially, the future of agriculture will doubtless struggle between a rising sense of the capacity and consciousness of animals with our evolutionary need to find more efficient means of delivering nutrition to ourselves. This study is predicated on something Rawlsian, a position more focused on equality of interests rather than characteristics.

Box 3: Life and Theory of Justice

Quote by John Rawls

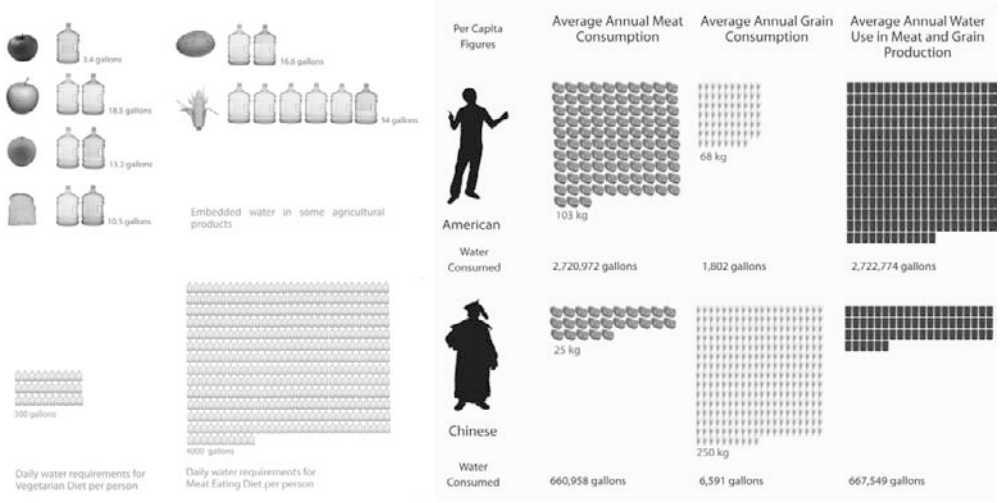
> *"Equality of Interests rather than Characteristics"*

As any move to a more autarkic economy, self-sufficiency in food requires substantial transformations on both the demand and the supply sides of the food equation. To begin, the average American simply wastes close to a third of a pound of food per day. Not all of this is recoverable but even were one to hypothesize a rate of recovery of five percent – a tiny number – close to 150,000 New Yorkers might be fed on what is currently abandoned. Moreover, food waste, most of which winds up in landfills, is an enormous producer of methane, a greenhouse gas 23 times more potent than carbon dioxide. However, methane is a useful source of energy, and its recapture has the potential to close yet another loop in the city's respiratory systems. The ultimate point, of course, is to eliminate the concept of waste.

Food waste is also water waste (and land waste, and energy waste, and….) and this occurs at virtually every stage of the process, from growing to processing to transporting, all of which are profligate users of water. Embodied water is also a crucial measure of the efficiency of any food system. For example, the amount of water embedded in the daily consumption of a typical American meat-eater is approximately 4000 gallons. A vegetarian requires about 300 gallons. Making the footprint more literal, an acre of land is required to produce 165 pounds of beef; the same area can be used to grow 20,000 pounds of potatoes. As scarcity becomes more of an issue, these divergences become more ethical.

Figure 2: Diet Comparison. Meat vs. Vegetarian. Chinese vs. American

Source: Terreform Inc



At current rates of consumption and with contemporary eating habits, the food footprint of New York City is around 7.1 million acres, about 36.4 times the area of the city as a whole. We consume (or waste) around 38.2 million pounds of food every day and only a near negligible quantity of this is produced in the city. Of course, not all imports are created equal. A kiwi from New Zealand travels 14,000 miles by air, has a water footprint of five gallons per fruit, and accounts for approximately .85 pounds of CO_2, something like seven times the weight of the fruit itself. It takes about 295 joules of ecological energy to

produce one joule of edible energy in shrimp. Clearly, a demand side consideration of the problem of feeding of New York is obliged to make distinctions among foodstuffs, based on embodied energy and water, on carbon and other emissions, on up and downstream contaminants, on embodied injustice in production, on nutritive value, on public health considerations, and on suitability for local production.

As an initial benchmark for measuring the city's nutritional requirements, we assume the U.S. Department of Health and Human Services standard of 2000 daily calories of food, distributed according to its current intake pyramid. New Yorkers currently eat an average diet of 2681 calories per day (that extra 681 is the equivalent of 4.3 cans of soda). If we factor in wastage rates, the actual per capita input is about 3900 calories. A quick look at these numbers suggests that if we were to eliminate waste and reduce our caloric intake to the national standard, approximately half of New York's aggregated demand for food could be eliminated. The food footprint of 36 New Yorks could be immediately reduced to 20! This does not assume any transformation in agricultural methods nor any gains that might be made from the extreme localization of production. Indeed, this assumes the continued consumption of dairy, meat, and other "inefficient" systems for the supply of protein and other nutrition.

Box 5: Food Footprint of New York City

Source: Terreform Inc

> Total area needed to produce food for current demand of New York City is 7,108,667 acres, i.e, equivalent to 36.4 times the area of New York City.
> Reducing the Food Waste for the current demand, brings down the demand to 4,970,721 acres, i.e., equivalent to 10.4 times the area of New York City reduced.

Our first investigation of a self-sufficient food system proposes precisely this, a 2000 calorie diet based on current styles of consumption but with necessarily reduced quantities and ten percent wastage – a fairly dramatic, but plausible, reduction. We have examined a number of ways to achieve this. One possibility is the widespread utilization of vertical farming in any of a number of configurations currently proposed. According to widely-publicized research done by Dickson Despommier at Columbia University, a vertical farm of approximately thirty stories with and area of approximately one city block and utilizing intensive hydroponics, aquaponics, and animal husbandry, would have the ability to produce food for around 50,000 people. Such installations would have additional benefits in the production of energy, the recycling of water, the recovery of wastes, the elimination of run-off, etc.

Box 4: "Vertical Farms"

Source: Dickonson Despommier. Columbia University The Vertical Farm.

> It is projected that a single 30 story (3 million square feet) Vertical Farm, with a foot print of 1 square city block, could produce enough food to feed 50,000 people, if the currently available technologies are employed.
> **Thumb Rule:** ***1 indoor acre = 4 – 6 outdoor traditional acre.***

A solution based purely on such vertical farms would require 183 such structures distributed through the city, over an area equivalent to that of Manhattan north of the George Washington Bridge. Alternatively, the number of vertical farms might be cut in half with the systematic conversion of currently vacant land and buildings, the utilization of green roofs, the elimination of parking lots, the recovery of 50%

of existing street space (essentially the area currently given over to parking), and the utilization of a very large number standard barges for agricultural use. This adds up to about 150,000 acres at grade, not including private yards and gardens nor currently occupied built space. Successive dietary transformations would progressively reduce the demand for space, technology, and radical morphological transformation. A 2200 calorie vegetarian diet, including eggs and dairy but eliminating meat could be provided by 115 vertical farms or 58 vertical farms plus approximately 100,000 acres of other spaces of cultivation, including vertical growing surfaces fixed to existing structures. A fully vegetarian regimen would offer only a marginal improvement, and either diet would yield a food footprint from New York City of less than one third its current scales.

While vertical farming represents a macro-technology for facilitating urban agriculture, a wide variety of other technical means, deployed at every scale, might be engaged to transform the productive character of the city. Vertical agriculture is, in fact, an elaborate refinement on greenhouse agriculture and the surface area available to enclosure throughout the city – on rooftops, streets, abandoned rail rights-of-way, barges, park spaces, etc. – is enormous. The multiplier necessary to increase the cultivated area of the city is also susceptible to increase via low-energy artificial lighting, via the use of wall systems and window boxes, via low-input hydroponics, aeroponics, and via intensive aquaculture which can be located in spaces from basements (Japan is the world leader in this) to a variety of pens in the city's waterways. An even more efficient emergent technology of aquaponics unites hydroponics and aquaculture to make a more sophisticated and self-sustaining loop. Technical and scalar diversity are absolutely crucial to provide system resilience and to protect against the variety of failures that any system is susceptible to.

Although a variety of relatively sophisticated technologies are available for substantial increases in productivity, the example of a number of cities in which the deployment of much simpler means of intensification is tonic. As mentioned earlier, in Havana, the cruelties of shortage have resulted in a system of urban agriculture in which the premium is placed on the utilization of every available area of the city that might be turned to cultivation. A special intensive technique called "organoponicos" has been employed throughout the city with the result that the city is currently able to provide 90% of its fruit and vegetable requirements within its borders. This very high rate of internal production is reflected in a number of cities in China as well as many cities in wartime, during which intensive small-scale cultivation has become normalized.

Conclusion

A self-sufficient food system would potentially ramify morphologically at every scale with an influence that could dramatically modify the character of city space in a variety of ways beyond its reconfiguration for intensive agricultural production. There are, for example, approximately three million households with kitchens and this, in aggregate, amounts to several hundred million square feet of space. When other spaces devoted to the processing of raw foodstuffs, such as restaurant and other collective kitchens, are added to this, the aggregate easily surpasses half a billion square feet of space. Additionally, we can speculate about a logical multiplier to account for the current logistical needs of food distribution within the city, the wholesale markets, supermarkets, and bodegas; the roadway and other transport infrastructure; the waste recovery and removal systems, that would surely bring the literal area required for food preparation, distribution, and management to an order of magnitude of a billion square feet.

Given the likely demographic shifts that will occur in the next decades (nuclear family living arrangements are already a minority component in household hierarchy in the United States), the reconfigurability not simply of residential structures but of a variety of single-use buildings from offices to factories harbingers a distinctive new set of formal possibilities for both physical and social architecture. This new urban architecture is likely to be radically mixed in use at building, block, and neighborhood scales, as well as far more autonomous in its incorporation of the various aspects of urban respiration at the local scale. Our expectation is that these new architectures will not simply embody the production and preparation of food in increasingly collectivized ways but that questions of waste, water, energy, manufacture, building, climate, and movement will increasingly become crucial components of urbanism, always with an eye to closing loops locally as proves logical.

Such a system will, we stress once more, engender a fundamental alteration to our individual relationships to food and its production. Today, we are spectators, whether at the pristine and invisibly prepared product on the supermarket shelves or at restaurants where we get clean, prepared meals which betray

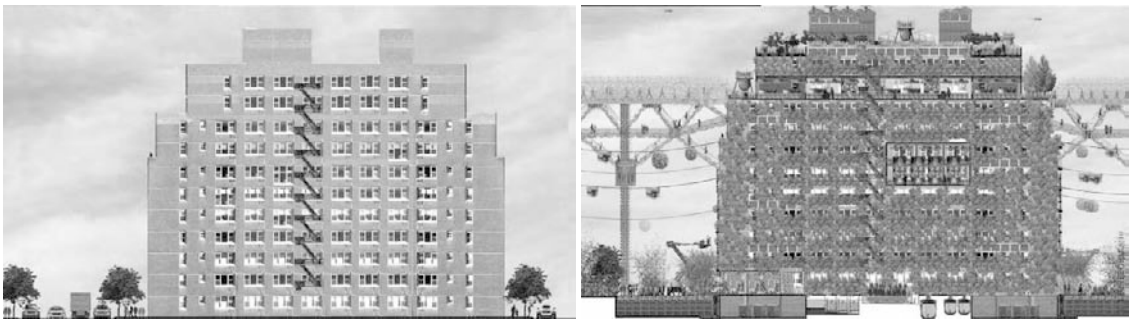
nothing of their origin in toil and soil (never mind the tiny logo on the menu identifying some product as local or organic or low-cal). Part of the mission of this "steady-state" research is precisely to build a stronger relationship to food, to enhance both responsibility, self-control, and the power of the collectivity. By moving production and consumption closer together, we hope that many new forms of food-focused conviviality and process can grow.

At the largest scale, the impact of a self-sufficient food regime will dramatically re-weight the distribution of hardscape and landscape in the city. Every apartment will bristle with green. Streets will disappear and be replaced by farms and greenhouses. Rooftops will offer a second grade of agricultural, recreational, and other respiratory spaces. Green bridges will link buildings. The waterfront will reawaken as a zone of food and other production. Vast areas of private gardens will be remade as small-scale agrarian plots. Parks will become productive. Rail rights-of-way will be utilized as linear farms. Low-density areas of the city will be consolidated to free up surplus territory for agriculture. The newly needless infrastructure of highways will disappear, freeing up hundreds of square miles for new uses. A great green grid will dominate the form of New York and nobody in the city will be out of sight of the place where next meal is coming from.

Figure 3: Steady State Solutions. Before – After for different building prototypes

Source: Terreform Inc.

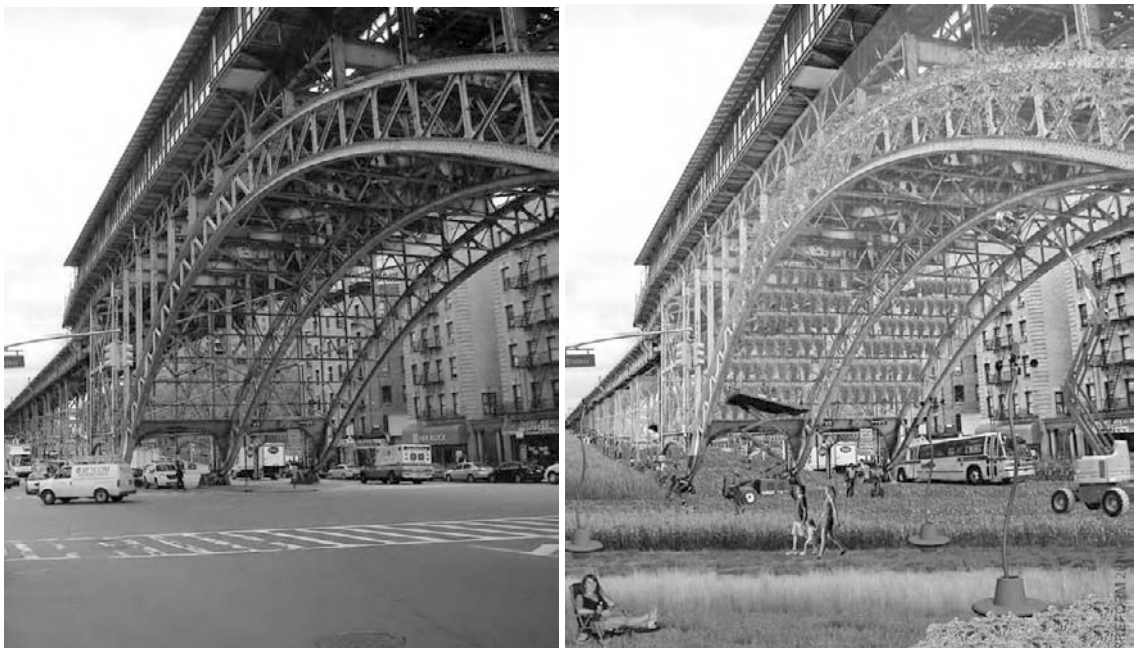
a) Townhouse Prototype



b) Residential Apartment Building Prototype

c) City Block Prototype

d) Street Prototype



e) Unused Spaces

f) Vacant Spaces

About the authors

Michael Sorkin is founding President of Terreform and Distinguished Professor of Architecture and Director of the Graduate Urban Design Program at the City College of New York, where he has taught since 2000. Michael Sorkin was born in Washington, D.C. and received his architectural training at Harvard and MIT. He also holds degrees from the University of Chicago and Columbia. From 1993 to 2000 he was Professor of Urbanism and Director of the Institute of Urbanism at the Academy of Fine Arts in Vienna. Previously, Sorkin has taught at numerous schools of

architecture including the Architectural Association, the Aarhus School of Architecture, Cooper Union, Carleton, Columbia, Yale, Harvard, Cornell, Nebraska, Illinois, Pennsylvania, Texas, Michigan and Minnesota. Dedicated to urbanism as both an artistic practice and a medium for social amelioration, Sorkin has conducted studios in such stressed environments as Jerusalem, Nicosia, Johannesburg, Havana, Cairo, Kumasi, Hanoi, Nueva Loja, Ecuador and Wuhan, China. In 2005 -2006, he directed studio projects for the post-Katrina reconstruction of Biloxi and New Orleans at both CCNY and the University of Michigan.

Sorkin lectures around the world, is the author of several hundred articles in a wide range of both professional and general publications, and is currently contributing editor at Architectural Record for which he writes a regular column. For ten years, he was the architecture critic of The Village Voice. His books include Variations on A Theme Park, Exquisite Corpse, Local Code, Giving Ground (edited with Joan Copjec), Wiggle (a monograph of the studio's work), Some Assembly Required, Other Plans, The Next Jerusalem, After The Trade Center (edited with Sharon Zukin), Starting From Zero, Analyzing Ambasz, Against the Wall, and Indefensible Space, and Twenty Minutes in Manhattan. Forthcoming are Eutopia, All Over the Map, New Orleans Under Reconstruction, and New York City (Steady) State.

Urban Design Research Associates:

Aleksandra Djurasovic obtained her Bachelor Degree from the University of California Davis in Landscape Architecture and Psychology and her Graduate degree in Urban Planning from the City College of New York. Born in Bosnia and Herzegovina and schooled in the United States, Aleksandra's interests lie in embracing the diversity and multiculturalism through design and enhancing the living systems through sustainable design practices.

Auptha Surli Dev, LEED-AP. Born and brought up in India, Auptha was raised in a diverse and rich cultural environment, which shaped her interests in art, music and dance. She obtained her B.Arch degree from BMS School of Architecture, Bangalore nand Masters in Urban Planning from the City College of New York. A Registered Architect of COA-India, Auptha has previously worked with Jaisim Fountainhead and SMLXL Urban Design and Architecture, Bangalore, India. Currently, working as a Research Associate at Terreform, her interest lies in exploring ideas of Sustainability and Quality of Life – a design approach that can bring people together, and support a peaceful cohabitation and integration.

Shirish Joshi was born and raised in India, Shirish Joshi holds a Bachelors of Architecture degree from the CEPT (Center for Environmental Planning and Technology) University in Ahmedabad India and a Masters in Urban Planning degree from the City College of New York. He has previously worked with the Ahmedabad Heritage Centre which was involved in the conservation and restoration of the historic walled city of Ahmedabad. His interest lies in understanding the 'Urban' vis-a-vis what is sustainable urbanity and the idea of 'Density' as something beyond just the unit of number of persons in a given area. Parallel to his profession Joshi has also been actively involved in public art and exploration of space through the medium of theatre.

Francis Milloy is an architect, urbanist, and researcher with over 15 years experience in his field of study. He received his Bachelor degree in Architecture from the University of Strathclyde, (Glasgow, UK), his Post-Graduate Diploma at the University of East London, (London, UK), and has completed his RIBA professional practice examination. Francis has worked as an architect and lighting designer for over ten years on various projects throughout Europe and the Middle East. In 2007, fuelled by an interest in social and environmental justice and the opportunity for research into the forms these issues might take, Francis moved to New York to obtain a Masters in Urban Design at the City College of New York.

Leslie Billhymer is a research associate at Terreform Inc and a lecturer at the University of Pennsylvania. She received her M.Arch. degree from the University of Pennsylvania and holds a BA in American History and Economics from Northwestern University. Prior to Penn, Billhymer worked for four years in grassroots organizing and policy development for several political organizations including MoveOn Political Action Committee and the San Francisco Green Party.

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the Learning Network on Sustainability

Local Wisdom: post-growth fashion

Kate Fletcher
London College of Fashion, UK

In order to bring about change, sustainability values and experiences have to be real to people. Yet we know very little about people's everyday encounters of fashion and sustainability. In this paper I explore the interconnections between real, live experiences of sustainability in fashion and what they suggest about the shape and structure of the industry that creates the fashion and clothes that we wear. The experiences, recorded as part of the on-going *Local Wisdom* project, convey some of the 'craft' of using garments of the British public. The project's aim is to recognize and honour culturally embedded sustainability activities in fashion that exist at the level of the user and give them a platform to flourish and inspire. It involves gathering images and stories from the general public about the way clothes are used with the hope of developing fresh understanding about more resourceful and satisfying use of garments. Together, images and tales of resourcefulness, thrift, emotional connection and social defiance express ways in which to improve quality of fashion experience within the physical limits of the clothes we already have. They offer a human scale, intimate and tentative glimpse of a new prosperity in fashion that exists outside the predominant economic and business model of growth that is so closely associated with fashion today.

Three tales of a user's 'craft'

It seems only appropriate that any exploration of the connections between the way people use clothes and sustainability should be grounded in real experience. Thus this paper begins with three stories recorded as part of the Local Wisdom project[1] that convey some of the garment-wearing ingenuity of the British public.

Edward: *"I call this my three stage jacket. It began about forty years ago as a very slim waistcoat that was given to me. I knitted a panel and put it into the back just to be able to fasten it together at the front, you see. And then about fifteen years ago I added sleeves and a collar and some trimmings. And then, only about five years ago, I became a bit too big to button it up so I added latchets across to the front so that I can fasten it."*

Yvonne: *"This is a dress that I've had for 25 years and share with my sister. We sort of have it for 5 years each and then post it back to each other and it's like fancy dress for me… almost like cross dressing… it brings out a different part of me. At the moment I just wear it for special occasions but I once met a woman who was in her 80s and who wore eveningwear all the time. She'd made a decision years before not to buy any new clothes and to wear everything until it wore out. She'd worn her way through her wardrobe and had got to her eveningwear. So when I'm in my 80s I'm going to wear this dress…"*

Andy: *"In 1978 my Mum gave me £10 to buy a jacket and jeans and this is the one I bought. Back then I was a punk and I sewed badges on the back… Sex Pistols, Sham 69, The Stranglers... and my Grandad's RAF stripes on the arm. I've still never washed it… why would I? and anyway it would wreck the badges."*

[1] www.localwisdom.info

These three tales of a user's 'craft' offer one starting point for understanding more deeply the potential of the actions of the wearers of clothes in shaping the sustainability of the fashion industry. Make no mistake such individual stories of resourcefulness, thrift, emotional connection and social defiance are far from earth shattering in nature. They are rarely dramatic, instead they impose a human scale and intimacy on the insight they afford. Yet, for me, their small size is key. For actions like making a change to a seam or never laundering a garment that is worn time and again are eminently do-able activities and within the reach and influence of us all.

Introduction to the Local Wisdom project

In 2009, I started the on-going 'Local Wisdom' project of which the tales above form a part, with the aim of recognizing and honouring culturally embedded sustainability activities in fashion that exist at the level of the user. It involves gathering images and stories from the general public about the way clothes are used with the hope of developing fresh understanding about more resourceful and satisfying use of garments.

The process of recording these widely distributed acts of inventiveness is very simple: a photo shoot is set up in various locations, in the first instance at three places in the UK. It is then widely advertised in the vicinity; signs are put up in newsagents' windows, in local libraries and sports centres. Advertisements are placed in local newspapers and interviews given on community radio networks. We network with local groups and so far have affiliated with Stitch and Bitch clubs, regional textile festivals, the climate change campaigning group Cape Farewell and the Transition Towns movement. We extend an open invitation to the public to attend the shoot with garments that fit into specific categories and then record the telling of the garment's 'story' in audio and photograph the volunteer participant in his/her piece. The emerging body of information is ad hoc, specific and often surprising. It is, by turns, interrogated and supported anew by the actual practices of clothes wearing captured at each additional Local Wisdom event.

The Local Wisdom project aims to tease out sustainability-supporting user-related activities, as distinct to producer-related ones. That is, to uncover the ingenuity and improvisation that goes on with and to clothes after the point of purchase. These are not necessarily done within the rubric of intellectualized concerns or commercial opportunities for sustainability, but instead emerge from the culturally embedded 'wisdoms' of thrift, domestic provisioning, care of community, freedom of creative expression and connectedness to nature, among other things. This explicit emphasis on the widespread practices of use, rather than the challenges of production, as a starting point for change towards sustainability signals a departure from what has gone before. Most work around sustainability themes in fashion to date is firmly focused on the manufacturing supply chain and lessening the (very considerable) impacts of agricultural practices, fibre mills, dye houses and cut-make-trim factories among others. Yet vital as it is, this work forms but a part of the sustainability challenge for the fashion sector. For what goes on *after* production processes are over and the garment has been sold – that is the personal, variable, myriad use patterns that occur in homes and wardrobes – is also a key factor influencing sustainability in fashion, yet is often overlooked.

Local Wisdom offers a glimpse of these experience-based extant practices and is an exercise in empiricism; in gathering practical experience and ideas of many users in order to seed understanding about what type and form change towards sustainability may take in fashion, when the root of this change is the users of clothes, not their producers. The garment categories drawn up for the *Local Wisdom* photo shoots are informed by some of the key learning that has been made in sustainability issues in fashion over the last two decades. One such area is clothes' laundering, which has been shown to account for around 80% of the lifecycle energy consumption of frequently washed garments (Franklin Associates, 1993). Another is the multifaceted area of garment durability and the complex emotional and psychological issues associated with making a garment last, rather than just making a long-lasting garment and which have the potential to profoundly affect patterns of consumption and disposal (Chapman, 2005). Other more speculative categories are also included, based less on established data sets and energy calculations and more on a vision for how we might live in a sustainability-directed future. Eminent industrial ecologist John Ehrenfeld (2008) has suggested, for example, that products which foster a sense of connectedness with the natural world and with other humans are important in promoting sustainability – and the Local Wis-

dom process provides an opportunity to see whether people already use garments in this way. The nine categories used in the Local Wisdom project to date are:

- Garments that are shared between people;
- Garments that have never been washed – and aren't leather;
- Garments that have the character of a particular place in them;
- Garments that link you with the natural world;
- Garments that catch your attention each time you wear them;
- Garments that tell the story of how they've been used;
- Garments that are made up of separate pieces that can be interchanged;
- Garments that make you feel part of a community (but not a uniform);
- Garments that are enjoying a third, fourth or fifth life.

The wisdom of users

The culturally embedded practices revealed by the *Local Wisdom* process is, to date, largely made up of a set of pragmatic, materially-frugal actions, often motivated by emotional triggers and frequently exemplified by old or second-hand (rather than new) clothes. This 'wisdom', in my view, adds quality and fine distinction to understanding the ways in which certain resourceful and satisfying practices work on the ground. For example, from the wide range of never-washed garments brought to the events, it became clear that a key influence in determining whether a piece can defy social pressure and never be laundered, is fear that the washing process itself causes something precious to be lost: a scent, a memory, the particular way a garment fits, the quality of handwork, and even a political stance. This evocation of emotion as a major influence in home laundering practices stands at odds even with leading industry approaches, which treat laundering as a technical and behavioural function of wash cycle efficiency but not an emotional one.

Other wisdom reveals nuanced insight into what motivates people to share garments (mainly, it appears, to reinforce connecting bonds with others and to forge new shared experiences) and how people manage this process practically (posting a garment back and forth through the mail every few years; telephoning around a family group to see, 'who has the dress'; etc). Other wisdom still uncloaks the very great extent some people will go to in order to rework garments (and resources more generally) to meet their changing needs and express creativity and the associated expertise, sense of pride and satisfaction this brings. Indeed much of the clothes-based ingenuity gathered in this project so far appears to be a combination of practical technique and emotional skill; that is, head and hand, jointly employed to negotiate the symbolic rules and roles fashion and clothes play in people's lives.

These culturally embedded practices offer a set of vastly different starting points for change towards sustainability than those adopted by industry to date, for they privilege sensitivity to people's lived experience rather than industrial or commercial ideas about what sustainability is or should be. Not only are such practices personal, variable and slow to enact; falling outside of (mass) commerce, and hence fashion, as we know it (which instead prefers standardised, global products that are quick to produce); they also fall outside many people's views about the intellectual scope of the sustainability challenge for industry and the 'proper' response to it (where it is often framed as a production-related issue to be solved by industry, technology and savvy resource management techniques). Yet it is my view that these sorts of user-initiated, culturally embedded practices hold potential to transform fashion sustainability in a new way. They offer an expanded view of the reality of sustainability practice on the ground; which exists outside the boundaries within which designers, manufacturers and retailers currently operate. In addition, they sketch out the possible shape of a new layer or type of fashion commerce based on broader values than profit and sales growth, geared instead towards increasing the quality of fashion experience rather than its quantitative scale.

Expanding the fashion industry's sustainability framework

In the last two decades, the intellectual framework that has most shaped sustainability work in the fashion industry (as in most other sectors) is lifecycle thinking. Yet by and large the practical 'on the ground' implementation of this intellectual framework is very far from the conceptual ideal. Evidence for this is widespread and found in policy, in the predisposition of companies to mainly change those processes which bring benefit to themselves, and in the industry-wide preference for technology-based solutions to sustainability problems. Favouring technological fixes over other approaches overlooks the power and agency that culturally embedded practices like low energy use, garment refashioning and novel ways of clothes' wearing, have in influencing sustainability. These practices, which reflect the reality of sustainability practice for the public, exist outside the boundaries within which designers, manufacturers and retailers currently operate. For these designers, producers and high street stores tend to work in ways that are familiar, in areas where they have most control and where they will feel the benefits directly. They focus on materials and their provenance, production practices and logistics efficiency. What happens with users falls outside of this. Yet for me, the stories and images of culturally embedded 'wisdoms' associated with use are the essential companion to fashion design and production. For designing and using form a single whole: the one shapes the other. The process of feeding back user innovations and improvisations to designers inescapably influences the evolution of fashion practice over time and space. In honouring live experience of the practices surrounding garment use, the broad and connective intellectual framework of lifecycle thinking is affirmed. New stakeholders (potentially all users) are brought into the process. Different ways of knowing, such as through experience or intuition, gain equal privilege to scientific rationalism.

Small acts of user creativity, resourcefulness, emotional significance or defiance have been called 'a user's craft' and are described by Philosopher Richard Sennett (2008) as 'live intelligence fallibly attuned to the actual circumstances of life'. This craft, displayed unassumingly by many of the *Local Wisdom* project participants, deals with the metamorphosing of the form, application and way of using material objects, like garments, over time. It holds a mirror up to the multiple interconnections between people, resources and products and shows the potential of experience on the ground and in wardrobes to influence the sustainability of a garment's design. Very practically, it also provides us with an array of starting points, ideas and pragmatic examples of a more satisfying use of fashion resources; though one that is studded with radically different expressions of material status, ways of behaving, emotional connections and power relations to the established norm. Using it as the basis of practice turns the design process out on itself, changing its goals and ideas. John Ehrenfeld (2004, 4) sees such change of process and thought as absolutely necessary for sustainability: 'Achieving positive results requires drastic action. We need to shift from our reductionist, problem-solving mode to one that is driven by a vision of a sustainable future we all share. We need to reflect carefully on our current state of affairs and replace ineffective ways of thinking and acting'.

Describing a new type of commerce

In fostering sustainability through effective thought and action, and capturing expressions of this (as in the *Local Wisdom* project), a set of changed economic opportunities begins to emerge. This contrasts sharply with the priorities of today's fashion industry that is structurally reliant on economic growth tied to expanding resource use: on making and selling increasingly more units to improve market share, increase profit and stay in business. The growth imperative that shapes daily decisions in fashion businesses (like the vast majority of others) is fundamentally at odds with the finite nature of the resource base and fragile ecosystems upon which we depend for survival. In the last 60 years the size of the global economy has increased by a factor of five (Jackson, 2009, 5) and the default assumption is that this will go on expanding indefinitely in both poor countries, where better quality of life is unquestionably needed, and rich nations, where it has been shown that material wealth – the goal of economic growth – adds little to happiness. At the same time, a slew of indicators reveal the implications of this economic structure on environmental and social quality: compared to just two generations ago, poverty is just as endemic – with two billion people still living on less than $2 a day; social cohesion, particularly in the rich West, is weaker

(Hamilton, 2003); atmospheric carbon concentrations are at far higher levels; natural environments are more degraded; and there are growing numbers of conflicts over land use and access to water (Stern, 2007).

For an increasingly vocal body of commentators, the great contradiction implicit in promoting growth based on a continually expanding scale of resource use, 'as the cure for all economic and social ills' (Daly, 1992, p180) is motivating the formulation of alternative economic structures and social practices designed to foster prosperity without growth (see for example Jackson, 2009 and Hamilton, 2003). The goal is to disassociate material throughput from commercial success; and to define and describe economic activity by ecological limits. One of the forerunners of this 'post-growth' economics is Herman Daly (1992 2nd Ed), who 30 years ago set out ideas for a balanced and bounded 'Steady State Economy' in a book of the same name. In Daly's Steady State Economy, there is a constant stock of physical capital which is capable of being maintained by a low rate of material throughput that is within the regenerative and assimilative capacities of ecosystems. Daly defines a steady state economy in physical terms – the resource creating and pollution-absorbing limits an ecosystem places on the economy – not as zero growth economic activity. In a steady state economy, commerce is alive and well, just operating in different places and layers; 'the end of physical accretion is not the end of progress. It is more a precondition for future progress, in the sense of qualitative improvement' (Daly, 1992, 182).

It goes without saying that the building of an economic framework that cultivates qualitative improvement without ever increasing material throughput poses a profound challenge for the fashion sector. It raises numerous questions not least, for example, what 'quality' means beyond resource use and how that influences fashion's output and role which today is a fusion of both material and message. It queries what the physical limits of the fashion sector are, if bounded by a healthy ecosystem. It also asks about the scale of 'throughput' (i.e. consumption of new garments and disposal of old ones) that the ecosystem is able to regenerate and assimilate safely. While accurate answers to these questions are still to be developed; it is clear from ecological and social evidence as varied as climate change, growing waste mountains and persistent global poverty, that the physical scale of today's (fashion) economic system is unsustainable. While the numbers are still to be worked out, the truth is stark: in a post-growth economy, the fashion industry's trade in physical product would shrink dramatically from its current levels.

In an economic system geared to the optimum scale of total resource use relative to the ecosystem, rather than to growth, the quantity of physical fashion product is held at a steady level. What is not held steady and is free to expand is knowledge, creativity, ingenuity, the success of our relationships, the quality of our experiences, and how satisfied we are. Cultural capital can increase. Wealth can be redistributed and resources allocated differently. A post-growth economy is an economic system that 'develops qualitatively but not in quantitative scale' (Daly, 1992, 182). Its effect, according to Tim Jackson (2009) in his report for the UK Government, is to provide us with 'bounded capabilities' that help us prosper and live well within clearly defined limits.

It is into this context of 'bounded capabilities' and flourishing within limits that a user's 'craft' finds a natural home. For the craft of users needs little money, materials or physical capital to make it happen: it does not expand resource use. Instead it works to improve the real, live experience of using garments through the application of expertise, ingenuity and freethinking. The craft of users often results in garments being kept in service for longer, perhaps through repair and refashioning (such as in the case of Edward's three stage jacket mentioned in the introduction), or through the forming of powerful emotional connections (like in the case of Yvonne's shared dress). The effect is to delay disposal and, if keeping them in active service prevents a replacement being bought, reduces the throughput of physical goods through the economy. Other tales of ingenuity in use, such as Andy's never laundered jacket, influence the same agenda but through a different route. Rather than slowing the churn of garments through the economy, they improve the resourcefulness of each item as it is used.

More than that however, the stories and images of user inventiveness captured as part of *Local Wisdom* seem to infer an increase in *quality*. By this I don't mean better quality materials or more expert making techniques (though this too is possible); but rather an increase in the quality of engagement and connection that people have with their garments, and because of the self-improvement nature of much of this activity, also with themselves as human beings. This improved connection has been called 'true materialism' and contrasts with the sort of materialism prevalent today. Sociologist Juliet Schor (2002, 55) cites the cultural critic Raymond Williams when she says, 'we are not truly materialist because we fail to invest deep or sacred meanings in material goods. Instead our materialism connotes an unbounded desire to acquire, followed by a throwaway mentality'.

To be in a state of engagement and connection, people have to be active and able, to have access to skills, tools and opportunities to use them. They have to be recast in roles other than just as consumers but

also as competent individuals and suppliers of ideas and skills to the fashion system. Much has been written about the psychological and sustainability benefits of shifting away from 'a life of consumption' or one dominated by 'having', to what Ivan Illich (1975) calls, 'a life of action'; or in Erich Fromm's (1976) terms, life in the 'being' mode of existence. In a small way the practices unearthed in *Local Wisdom*, can be seen to be part of this shift and convey a seizing of initiative by users of clothes to actively change or improvise their patterns of use. As such they express one way to improve quality of fashion experience within the physical limits of the clothes we already have. They reflect, albeit tentatively, one set of activities that comprise fashion in a post-growth economy. They bring those wisdoms borne of using clothes as part of everyday life into direct contact with the future sustainability of the fashion industry. And with that they bring the prospect of trading cultural capital and users' knowledge in a new layer of exchange or commerce that is measured in terms broader than growth and increasing use of resources and instead based on increasing the quality of the fashion experience.

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About the author

Kate Fletcher is a design activist, consultant, writer and key opinion leader in fashion, textiles and sustainability. Her work, in academia, with high-street retailers and NGOs, has been at the forefront of design for sustainability in fashion and textiles for the last fifteen years. It has roots in ingenuity, vitality, care and resourcefulness and is fed by design ideas and practical action. Kate holds a PhD from Chelsea College of Art and Design, is Reader in Sustainable Fashion at London College of Fashion and the author of *Sustainable Fashion and Textiles: Design Journeys*.

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the Learning Network on Sustainability

Temporary events and environmental sustainability

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The "environmental fiction" that Andrea Branzi (Branzi, 2006) defines as "superstructural and transient" invades the city within a fixed time, with buildings as ephemeral spaces, furnished temporary features, temporary installations and events for a period shorter or longer, provoking emotions, consent, dissent, alternative uses of space stressing multiple meanings and possibilities. It is a fiction related to rhythms not only generational as it traditionally was in the city, but seasonal, if not weekly or daily.

While, on one hand, the codification of a design language is the subject of debate and other reflections, it still lacks an established sustainable approach, although there are already technologies and tools to be used for an environmental compatibility.
The aim of this paper is to investigate the state of the art and to begin a process in order to have guidelines to those sustainable aspects that are not covered by actual legislation.

Introduction

The "human transhumance" (human migration) as taken place over centuries in various forms shaped by needs, functions and activities that have changed. A clear distinction characterizes the movement, the journey, the wanderings of a nomadic history, from the contemporary one. The first was the result of the need to satisfy basic needs of subsistence, the search for environments not yet affected by human activities, or of colonial conquest of territories which was the cultural heritage of certain populations that were geographically limited. On the contrary, modern nomadism is a symptom of "glocalization" that is generated by the economic framework in an international context[1], linked more to meet secondary needs related to wellbeing (cultural, physical, social) and experience, and not to primary needs. The type of user is versatile, a consumer experiences and no longer belongs to well-defined categories but contaminates age, social and economic status (Pine and Gilmore, 2000)[2]. In this context there are a number of functions that are related to the need to be together not as an obligation but as a necessity, linked to the transmission of culture, entertainment, the spread of the arts, the contamination of knowledge, which become increasingly part of a common heri heritage and no more realte to the context in which they were born, making mobility a way to live experiences and layers one's life.

[1] Evolution of work methods, production, business administration has created over time a shift from a small-mid range economy which covered the immediate context of the company, to an increasingly international economy that could act physically in one place and distribute the output of production in far away in time zones and different geographical contexts

[2] Although now published for almost a decade, the book by Pine and Gilmore, is still relevant in its definition of designing experiences and its identification of changes of users and their ever growing demand for the ephermal.

The role of design in the temporary solutions

Mobility is an integral part of the temporary event that assumes itinerant and fleeting characteristics. It has a key role in the diffusion of culture-related experiences in contemporary society. Whether it's a musical tour, an art exhibition in stages, a scattered theater festival, a town festival, sports events or the media, the output of the event moves on two parallel tracks that seek on one hand the experiences that Pine and Gilmore have well codified and on the other allows a degree of freedom and experimentation in terms of material and forms of intervention, that makes the discipline of design best suited to address those changes in the urban or Suburban. Design, leaning against a systemic logic helps to obtain flexible and attractive spaces, communicative with a sensibility that comes from experience gained in the field of designing interior spaces.

That "environmenatal fiction" that Branzi (2006) defines as superstructural and transient invades the city, and places it within a fixed time, with buildings as ephemeral spaces, furnished temporary features, temporary, installations and events that make places for a period shorter or longer, provoking emotions, consent, dissent, alternative uses of space stressing multiple meanings and possibilities. It is a fiction related to rhythms not only generational as it traditionally was in the city, but seasonal, if not weekly or daily.

From this point of view design deals with Temporary Urban Solutions (TUS) that are devices, set ups, design strategies that contaminate a single building, a built-up area, an open or transit space. They enact a functional and perceptive transformation process in occasion of temporary events connected to hospitality, retail, free time and entertainment.

Temporary urban solutions adapt themselves to the city's trend to have fluid and changeable spaces that depend on a functionalization of living and working spaces, which no longer follows the "long-term" logic, but a "hic et nunc" one, "here and now".

Having lost their specialized trait, the contemporary city's open spaces and most of the abandoned building heritage demand to be adapted to a wider and wider number of functions, not only through requalification but also through re-functionalization, using Interior Design tools or, even better, those of Space Design (Piccinno, 2008)[3]. They take charge of another housing need, where the private dimension and the collective one must be able to live with one another.

If, on one side, the city has more and more fragmented borders, that generate "other" places, not programmed or close to the creation of a spatial "drift"[4], on the other side, a contemporary passer-by[5] makes these spaces his own, building dynamics and "mis-behaviours"[6], that transform the "third landscape" (Clement 2005) into an own landscape, forced to respond to his needs with spontaneous tools and actions.

The "environmental fiction", defined by Branzi (2006) as super-structural and transitory invades the city, the spaces with a determined time, with ephemeral buildings, furnished and temporarily characterized spaces, events and temporary installations, that transform places for a more or less long time, raising emotions, agreement or disagreement, alternative use of spaces, aimed at underlining their multiple values and possibilities. The fiction is connected not only to generational rhythms, as it was in the traditional city, but to seasonal ones, if not even weekly or daily ones.

In a programmatic attempt to define the system, "Temporary Urban Solutions" can be referred to four major categories: retail, hospitality, free time and entertainment.

Retail

Retail has left aside the modality of the unique dealer to shift closer to other typologies, which are able to meet a momentary need, created ad hoc for a certain occasion (new collections, thematic fairs), for a commercial intent (openings of new traditional retail stores), or an investigative one (testing the potential

[3] "Within the School of Design of the Politecnico di Milano and for the INDACO department, the Interior design didactic research unit and the "Space Design" sub-unit, has started some research and project experiences in the field of Space Design; within the didactic activities of the Bachelor ad Master degree studios; with the international network called GIDE (Group for international Design Education); for external institutions; for research or management activities linked to contests".

[4] Situationists deal with it at the end of the 50's according to the French Dadaism experiences some years before.

[5] Francesco Careri in his book "Walkscapes" assesses that "[…] walking can be a means through which to invent, a different approach of intervention in public metropolitan spaces, to investigate them, to give them symbolic meanings […]"

[6] Frank O'Sullivan, director of thee MA in Interior Design at the Brighton University speaks about "misbehaviour" a san attitude "against" (the function a place is meant to have, the rule, the existing legislation) that generates a demand for a new use of spaces, by granting them new equipment.

of a brand in a specific market). If the store moves towards the spectacularization of product and space, embracing new ways of communication and interaction with the customer (concept store), outside this closed stage, sales open to the city and its diffuse spaces. This is a non traditional market, made of sale modalities (aggregative and non aggregative) that use the most various means (vans, platforms, inflatables etc.) adapting them to their commercial needs, transforming spaces, consolidating the brand image and surprising the "passer-by".

We are talking about pop-up stores, stands, markets[7], fairs, totems in multi-brand spaces, corners in malls (Gerosa, 2008), sets that re-configure the existing, characterizing it in different ways through it's life-cycle.

Hospitality

Nowadays, giving hospitality can be defined as a new need-emergency that rises from the evident change in the way of travelling, from new types of nomadic life, from non predictable situations connected to natural and human catastrophes, from the increase of "temporary urban users" due to thematic events (fairs, concerts, political demonstrations, sports events) that have introduced mobility as a permanent condition. Temporary Urban Solutions for hospitality can be broken down into three main categories[8]

"Housing": basic hospitality cell; "Community": design of collective spaces able to host within them social and restoration functions (lounge, bar), as well as primary functions (restrooms, kitchens, laundries): "Networking": design of the network that connects housing cells, i.e. of the system of pedestrian paths, lighting, signals etc. as well as "immaterial" communication services (internet, radio, booking system etc.).

Free time

Equipping public spaces refers to parks, squares, passage spaces, border spaces and in-between[9] ones. Places where free time can be transformed into full time. "The city is a game that can be played according to one's own liking, a space where to live together and experiment alternative behaviours, where to lose useful time in order to make it fun-constructive time"[10].

Entertainment

Entertainment represents a category to itself, that regards specifically mass reunions in occasion of medium size or big events: concerts, political and religious demonstrations, sport. Even if these event typologies rely on existing structures (stadiums, sport arenas), they generate two types of Temporary Urban Solutions: the first one is connected to the set design of the event itself (stage, platform settings), the other one regards side situations (paths, advertising corners, food&beverage).

Temporary Urban Solutions, due to their provisional action, involve some project and building devices that concern the problematic of contextualization as well as the life-cycle one.
Temporary interventions in cities (Branzi, 2006) can be "black-boxes" if they do not weave any relationship (either physical or immaterial) with the surroundings. Therefore, they become similar to contemporary architecture monuments, the outcome of project actions carried out by famous architects, not connected to one another, i.e. "brand architecture" (La Cecla, 2008). On the other side, temporary interventions can be "value multipliers", generating new dynamics of using spaces, implementing aspects

[7] The tradition of the covered and open market is nowadays different forms, ways and places that touch the borders of "Temporary urban solutions" even if keeping their own identity. The floating markets of Damnoen Saduak in Thailand, the covered market of Santa Caterina in Barcelona, the Grand Bazar in Istanbul, the covered market of Madama Cristina in Turin, are just some examples of temporary, mobile, jointed, replicable spaces, that rely on a container or represent one themselves.
[8] The three categories are at the basis of the brief for the contest "Milano Design Camping", an international design initiative to search for temporary housing solutions for the city of Milan, published in April 2010.
[9] According to the architects Diller and Scofidio "[…] space is everything that lies between one man's skin and that of another man […]" in Cattiodoro (2007)
[10] Careri (2006) reports the teories of the "Internazionale Situazionista" on what he calls '"Anti-walk" on the basis of Huizinga's(Huizinga, 2006).

linked to the culture of places, depolarizing one-centred cities[11], placing themselves in a complementary way to the "non-value" caused by abandonment, by misuse, by dis-behaviour, contextualizing themselves in highly environmentally characterized (natural or human) settings.

These solutions relate to the territory in two ways:

- macroscopic: relationship with the landscape, with tradition and local culture. This can be looked for in a declination of the "frame" or e.g. finishing a pre-built structure that will be entrusted to local specificities according to the logics of self-design; or that can be shun through the logic of the box multiplied to infinity;
- microscopic: the relationship with the ground, the degree of constraint to the territory, that highlights the major of minor lightness of intervention and the possible predisposition of support platforms for parasite microstructures rather than autonomous elements that place themselves in an independent way.

Event sustainability framework

While, on one hand, the codification of a design language is the subject of debate and other reflections, it still lacks an established sustainable approach, directing such kinds of intervention, although there are already intrinsic technologies used and the communication methods that promote requirements of environmental compatibility. The environmental impact that a TUS has is not entirely negligible while representing a small percentage compared to the areas of production, transport and service. If we limit the investigation to music events it can be estimated that in 2007 there were approximately 50,482 concerts in Italy. The total emissions from these musical events is about 45,000 tonnes of CO2 and though this might seem to be a fraction of the total annual production of 532 million tonnes of CO2 in Italy, it is equivalent to emissions from about 22,500 cars that travel for 100 kilometers each. If we add other types of such events, it is clear that the numbers assume a major importance keeping in mind the obligations of the Kyoto Protocol to make reductions in emissions of pollutants (carbon and five other greenhouse gases, namely methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride) to an extent not less than 5.2% compared to the emissions recorded in 1990 (considered as base year) over the period 2008-2012.

State of the art and development

To date, Temporary Urban Solutions does not have a mandatory regulation or a specific regulatory framework. While the product and the building are the focus of national and international regulatory bodies[12] gently introducing a certification scheme and design of devices aimed at minimizing the impacts on the environment, "the temporary" is still moving on the border between the two touching upon on some aspects of evaluation as object (eg, components) and others as buildings (eg environmental comfort, plant engineering) with a third field directly connected to the managing of the service.

Environmental sustainability of a TUS could be assessed by analyzing the following factors belonging to specific fields and life cycles (before during and after the event).

- Regarding the product, process and service system
    - Energy consumption (through an energy analysis, or LCA) and connected system of compensation and decreasing.

The term "Zero Impact" that accompanies some big concerts in recent years is associated with the creation or thickening of forests, with the basic principle of photosynthesis giving back to the environment the oxygen deprived due to temporary events[13] in their life cycle phases. The system event

[11] The Milano Design week, taking place in occasion of the Furniture fair, is a classic example of re-polarization of the city. Neighbourhoods such as Tortona or Lambrate become new poles of attraction in the short period, moving masses, interests, economies.

[12] Within the family of ISO standards 14020 and 14040 deal effectively with the context of the assessment of environmental sustainability in the production of objects and construction of buildings through the branding of type I, II and III environmental management systems and standardization of methodology LCA (Life Cycle Assessment).

[13] The association LIFEGATE was the first in Italy to develop a service like this. A case study is the compensation that was done for the "Festival Internazionale del Film di Roma" (15-23 October 2009): Faced with a release of more than 1 million kilograms of CO2

management together with "green" design practices are creating guidelines on how manage before, during and after the event that are begining to join well-established practices. Choosing local suppliers, implementing car-pooling projects, use of paperless communication channels during promotional and post-promotion, increasing the use of recyclable materials and a system separating garbage, are inputs that are the basis of a proper environmental management[14].

- Disassembling, recycling, reusing of materials/products used in the TUS and of the waste produced before , during and after the event.

Design therefore does not yet have a recognized role in optimization of sustainability in this area, although the prerequisites for generating good design practice are there. Consider the technological feasibility of the events: It involves the use of technical devices which necessarily correspond to the principle of ease of assembly and disassembly, which in turn generates the use of single material components that are disposable and easily recyclable. Both in structural and in the setting up of areas we use technology and materials which meet these requirements: Scaffolding rental (with considerable savings in production of ad hoc structures), use of multi-purpose pylons ("American Truss", "Lahyer system "), system of dry connections, connecting materials with limited use of glues (from floor coating to products for set design).

Despite this, the present scenario of recycling and collection of waste generated during an event, has numerous initiatives to raise awareness of user of TUS. "Fa la cosa Giusta" (Cappè and Tagliabue, 2003/04) ("Do the Right Thing") exhibition born in 2004 in Italy, aims to disseminate examples of "best practices" of consumption and production. Through the "3R's: reduce, reuse and recycle" adopted a program that involves the reduction of energy (green energy use, lighting LEDs), reuse of materials used for construction through a serialized components, recycling waste, use of plastic-free products and cooperation with AMSA[15] for waste collection and disposal during the event. AMSA during the Milan Design Week also managed a project with Zona Tortona[16] "C'è differenza" ("There is a difference") for the collection of material from construction and dismantle, for user awareness about recycling during the event. This strategy was adopted with "Recycle with Pride" organized by Office of Recycling Outreach and Education" during Gay Pride 2010 in New York with a massive education campaign to separation for recycling of consumer goods during the event. At the same time, Rock Werchter is a music festival that takes place 40 km from Brussels with more than 300 000 spectators over 4 days. It was among the first musical events to monitor and reduce their environmental impacts by 2006: the conventions of public transport, refreshment stand powered by portable solar panels, recycling, supplies dynamo mobile charger, one free drink any 20 used plastic glasses collected, since 2007 monitoring the daily energy and water consumption in services and catering activities, and since 2008 monitoring the impact created the camps, by the traffic and consumption of land for parking areas.

There are few examples about labelling and certification in the international context. "Sustainable Events ®" is an Italian project[17] which since 2007 has developed a certification attesting the level of commitment to environmental sustainability of an event through the use of software screening Sustainable Event ® with a parameter called the "significance" (recognized by EU Regulation EMAS No 1221/2009) which is assessed using three dimensions: environmental, communication / educational management. This certification is associated with environmental labels type 1 (according to ISO 14024:1999) as a mark of excellence.

- Regarding the product system
  - Toxicity (with laboratory tests that can test the degree of impact on health and the ecosystem of toxic and noxious substances).

The eco-labeling schemes based on ISO materials and products today does not guarantee a non-toxic materials because it does not include a series of laboratory tests on the release of toxic materials, or the growth of microorganism/bacteria. CSTB in France and CNR in Italy over the past year have moved to

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generated from transportation, electricity and new resources are created in the forests of Costa Rica, for a total area of 200,000 square meters (which will also create job opportunities to local communities) and a new protected green space was created in the Reserve Valley of Aniene (Roma), leaving a public park with over 600 plants and trees.

[14] The Edison group with the project "Edison – Changes the music" drafted in 2009. The "Green Music Book" guidelines (in open-source) for a sustainable design practice in the events of musical character. Sustainable.org makes a decalogue in free-access rules that range from managing the use of materials still on the same theme.

[15] AMSA stands for "Azienda Milanese Servizi Ambientali" (Milanese agency for environmental service. It is in charge of collecting wastes in the city of Milan, Italy.

[16] Zona Tortona belongs to DesignPartners, a company that organizes temporary International events in Milan.

[17] It is a cooperation among Università di Bologna, Tangram and Punto 3.

develop a series of laboratory tests to support this gap but have not yet been codified in international standards. TUS also like to cover other areas would benefit from this implementation.

Conclusions

Not following this logic, however, today the limited scenario of sustainability in the mobility event is working more towards offsetting emissions of harmful substances (primarily CO2) rather than decreasing emissions at the source.
While on one hand consolidated planning and management practices are still missing today which makes no reference to the logic of craft but of Life Cycle Design which involves a production system that is ready to respond to environmental needs, to the other, there are areas that are already well defined (low emissions, proper management, use of appropriate technologies and materials certificates) on which you can base your project and can make even this aspect of sustainable mobility.

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the Learning Network on Sustainability

Sustainability of design and Eco-Holiday Project[1]

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The increase in the use of materials and energy sources and resulting environmental pollution led to the emergence of the concept "sustainability" in the 1970s, which remained on the agenda until today, gained popularity, and received its place in industrial product design. In the 21st century, it gained political infrastructure with new formations and methods by the "European Commission". However, actual developments have to follow from this point on. Here, every sector and each citizen have to do their duties. It is the duty of the design instructors to commence sustainability of design at one point without any delay. That is how eco-holiday project was born, and it is not possible to say it was a successful one, since it was made only with sophomore students. Students and instructors were not sufficiently conscious. Because of the scope of the issue, it was very difficult to be creative and obtain results in all solutions. Instead of being creative, negotiations and discussions infested the classes.
Keywords: Sustainability, design, eco-holiday project.

Sustainability and Its Historical Development

The concept of sustainability covers a number of chain measures to protect the balance of nature, to render living environments and social lives more equitable, safe and economical in order to respect and protect humans and other beings in their natural environments and help them see the future.

The increase in the use of materials and energy sources in the 1970 led to an increase in environmental pollution, which gave rise to the concept of sustainability.

World Commission on Environment and Development (WCED) convened for the first time in 1984 and issued the Brundtland Report in the spring of 1987. This report defined "sustainable development" for the first time, and claimed that mankind is able to implement sustainable development (www.mddep.gouv.qc.ca). In the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992 the strategies mentioned in the Brundtland Report were further improved by representatives from 179 countries, and they considered issues such as the protection of natural resources, sustainment of all varieties of forests, and climactic changes. The conference established that the main reason behind the deterioration of natural environment, especially in industrialized countries, was the execution of production and consumption with unsustainable models. The conference considered the making of preventive strategic decisions; the use of energy and sources in more feasible processes of production; the research for cleaner methods of production in all processes in the life cycle of products; and the minimization of waste during and after production as strategic decisions. These decisions were developed by many countries as their own strategic decisions and implemented. With the "White Paper" titled "Growth, competitiveness, employment: New formations and methods on the way to

[1] Eco-holiday project was made with 35 sophomore students in the Spring term of 2008-2009 academic year. The project was conducted by Assoc. Prof. Dr. Secil Satir, Instructors Humanur Bagli and Ece Ariburun, and Researchers Ayhan Ensici, Turgut Cirpanli, and Ceyda Vatan.

21st century" issued by the European Commission in 1994, a political infrastructure was formed for sustainable production (Şatır, 2009: 331).

The Contents of the Concept, Sustainability

Excessive industrialization with materials such as petrol and petroleum derivatives that harm nature caused the emergence of sustainability as a concept. Papenek (2003:33), who realized that the basic support of life was ecology and environmental balance, itemized the Environmental issues in Life Cycle Assessment:

- "The exhaustion of scarce or finite resources
- The production of greenhouse gases
- The production of chlorofluorocarbons leading to ozone depletion
- The production of acid rain
- Habitat destruction and species extinction
- Materials or processes that harm plants, animals and humans
- Air, soil and water pollution
- Noise pollution with its deleterious effect on the human psyche
- Visual pollution"

The sustainability of design is not a subject that could be considered and assessed on its own. There exists a comprehensive process and chain life cycle before and after product design. In this context, it is compulsory to prepare safe environment in urgent and priority matters such as provision of air, water, food, and accommodation for the sustainment of living environments and for the protection of future habitats.

Birkeland's (2007: 28) ecological design scale establishes the duties of designers from separate fields in an expression which becomes more specific as it moves towards the center:

- "Bioregional planning", mentions about an integrated planning; the handling capacity of regional biologic life and ecosystems, the shaping of life styles, production and management systems, etc.
- "Urban ecology", represents the cities as second level of the scale from the outside.

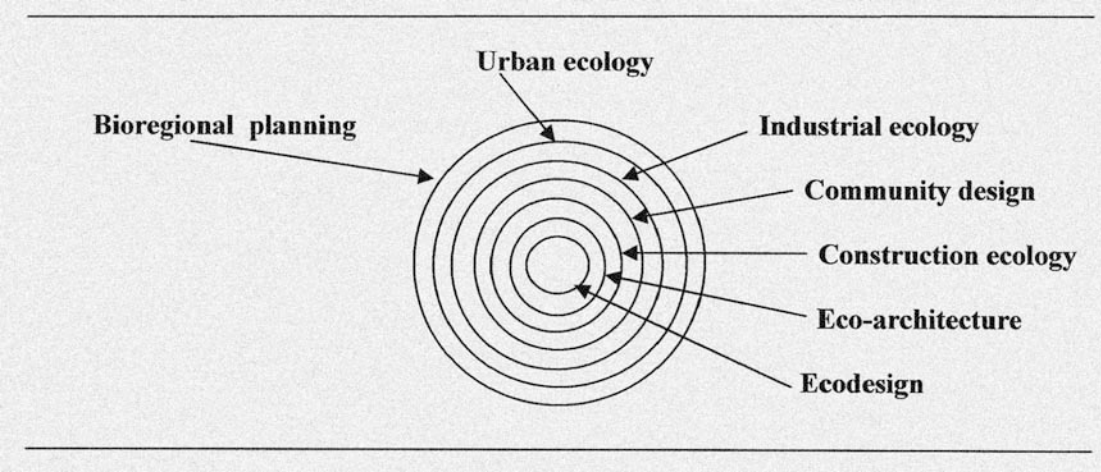


Table 1: Eco-logical design fields exist at all scales

Soucre: Birkeland, 2007: 28

- "Industrial ecology" considers the economy of production processes and their environment-protectiveness.

- "Community design" points to the effects of developments and settlements on the ecological balance.
- "Construction ecology" mentions a structure which economizes on materials in product structures, and manages ecological means correctly.
- "Eco-architecture", points to the fact that ecological designers reduce the operational impact of structures and support designs which improve man's efficiency.
- Ecodesign: Eco-logical designers are reducing the amount of toxic materials and energy used in industries and homes, facilitating disassembly, reuse and recycling, and working to reduce status-seeking and waste by consumers."

In Birkeland's (2007:25) study, the design guidlines taken from Sim van der Ryn and Stuart Cowan's book Ecological Design (1996 – Island Press, Washington D.C.) show that everybody is a participant-designer, and working with participant-designers provides the best solution. In this context, the summarized guidelines include:

- "Solutions grow from place:": Ecological design, which suits to local conditions and people of the region, brings forth small-scale solutions.
- "Ecological accounting informs design": Tracking the environmental effects of existing or proposed designs should be used in the choice of the healthiest design option.
- "Design with nature": Re-evaluating the living and regenerating processes for design means getting more alive for our needs while respecting nature.
- "Everyone is a designer": Heeding everyone's call, making them participant-designers will lead to more prosperous results since they know their environment better.
- "Make nature visible": The most effective design is one which make us recall our place in nature, which makes natural cycles and processes visible and brings life to designed spaces.

In Birkeland's (2007:25) study the "Hannover Principles" provided by William McDonough briefly encouraged the following: humanity and nature coexist, design should take into consideration even the most distant effects of this interdependence; the relation between materiality and spirituality should be respected; responsibility should be taken for the coexistence of humanity and nature; long-term and safe objects should be designed; the notion of waste should be eradicated; natural flow of energy should be used most effectively; the nature is our guide and limits of design should be comprehended; we should take the ethical responsibility for long-term sustainability.

When it comes to how we could be directed towards a sustainable order, Manzini (2002:9,10) gives clear instructions by first defining the "design guidelines for sustainable solutions":

> "The design guidelines have to be considered as concise expressions of possible design strategies. The design guidelines have to be used in the concept generation phase, when the choices that have to be done are necessarily holistic, i.e. their social, economic and environmental dimensions are integral parts of the whole project and, therefore, cannot be considered separately... Design directions in which all the different solution dimensions are included."

> "The assessment indicators are used when the design process is at an advanced stage of its development. In fact, only at this stage it is possible to split the impact of the designed system in measurable bits and, in this way, to define separately its social, economic and environmental impacts."

The design guidelines by Manzini (2002: 9-10) were quoted as titles below and their content were summarized:

- "Check basic assumptions" : Rather than a principle, the author defined an ethical movement here which made sure it is consistent with the "ethical, social, and economic principles of sustainability".
- "Use what exits": This points to the fact that primarily existing resources and infrastructures should be used.
- "Minimize mobility": By localizing production and consumption, and narrowing the flow of materials, products and people, it is aimed to minimize and balance the mobility.
- "Use sun, wind, and biomass": Renewable resources are the only solution that is acceptable in the long term. Use the locally existing, renewable sources of energy.

- "Create symbiotic systems": By taking industrial ecology as the foundation of new production systems, you should look for solutions that design with zero waste.
- "Integrate and share": Design integrated multi-functioning systems that minimize matter and materials and that put the need to socialize on the foreground.
- "Empower individuals and communities": Activate individual and social participation in order to activate the system to be designed and focus on problem-solving.
- "Develop flexible, networked organizations": Develop the learning capability of the system for sustainability, which is deemed as a social learning process.

The diversity of the guidelines of sustainable design shows the difference of fields that need to be related and also shows their interrelations. Walker (2007:16), stresses the importance of the three fields for sustainable development: "environmental management, social equity, and economic issues". For example, planning to abandon harmful petroleum derivatives, deciding upon a renewable energy source that replace it, calculating its feasibility could be issues of "environmental management" which may be a subject that could be handled by businesses on their own. However, a thorough testing of its efficiency and installment costs should be taken into consideration. In a wider sense, for the whole country, government policies, and local management should accept and decide about the issue. Good environmental management and economic decisions also balance the social structure.

The main argument of Hawken's study is that the real problem is not the disposal of toxic waste. Toxic waste is only the symptom of the main problem. And the main problem is the creation of such waste. The cyclical structure of nature made it possible to reach one billion years of history, since all species are either directly or indirectly beneficial to each other. Incineration of toxic waste could at first seem like a good measure. In the U.S., the fly ash resulting from incinerated toxic waste is kept in impermeable packages, guaranteed for 20 years, in landfills where they will stay for thousands of years. Some American companies, however, ventured to incinerate garbage with the notion "trash to cash" in order to eradicate the negativities of nuclear energy in U.S. General Electric (GE) Plastics' transformation of car buffers into internal car parts, plastic desks, construction materials, and incinerator fuel could be given as examples (Inman 1999: 46-49). Although at first it looks beneficial for companies and the environment, again in the U.S.A.:

> One study in New Jersey showed that a state-of-the-art incinertator consuming 2,250 tons of household garbage daily would annually emit 5 tons of lead, 17 tons of mercury, 580 pounds of cadmium, 2,248 tons of nitrous oxide, 853 tons of sulfur dioxide, 777tons of hydrogen chloride, 87 tons of sulfuric acid, 18 tons of fluorides, and 98 tons of particulate matter small enough to lodge permanently in the lungs. Most important, incinerators turn out to be dioxin generators. The lignin from paper and wood combines with chlorine gases to form the 210 different dioxin compounds (Hawken, 2005: 46, 47).

Hawken's study showed that 100 tons of garbage resulted in 30 tons of fly ash; although the container plastic was guaranteed for 20 years, fly ash landfills in New York and New Jersey reported toxic leaks months after installation.

It is a fact that advertisement sector, which made a great leap forward in the 20th century, obviously promotes consumption. This promotion increased luxurious life styles especially in rich countries, and injected an identity of consumption culture into social structure. Having developed these habits by taking each other as models it is not easy for consumer societies to give up luxury. For the manufacturer companies create inappropriate and exaggerated needs and these artificially created objects of need are injected to consumer thoughts through advertisements.

In the process of these developments, as mankind wanted to transcend nature, industrial systems continued to serve to the excessive comfort and welfare, and allure of the material world. Industrial companies adopt a process which cannot easily turn them back from their profits. Consumer culture tore people away from nature and growing population increased the rate of harming it.

Walker (2007) claims that it is not possible to take pleasure from using designed products knowing that they cause environmental destruction and lead to a manufacturing system to which social inequities permeate. He goes on to mention that it is not sufficient to improve traditional implementations and that there is a possibility to create a material culture where responsible, ethical and humane values are on the foreground. According to Walker, contemporary design ironically seems to create problems instead of solving them:

> "Marcel Duchamp once said; 'There is no solution because there is no problem' (Éditions Hazan, 1997, Postcard of Marcel Duchamp with the quote, Paris D.R. CN504, Printed in France). If there is

> no problem then what does the designer do? In my view, it is more accurate and more costructive to say that designers create possibilities. We create possibilities of how things could be; but we have given less thought to the question of how things should. When we pass from could to should we introduce an ethical dimension, and this is a key feature of a more sustainable approach" (Walker, 2007: 37).

Walker emphasizes that improvisation means making do with the limited means available; that solutions which come up as consequence of causes are less applicable; that a more sensitive type of design and creativity should be encouraged. The source of such an approach is shown to be in regional and local design, because there is an integral consistence between material values, beliefs, and life styles of traditional cultures. The objects of these cultures usually have a profound and symbolic meaning beyond their functional benefits.

> "We can also learn from the craft and folk design traditions. But it is our challenge to find ways of bringing together the local and global to create design that are suited to modern, technologically and economically developed societies. Such an integration would also go some way to bringing the chasm that has grown between craft and design for industry"(Walker, 2007:36).

In the context of sustainability of design, updating services and system design besides the measures such as the reduction of materials, avoiding to create waste, simplifying manufacturing systems, and the systems' being content with what is at hand, make researchers think of more advanced measures. One such thinker is Fry. Fry mainly deals with the notion "quality economy" and suggests a "Shifting from Quantity to Quality".

> "The paradigmatic shif that is needed is to think and organize economy in relation to entropy- so as to move from a quantity/fast entropy to a quality/ slow entropy economy. This shift would represent a dramatic reduction in materials take-up and production, combined with dramatically increased concern and accepted responsibility for what materials and the made do in and on the world and everything that dwells therein. Rather than this shift diminishing an economy's ability to generate wealth, the very nature of wealth becomes redefined"(Fry, 2009: 215,216).

Fry's explanations make us think that for sustainability, a change from quantity to quality does not lessen richness but instead requires a redefinition of richness. Accordingly, it is emphasized that the costs of destructions that lead to climatic changes, environmental problems and poverties should be inspected; and the cost of global inequities should be examined as well, for a redistribution of justice to contribute to sustainability. Fry also fuses the notion of quality with "Quality Economy", against rapid growth, illusory richness, racist discrimination, he sees quality economy as a fundamental and philosophical value, as a solution which has nothing to do with luxury and in which how an object is formed and what it sustains is questioned. While quality is defined as "decreasing production volume and expanding range of services" it was also explained in detail in four examples which could be "turned outward" and "developed in other ways" (Fry, 2009: 218-220).

- "The Making of an Environment of Care"; Creating a comprehensive environment of care among people of all age groups and all occupations relating to on an awareness that life could be sustained relying on a productive economy that depends on quality will make further attempts for the solution easier.
- "Transforming the Nature of Things"; "Quality, as presented here, demand so much more from products and services...Extending this thinking invites us to contemplate the relation between the creation of 'quality things' and things eliminated".
- "Transforming Being with Things"

Here it is necessary to abandon labour-saving which has become life threatening, and to use more tools that require manpower, giving the control of the physical world to man's own hands ... What is rematerialized in the scope of quality is "humble" and "mundane"; here the term mundane is an objective structure that serves to a larger social class.

- "Creating Major Changes in Modes of Dwelling"

According to Fry, if it is impossible to change all beings and hitherto dominant cultures by transcending man's centrality, the responsibility should be assumed completely. If today's energy and material-intense life styles continue as usual, we will have to adapt to the conditions of a deteriorated order without relying completely on science and technology. If people realize the negative developments in the world they inhabit and become willing to change their lifestyles, cultural, ethical and economic transfor-

mations may start quality economy and hence the culture of sustainability. In order to design for future lives, quality economy should establish links with political and new economic thought and start a grand project which needs contributions from all fields.

Comparison of Sustainable Design

It is not easy to get used to the notion of sustainable design. It is actually quite difficult to attempt making designs with certain limitations and by abandoning the definitions of design we have experienced, applied, and taught so far. It looks more of an insolvable phenomenon for students who experienced design with deductive methods and by adopting a concept. Nevertheless, now, designers will need imagination, creativity and innovation more than ever. The need for innovation should be met at a level of cultural developments, with products of that have minimized harms, using less materials and considering the local cultures and by being aware of social, environmental and economic responsibilities.

Conventional design	**Sustainable design**
Industrial design	Design of functional objects
Product design	Creation of material culture
Specialization	İmprovisation
Conventional	Uncertain, uncomfortable
Professional	Amateur, dilettante
Specific	Holistic, integrative
Instrumental	Intrinsic
Problem-solving	Experimental
Solutions	Possibilities
A priori design	Contingent design

Table 2: Reframing design. A comparison of key characteristics

Soucre: Walker, 2007: 38

As Walker (2007:38) compared conventional design with sustainable design, in fact he put on the foreground the design of functional objects which is already in the scope of industrial product design. This makes us think of “design engineering” field and shows us the necessity that functional objects should be designed with a minimum of materials and should establish a direct communication with the user. Creating a minimized material culture instead of a product culture means that objects of use are manufactured on their own site, in an improvised manner and perhaps by their own users or by the artisan. A sustainable design is dependent on the environment, is integral and unique; while meeting the needs of people who became one with their environment, it also experiences life with the probabilities of future.

Employment of Sustainability in Design Training and Eco-holiday Project Implementation

With the eco-holiday project, both instructors and students inspected the issue of sustainable design: In this context, some part of the study, which is the subject matter of this paper, was completed. The following notions and phenomena about sustainability were learnt from the study:

- Environmental issues related with life cycles,
- Other eco-logical fields of design that cover each other starting from biological regional planning until they reach eco-design,
- That design should have a direct link with nature and locality,
- That everyone could be a potential designer, and knows about their problems best,
- That sustainable design could prove to be beneficial in eradicating social inequity, besides its regional and local character,

- That at first what is existing, natural, and less mobile should be used and networked, integral systems should be assessed,
- The importance of creating solutions that leave no waste behind instead of a solution that involves recycling of waste or incineration,
- Designing products in modular elements, developing mounting and demounting methods, being productive by changing parts,
- The necessity to abstain from luxury,
- The necessity to shift rapidly from a material culture that attaches importance to consumption to a spiritual culture that will learn making do with less,
- Instead of creating luxury products, it was expected that environment friendly conceptions should be crated with no waste and using energy, material, time and effort economically,
- "Traditional handcrafting production methods and their masters' regional and local working styles should be given importance and they should be employed in product design" (Satir, 2009: in USB),
- Understanding the difference between conventional and sustainable designs and their methods,
- Developing the notion and content of quality economy.

With all the learnt information, the sophomore students at industrial product design department did not fail to understand the issue basically; then under the heading "ecology", the students were expected to conceive an ecological holiday inspecting the concept and types of holiday (touring, daily holiday, weekend holiday, regional holiday, business trip-conference, winter-summer sport holidays, healthy trekking, etc.). The conceptions were for establishing ecological needs.

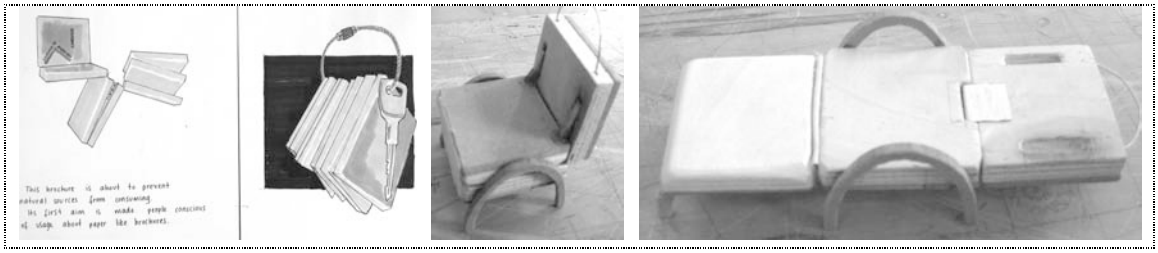
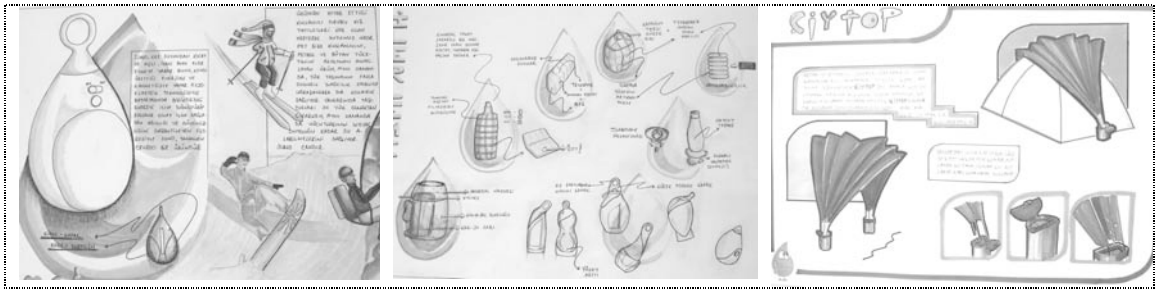


Figure 1: 'Eco-brochure' for hotels, motels, holiday villages – Project: İzlem Akman
Figures 2, 3: Expandable chais longue for terraces, gardens, and beaches – Serefnaz Karakuş

Eco-brochure project was projected to be made of thinly pressed wood dust or recycled cardboard. Mini brochure informs about the environment while serving as a key ring for the hotel room.

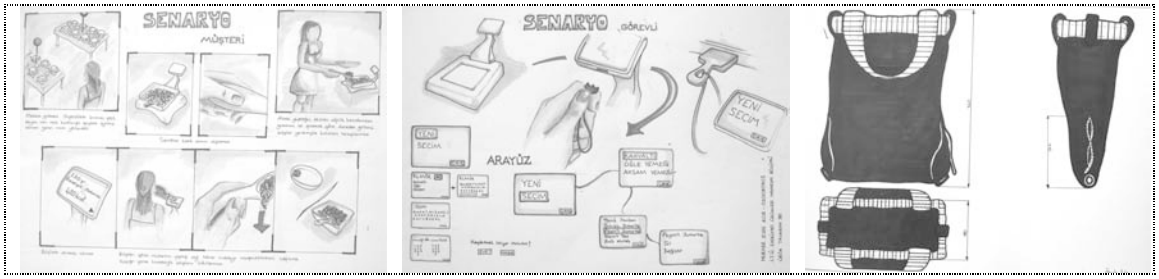
Expandable chais longue was projected to be made out of thick canvas over unsinkable woven arc; the frame is made of metal pipe.



Figures 4, 5: Apparatus that turns snow into water – Yasemin Sinem
Figure 6: Tent cover to gather dew – Pelin Kepez

Apparatus that turns snow into water operates with piezoelectric effect produced from pressurized crystals. Instead of carrying water with them, mountaineers and winter sportsmen could easily obtain water from snow with added minerals.

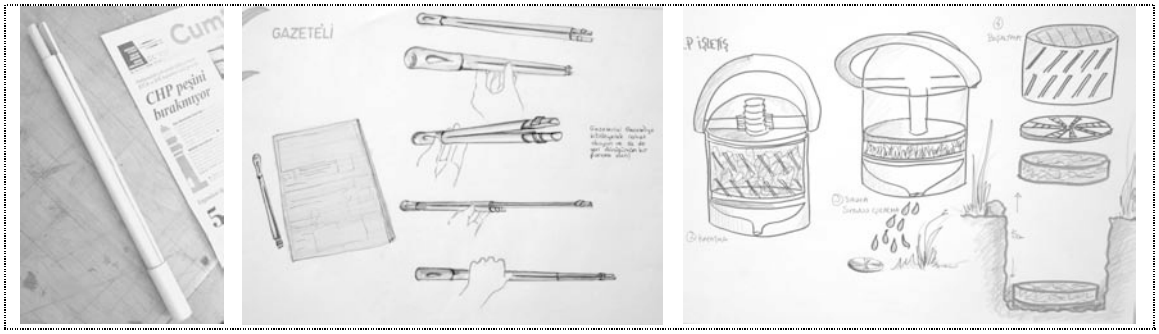
Those who camp in cool regions could gather dew and obtain water thanks to impermeable tent cover.



Figures 7, 8: System that prevents wasting of food at hotels and holiday villages – Huriser Ezgi Ece
Figure 9: Textile market bag and basket – Oylum Onur

Limitless eating and drinking at hotels and holiday villages lead to overeating and loss of food. Foods separated according to color codes are weighed and their calories are calculated when served. This prevents wasting of food.

Textile market bag is collapsible to a basket if desired.



Figures 10, 11: Newspaper carrier when you read – Zeynep Basmacı,
Figure 12: Litter bin that presses organic garbage at home – Alarça Erözçelik

Newspaper carrying apparatus could be used any time. It consists of interlocking aluminum pipes. It could be adjusted to the paper's length and squeezed at the tip when the paper is inserted.

Organic garbage pressurizing litter bin saves up space for more garbage and helps to make fertilizers out of daily garbage. It is ideal for homes with gardens and holiday areas.

Conclusion

The subject of this paper is "sustainability of design" in training/instruction. This scope was shared by our project made with sophomore students in an 8 hours/week class for one and a half months in the spring semester of 2009. To avoid a sudden introduction to 'ecological design', students who only recently grew cognizant of design were assigned to develop an 'eco-logical holiday' concept so that they could comprehend the issue with the concept of holiday. The students were taught the basic information related to the sustainability of design, and their making research in groups led us to think that they would be successful in their choice of project topics in implementing them. The classes were full of discussion instead of conceiving ideas.

It cannot be claimed that the project was successful. However, with the project the design students were helped to develop consciousness on the issue and they gained different perspectives to product design. Employment of Sustainability in Design Training is evaluated.

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Dissemination of DfS in design practice

the Learning Network on Sustainability

The Hub

A platform for sustainability practice

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This paper presents a case study about a well succeeded initiative that works as a platform for promoting sustainable practice in the design field. Concerning the needs of a designer related to sustainable issues, this study presents an analysis of the international network called "the Hub" and on how its characteristics can promote favorable conditions to the practice of sustainable design. In order to show the advantages and the possibilities, a case study on design offices's experiences will be presented. Finally, a replication model will be proposed.

Design in a new social economy

A new kind of economy is emerging in many fields, including the environment, care, education, welfare, food and energy.

In the Nesta (2007) report "Danger and opportunity, Crisis and the new social economy," Murray (2009) calls it 'social economy' because it melds features which are very different from economies based on the production and consumption of commodities.

At the same time, the sustainable issues enter in the international agenda, plenty of research takes place in market models that are harmless to the environment and to the society (e.g. Sevice Design).
In this new economic scenario the relationships between market-state- consumers have been redefined and new kind of enterprises and entrepreneurs are emerging. They are trying to transform social paradigms through their operate: the social entrepreneurs.

> Social entrepreneurs are people who work inside large organizations to develop and promote practical solutions to social or environmental challenges. Social entrepreneurs apply the principles of social entrepreneurship inside a major organization. They can also be characterized by an 'insider-outsider' mindset and approach.1 One example is Win Sakdinan at Procter & Gamble who developed the company's Future Friendly initiative, which helps consumers to save energy, water and packaging with its brands. 2 Another example is the nurses as social entrepreneurs programme developed at Oxford University's Saïd Business School. (Murray, Caulier-Grice and Mulgan, 2010: 128)

A designer often take part as a promoter or a member to new initiatives with social and environmental aims that are being created everyday but just few of them survive and evolves. Most of the time, The main challenge is the economical sustainability of those initiatives. The projects have no way to sustain themselves: because of lack of funding and partners. In addition, the absence of professional supervision that compromises the well development of the initiative.

Often this business ventures born with a non-profit aims and they are developed in a more economical direction but without strong business expertise, others are promoted by people with a reduced business experience and prevision skills.

In order to promote and support those (and others) initiatives. The common incubator model works as "a structure which shelters start-up firms, offering physical space and infrastructure, capacity building and administrative support" however, the social incubator commonly works with grassroots groups and other groups that are strictly connected to the environment in which they operate. There are plenty of dif-

ferent models in which the incubator support the projects. Murray, Caulier-Grice and Mulgan (2010: 135) presents the concept of innovation incubators:

> Innovation incubators play a critical role: they bring together the skills and expertise necessary to help sustain and grow a social enterprise; provide a space to test out new ideas rapidly in practice, with quick assessments; allow fast learning across a community of innovators; and establish clear pathways for scaling up the most promising models. The Young Foundation's Launchpad has drawn from the experience of many different kinds of incubator and innovation agency to develop a model that seeks to create new ventures and back social entrepreneurs – with a multidisciplinary team, a staged investment model, and an emphasis on linking business expertise with understanding of policy contexts. MaRS in Toronto links a university, a hospital, research labs, and a business incubator, alongside a social innovation investment fund. Murray, Caulier-Grice and Mulgan (2010: 135)

This paper presents a case study about a well succeeded initiative that works as a platform for promoting sustainable practice in the design field. The network called "The Hub" presents itself as a pool to gather social innovators in an inspiring environment, besides it build up a community around values such as Social Innovation and Collaboration. The Hub is a support plattform for social entrepreneurs. This study describes the main characteristics of the institution and it promotes favorable conditions to the practice of the sustainable design based on observation of and interviews with members, hosts and founders.

The goals of the research were:

- To identify the elements that compound the Hub environment;
- To understand how it creates the conditions to sustainable design practices;
- To define the guidelines to replicate it in other contexts.

Figure 01: The Hub Milano

Source: Filippo Podestà

Methodology

This research is a mix action-research, in the measure of one of us is an active member and founder of the "Hub Milan", and a traditional research based on structured interviews to "Design Hubbers" and Host in 5 different countries (Italy, Germany, Spain, England and Holland). We also collected some written and video materials about the Hub building process and working.

The borning process of the Hub Milan was full participated and helped by Eugenia Chiara, one of the firsts members, that took part in this practical experience and through this paper tries to abstract it for making a replicable example for contaminating other Hubs and similar structures both in sustainaibility and design field.

The active participation in the different phases (community building, space research, space co-creation, public presentations) of the development of the Hub Milan helped us to understand the creation process of this kind of structure.

Through the interviews we investigated the main features of The Hub structure and business model and the role of the "Host" in this kind of structures.

We choose to have different respondents in various countries because the Hub, as a flexible model, changes his features in different local experiences, creating really different structures with also different working and business model.

We interviewed 2 host of Milan, one host of London Islington's Hub and a Host of The Hub Berlin. The hosts are the main promoters of this initiatives, they told us the History of the first The Hub and its development as net-structure in the different countries. They have explained us the key factors of its good success: the business model, the hubbers's selection, the networking and community building strategies.

The interviews with some Design Hubbers analyzed specifically their attitude to design and sustainability issues and their relationship with The Hub, especially the benefits that they have using this kind of platform.

We considered as design professionals: graphics, products, interior and fashion designers and we tried to explore the different meanings and approaches to sustainability and the different kind of use of The Hub network.

We focused our questions on the relationship they have with The Hub, as community and as physical space, what they have learned there and which kind of benefits they get staying in this network, advantages and disadvantages of working there, namely, the conditions that promote and support a sustainable approach.

Finally, we analyzed also some internal material like regulations, wikis, co-creation process guidelines to understand what are the replicable tools and praxis.

The Hub

The Hub has been created in 2005. The first Hub created is located in Islington, a London district. In an external point of view, the Hub provides just a co-work space and a rent workspace (meeting room, event room, workshop room, etc) for a month or week. Nevertheless its business model goes beyond it. According the interviewed: "the Hub is a community of entrepreneurs and social innovators" and its business model is support its activities by providing business infrastructure (office facilities), access an world wide network and a social engaged community; and consultancies services (e.g. business consultancy) provide the other members.

The main stakeholders in the Hub are:

- The Hubbers: members of the Hub;
- The Founder: members present at the beginning that have lead the opening process.
- The Host: members (sometimes voluntaries) who are in charge to manage the Hub activities and responsible to promote the community structure.

In order To become a "hubber" it is necessary to choose a service pack (weekly use time plan of the space) and to be accepted by the community. Each Hub has a process for each new membership. In the Hub Islington, the Host judges the new entry, evaluating if the person has a project and if it shares the Hub values. If the conditions are fulfilled, the new member can join.

The Hub business can be driven by a public or a private institution. The Hub Milano experience has started as an association of the founder members and then turn into a company that provide co-work space rent and other services. The Hub Porto has been started by the initiative of the leader of the parish of Paranhos[1]. The public institution is in charge to manage the hub activities. Even with different administrative base, both are members of the Hub branch. The economic sustainability of the Hub is based on the monthly fees paid by the members, the rent of the space (for member and non-member) and external sponsorship (such as the Hub Porto).

The older Hub' branches provide the guidelines to open a new one. The steps are based on the previous experience and are important to sustain the main values. The main steps are fourfold:

1. The first step is to gather and to organize the interested community on open a Hub. Besides one or more member of this group has to establish a close contact with an older Hub.
2. The second step is researching a space where the new Hub can be hosted.
3. The third step is the space co-design. The member together with specialized professionals design all Hub facilities in order to meet the community' demands.
4. The last step for the opening stage is the public presentation for the external community in order also to invite more members.

The Hub business innovation lays on the community strategy. The Hub promotes a community environment by integrative events and connecting people through workshops and projects. At the first sight the co-design of the space are an important step to strongly bond the community' member to the Hub. The events are also important to gather the community at the same time in the same place, it also promotes the exchange of knowledge and expertise between the members. Finally, the global network allows contact and interaction with people all over the world, by the Hub.net intranet is possible to access and to search for people in all connected Hubs.

There are some community building strategies and networking technologies that are in use at the different Hubs, one of the them is the face-wall, a wall with photo-portraits and short presentation of all hubbers to encourage the wondering about each other. Another one is the Potluck lunch, a weekly shared lunch with some interesting guest that tell his experience about sustainability or innovation.The speed networking is a session where each hubber has, for few minutes, in front of another member and tell him his projects, a practice to encourage new collaborations.

Consultancy activities inside the Hub happens through the exchange of knowledge between members, in the Hub Milano we can mention the "business clinic" a weekly free consultancy service provided by one member about legal and management aspects of a new enterprise and the interactive marketing events, free events that presents innovative marketing strategies through Internet.

Another important initiative is the Hub Summer School that took place in the Hub Amsterdam and Hub São Paulo. It is an event that invite the internal and external community to participate in different workshops on social entrepreneurship, leadership and related topics.

In resume, the Hub works as a social network connecting and exposing different people who share the same values and willing to change the world through social innovative business.

Analyses

As above mentioned, the focus points of our analyze are to evidence sustainable design practices between The Hub members and understanding how it's possible to create the conditions to make them existing and improving.

In order to identify the Hub elements that create the condition for the sustainable design practices, we consider the studies of Manzini (2006) and Vezzoli (2007) as a reference for the analyses of the Hub experience.

Designers play an important role on the material culture' conception. They are responsible for the relationship between products and humans and their activity has a huge (and harm) impact in the society and environment. The Design Hubbers are aware of their conditions and try to face it by different strategies.

[1] Freguesia de Paranhos.

The Design Hubbers work toward sustainability by three ways: in design process (e.g. using recycled and harmless materials); in choosing the client (e.g. just clients environmental and social ethical responsible); and on internal methods (e.g. by applying sustainable design methods and tools).

The first interviewed-is an Interior Designer that works for a multinational branch. He uses the Hub to networking and as an office (not as an atelier). The sustainability takes place in his work in the research and in the use of harmless material (and in the materials reuse). In addition, he provides to the Hub community workshops and speaks on this topic in the Hub events.

Figure 2: Fernando Salvador – Hub Madrid

Source: Fernando Salvador

The second interviewed is a freelance Graphic Designer that goes to the Hub in order to inspiring herself and to change the daily routine. For her there is no much choice on process or material because the publisher are in charge of these decisions. So her sustainable approach lays on choosing the clients with an environmental and social ethical responsibility.

Figure 3: Camila Barrio – Hub Milano

Source: http://www.flickr.com/photos/organirama/4745152365/

The third interviewed is an Interaction Designer with a Social Science post graduation. She has a one person company and works on social design. Her approach is guided by issues such as ‘How can you live

well in a city?', 'What's the meaning of relationships in a digital era?', 'Do we have a healthy way of handling food?' and 'What is safety?' and by partnerships develops projects about these issues.

Figure 4: Eefje Ernst – Hub Amsterdam

Source: http://www.sociaalontwerpen.nl/eefje

The fourth interviewed is a design researcher that organizes events about sustainability and design also during the Milano design week. She promotes the concepts of a social and environmental sustainability in the furniture design field, organizing events and also projects with firms and consumers like the "sustainable shop protocol".

Figure 5: Clara Mantica – Hub Milano

Source: http://www.flickr.com/photos/organirama/4745762974/

We clustered Designer Hubbers in some rough professional categorizes that are (1) freelancers seeking for new networks and markets; (2) people or small groups starting a new business; (3) retired professionals ("creative retired") starting new kind of business.

According to the different profiles and needs they are also using the Hub space and community in different ways.

The Hub provides a complete structure for a workplace such as furniture, printers, kitchen, toilets, etc. Generally the Hub members use it as a permanent office, however according to the interviewed there is no infrastructure for some design activities at the Hub (an atelier space, for example) what change the use

for the designers into a place to meet people (networking and brainstorming sections), inspiring themselves, meeting point (e.g.: meeting with clients) and event space. So they keep a home office or other office and goes to the Hub to "refresh ideas" and "interact with inspiring people". However the Hub does not offer properly conditions for some design activities and it is also a dispersive environment.

The "Community Environment" and "Inspiring People" are the main advantages highlighted by the designers. They define the Hub as an "inspiring place". A space to exchange knowledge, learn about different issues with members with different expertise, and work together in specific projects. By this contact they learn more about other design related areas (e.g.: Marketing, Logistic, Technology) and areas that must be considered in a sustainable design process (i.e.: a life cycle perspective) social sciences, ecology, biology, etc. This contact strongly affect their work by providing a holistic and systemic understanding of the whole design process and its impact, according Thackara (2005), an essential perspective to work on sustainability. Moreover these other professionals are available for contribute and discuss projects (sometimes for free).

The innovations can be observed in the new business model both in the Hub and hosted companies that brings up new ideas up; the relationship amongst companies and partners goes beyond exploitation and works in a equal and profitable partnership with social benefits; and the local and global action and visibility. By the network is possible for the Designer Hubbers to work together all over the world and to know about new projects and ideas that are coming up in the social innovation field.

Conclusion

At the end of our analyses we have tried to identify the role of The Hub network in the universe of sustainable innovations and to define the guidelines for its replicability in other contexts, and the contamination with different experiences.

According to Franco (2008) every sustainable organisation must have a network model and the learning process has to change from a frontal mode to an horizontal networked structure. In the social nets there are two important roles: hubs and netweavers. The hubs are the connectors of a social net, the connection platform itself. It connects the nodes and can be accessed by the nodes and access other nodes creating its cohesion. They based their impact in thrust and social recognition, it' s recognized by the nodes as a trustful partner in their interactions.

The netweavers are those who built up the net. They are aware of the skills and potentialities of the nodes and act politically on weaving the network by finding people and negotiating the connection in order to meet both interests.

The Hub is socially "produced" by the net. The platform itself allows the contact between the people with ideas and new inspiring projects. These people needs be in contact with each other, by doing so they sustain the Hub in order to keep the existence as node on this net.

In the world of sustainable innovations The Hub plays this important role of connecting innovative projects and people and through this it helps the stability of the system, its survival and its growth. Based on the guidelines of Design for Sustainability proposed by Vezzoli (2007), we can consider it a platform for improving sustainable practices because:

- It has a systemic approach (i.e. engaging the final users on the conception), multi and transdisciplinary, and is adressed to all professionals involved in sustainaibility practices.
- It's a co-work space, thus intensifying the use of products by sharing it;
- It' engaged in the social and ethical dimension, and it diffuse and promote events about social innovation;
- It's a facilitator for knowledge sharing, with his networking strategies; and promotes the local community cohesion by gathering in a same place people from different economic and social strata on a workspace to share and work together (without an exploitation relationship).

As above said each Hub environment is unique and can't be replicated (because is impossible replicate the "people" there). But it is possible replicate the conditions to flourish the same social innovative environment by rebuilding the platform of connection i.e. the hub' concept of Franco (2008); and playing the role of netweaver in order to gather people engaged on sustainable projects.

According to our analyses the Hub model can be replicated in other spaces and with different institutional models, and this is also its vocation a natural development. There are some tools and strategies that can help this diffusion process and the globalisation of this system.

The web networking platform, the internal wiki and the mailing list are some tools already designed for a global use.

To reply this experience we can only try to delineate a flexible journey based on some local actions that can cover who wants to develop one Hub:

Assess and gather the local social engaged community

- assessing the already existence of local social agents;
- contacting this people that share the same values;
- opening an initial blog about social innovation and social entrepreneurship showing examples and best practice to encourage the people
- creating a local mailing list;
- making Hub group/account on social networks like twitter and facebook and pushing discussion and information through this channel;
- leading the process and involving the community in the decision-making process;

Building up a right physical space

- choosing a big, open, central and inspiring space
- designing it with a co-creation process
- defining rules, prices and way of use
- organizing events to promote the space

To netweave new connections and partnerships

- organizing networking events like potluck lunch, speed-networking
- spreading through the mailing list collaboration requests and job opportunities
- making recruitment for open job positions

To enhance the community cohesion and actions

- organizing collective events for knowledge exchange like summer school, free consultancies
- promoting collective visions, projects and proposals about the local landscape
- entertaining contacts with local public administration and key actors

This kind of structure is a valid platform for that can inspire different sustainability support organizations, both in the private and public sector.

Its open model for building and exchanging knowledge and innovations can be integrated in new or more traditional structures, such private and public schools and universities, NGO, cooperative consortiums, incubators.

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the Learning Network on Sustainability

Ethics and aesthetics

Sustainability as a criterion for selection by ADI Observatory of Italian Design

Dalia Gallico
ADI Lombardia | ADI Lombardia Observatory of Design

Commenting in Stile Industria on the birth of *ADI, Associazione per il Disegno Industriale* in 1956, Alberto Rosselli wrote: "we continually perceive that there is not a lack of available means, but of the principles that drive them". The recognition and the wider vision of this principle that anticipated the "ethical" role of the project, lead to the acceptance of that role. This is the same role that ADI currently support with an ethical, together with an aesthetic identity that Italian design must adopt at an international level, working to Sustainability together with business, finance and the institutions.

That is a rigorous product development and a service consistent with the needs, models of fruition and the symbolic/ emotional expectations of the users, but also attentive to the processes and the production costs and sensible to the environmental themes (minimisation of pollution, ease of waste disposal and the possibility of recycling).

In this way, Sustainability in ADI becomes a method for guiding and communicating business, the quality of its products, processes and services, a new way of "doing business", of being recognisable, of combining quality, innovation and recognition, a new way of better investing, of protecting invention, of increasing the value of the "intangible" factors.

ADI aim is now, together with all the most important design industrial association in the world, going on raising awareness and opening new markets to the green economy; spreading a positive vision, bringing effective tools to people's attention, putting players in touch, creating systems, highlighting good practices, improving good models.

Expression of this job is the ADI Design Index, which, every three years, preselects and composes a list of projects to present to the international jury of the *Compasso d'Oro Award*.

ADI Permanent Observatory of Italian Design (a commission of experts, critics, historians, specialized journalists) acts in such sense by selecting those products/services using precise criteria: formal aesthetic, typological, functional innovation; impact on the environment (production, consumptions, recyclability, ease of assembly); communicative value of the object; usability; wider usage; appropriate use of technology, of components, of materials; suitability for use; compatibility; adaptability; reliability.

Thus a network of knowledge about sustainability is created towards developing a system for the communication and the diffusion of an entire system-product that in turn gives life to other tools, such as the updating of on training proposal or Counseling services for young business people and designers, welcomes and information, guidance and consultancy, new relationship between producers and clients (innovative forms of co-production of value). That is to show Italian design that is both aware and an integral part of the life cycle of products and services, together with the harmony between private wellbeing and the common good, can reduce environmental impact and improve the quality of life.

Now ADI makes available its skills in monitoring and mapping the excellence in order to educate the customer-actor to a critic ability that can help them to understand what they buy. To actually succeed in spreading a culture careful to sustainable development it is not enough to simply exert pressure on designers and producers, but it is required a growing demand from below, a demand that would be capable of directing the system of consumption.

The Association therefore is a system result of the *transversal interaction between ethic subjects*, manufacturing companies, designers, associations, exhibitions companies, editorial structures, local institutions, sharing common goals and values in order to seize all the opportunities, interests, availabilities of actors during a phase of radical change in consumption and market.

This net system of the industrial quality product, created through the analysis of several planning studies, becomes, in itself, a compendium of knowledge and good practices.

The most challenging proof that ADI must deal now, together with all other international associations, is the redesign of a new system of knowledge and alliances, a multicultural system that feeds on differences.

From design to sustainability (and vice-versa)

What role does design play in sustainability? It is not always an easy role to show, since it differs from case to case, but design together with sustainability are – and will become more and more – a definite value and a competitive tool.

Sustainability can and must be a fundamental part of every single company's production, communication and distribution strategies. Let me underline that "every single": the case histories collected in the ADI Codex demonstrate that sustainability is neither a sole interest nor an exclusive prerogative of big companies or those operating in sectors that have traditionally been design oriented. Instead it is a basic lever for competitiveness and internationalization that is available to every entrepreneur.

Thus, design as presented by the members of the permanent Design ADI Lombardy Observatory covers a wide range of areas, from the more classical product focused, to the reconfiguration of processes, right up to the study of materials and the planning and design of services.

These are examples of companies both big and small that are able to "create a project from scratch", which in its turn adheres strictly to the capacity to create and manage innovation effectively.

Sustainability as a system boost

The most recent debate on the subject of economic development ascribes an increasing value to the concept of innovation, a principle factor in filling the competitive and thus growth gap that divides Europe from its closest competitors, and that in a European context, places Italy in a noticeably disadvantaged position compared to its main partners. In any case, the traditional idea of innovation processes as the adoption within a business context of technologies and research results through a transfer of technology, while correct, is only one element of the whole topic.

In reality, innovative boosts both characterize and have a transversal influence on all the cognitive and professional spheres, they bring about extremely fast processes of development and adapting to new requirements and they influence the labour market, its organization and the whole system of professional profiles.

It may well happen that a company, through the introduction of new product technology onto the market or the adoption of technology that is clearly superior to that of the competition, is not then able to take any advantage from it.

Today the role of the designer is written into a plan where innovation – as a fundamental tool for the growth of businesses – must pass from being characterized as an irregular occurrence to having a more systematic nature in which its individual creative capacity must consequently change to being the creative capacity of the system.

It is becoming clearer and clearer that the value and significance of design are overcoming the traditional aesthetic dimension, hitherto understood as a generic ability to create beautiful shapes or to improve the functionality of those already in existence. "Ethics and beauty are the current key words, to appreciate and transform into actions. The producers of goods and services in the design world, already looking towards the values of aesthetics, functionality and knowhow, can improve their profile, even economic, with the consolidated support of local resources (supply chain) and with technological and process innovation from a sustainable point of view. In order to carry out real changes both in our society and in our production methods we need a parallel revolution in our way of thinking that will change our behaviour, starting in the workplace. Less waste of raw materials and energy, and the project at the heart of product life cycle together with actions characterized by corporate social responsibility are the cornerstones of change; a turning point which could affect the current economic crisis, changing it into opportunities and challenges. Incentives for research and training for technical and sales staff are crucial for businesses together with communication that is more focused and transparent." *Giuliana Zoppis*

Those intangible factors which are decisive in contributing to the success of a product and a company are now being highlighted: sustainability,brands, patents, know-how, entrepreneurial capacity, human capital etc., and design is an element of extraordinary importance for tackling markets that are ever more complex, together with a public that is ever more demanding and unpredictable.

Sustainability can be seen as a method for directing and communicating a business, the quality of its products, processes and service, with techniques that increase its perceived value. Sustainability as a new way of doing business, to be recognized, to combine quality, innovation and recognizability, to invest better and to protect inventions.

In this case it is important to be aware of the business potential of sustainability: what is the potential for innovation, greater competitiveness, and improvement (the intangible factors) and to compare the successful (and unsuccessful) examples, in order to identify possible methods of management, development and future synergies.

Unfortunately the limits, in terms of size, financial means and the managerial culture of many companies still do not always allow them to fully exploit the potential that comes with the adoption of a competitive strategy based on these assumptions.

In this context, research into design "by installment" carried out by the Design ADI Lombardy permanent Observatory aims to present several examples of good practice in the form of chapters in a narrative to be collected, each chapter of which is a different story, in terms of geography, sectors, size and results.

"*Codex* should be a tool capable of shifting attention from products to production, highlighting those most important productive areas and which have most contributed to the qualification of Lombard and national level design.

From products to sustainability, production companies that within their various spheres have carried out significant product and process innovations thanks to investment, managerial capacity and market strategies, from which the product qualification and its internationalization have resulted. From products to territory, bearing in mind that the network of Lombard areas has contributed to and still contributes to that specialization in local production and its differentiation in market terms which by reducing competitiveness and helping integration, has in the end contributed to the creation of a national system that has brought about the idea of Made in Italy to be perceived as a national brand." *Giorgio Bersano*

This is therefore a first collection, chosen at random by the authors based on their knowledge and competence, of a series of significant products and sustainability, capable of "championing" a general picture of the Lombardy area while pointing out production examples, territorial specialization, and established or emerging companies.

An entirely unanimous project (there is no editor) spread over a year of research (and lively meetings!), with the objective of filling a gap of both information and cultural importance, and also to draw attention to otherwise hidden excellence and little known sectors.

Design in Milan between creativity and sustainability

It is no accident that undertakings such as the research come to life in a place like Milan, always at the centre of design culture. We have a wealth of design schools in our city, of businesses and events which are both distinctive and excellent: the high points – entrepreneurial, associative, training and professional – that represent fertile ground for the development of and statements about our design at international level.

"Redeveloping the community of a complex and critical city like Milan, recreating abandoned areas, re-furbishing them according to sustainable criteria and parameters for the revitalization of communal spaces for everyone is not the exclusive task of town planners, architects and designers; it requires a transversal creative and design effort, widespread, and shared between public and private, aimed at generating new perspectives and horizons for development." *Francesco Massoni*

These examples show that Sustainability is always made up of two elements: a dominant creative first element which has the task of breaking preconceived notions, introducing new elements; and a second element, which by contrast, has to introduce the idea of systematic nature or indeed of method. The development of networks of knowledge, relationships and ideas that transversely characterize the current

system of arts and knowledge based on the sharing – by different circles – of information, documents, tools and services, which facilitate innovation, itself the source of design processes.

The more consumer behaviour becomes unpredictable, the more company business strategies fall back on their ability to offer, or rather their independent capacity to innovate products, to provide them with unexpected services, to communicate effectively their importance and to acknowledge the feedback from the market and society (so as to redirect the offer, or product).

And if the price is no longer a competitive element, it is clear that there is a need to identify, develop and exploit other factors that will become the decisive elements in the consumers' choice, whether they are intermediate or final parts of the chain. For this to happen there must be a dialogue between (company) management and designers (inside or outside the company) which results in a double integration: that of products, services and communication in a single unit, the product-system, and the integration of the product-system into the definition and expression of the company strategy.

Looking at quality, there is no area where we can be accused of doing anything wrong. Exports increase little in terms of quantity, more so in terms of value.

"From reading the case histories collected in this research, one basic fact is clear, which cheers and encourages this continuous effort: the certain excellence and assured talent that emerge from the useless homogeneity of the offer, and the opposition to a (for many) lethal 'identity crisis'. Just one note to justify this excellence: if the latest figures relating to exports are analyzed, the most obvious fact is the increase in average value of each single product exported. It is the proof that Made in Italy is wrong to compete on the price field, but should instead know how to best exploit its design+territory system that is all around it, and which makes it desirable world wide." *Danilo Premoli*

The cast-iron production logic of standardized mass-production, all within the same historic factory, has to give way to process Sustainability, to an interweaving of technological combinations both inside and outside the production site, to an almost uninterrupted flow of materials and components, while the functions that govern these flows, the transfer of technology, integrated logistics, and the relationship with the suppliers become more and more important. This production method implies obvious and serious knock-on effects for design, which has to deal more and more with the subject of Sustainability organization, and the methods of management and checking involved in the internal/external production dialectic.

This network of knowledge, relationships and transverse ideas that cover the whole "new" system of design.

"Human landscapes are not always visible in the community and in cities: man's industriousness is also hidden in industrial warehouses, in offices, in research centres; it is effort and thought. These are behavioural phenomena that manage to organize activities in defined spaces, once identifiable with the areas that were concentrated nearby because of functional production relationships identical for technology and commodities, and which now, with the arrival of the Internet, tend to broaden their confines so as to find collaboration wherever there may be an innovative factor to be introduced into the cycle of conception, manufacturing and distribution of goods. An area changes its shape in a territory of organic collaboration in order to suit the necessary objectives. Geography becomes philosophy. It is the dynamics of the movement of ideas, rather than their delimitation in circumscribed areas, that now draw up the productive landscape, broadening limits and borders, and the creation of ideas or products, more than the factory is the real unifying force." *Marco Migliari*

The objective then is to identify possible lines for integration between the sectors, and to define methods for managing the changes brought about by Sustainability. What is missing in our culture is certainly not an individual problem; rather, it is linked to a lack of organization that manages to unite all the players: ideas to create a "packed" labour market, which blends methods for sharing Sustainability that are articulate and not rigid; research in small and also medium size businesses, which nourish the passion for novelty; Sustainability that flows up from below, thus spreading the word about new trends; Sustainability in new design that looks for new fields and areas; Sustainability as a conceptual project that will become a part of life, turning service businesses upside down. Design in life that is the perception of that which comes from society, from the decoding of needs and the understanding of that which it indirectly implies. It focuses on man and what is around him: at those moments of meetings, of work, waiting, entertainment, learning...

Sustainability within functions and roles

A renewed awareness of the central role that project takes on, in the very moment in which, together with its specific skills, it enters the arena of business economic policies and cultural strategies, through the new functions of Sustainability management and Sustainability direction that, by coordinating design, management and planning activities with all the other business functions, push towards the redesigning of production, communicative and distribution strategies, all of which come together to give the same definition of the business and its place on the production stage.

There is therefore a need to develop a research process capable of studying the changing nature of design and anticipating these new conditions. Furthermore, it must not be forgotten that Sustainability has taken on knowledge and teaching methods from other disciplines, and it is thus necessary to thoroughly analyze the rigorous scientific approach, but also to take into consideration the different aspects of business: cultural, economic, technological, environmental, aesthetic, strategic…

Sustainability = Sharing innovation. Creating conditions that facilitate contact and sharing, recognizing and exploiting the results obtained. Sustainability must be first culturally and then operationally completely integrated with all the other company functions, from marketing, to planning, to production, and to sales, so as to contribute for its part to the creation of a company identity that has to share from within the objectives of its products.

Inside or out, Sustainability must be an integral part of the complete development process and should emerge from an internal company culture.

"The distinctive nature of design in Lombardy is perhaps found in the high concentration of design paths, which criss-cross and intersect to produce transversal experiences that are in some ways unique, and from which then come products that are 'virtuously' innovative.

These intersections are also the result of mental proximity, before physical proximity, between those who conceive and those who produce a new product. It is a proximity at times reduced to nothing, since often both designer and entrepreneur concur; at other times, it is a healthy and dialectic distance that creates comparison. In the end, both methods combine to create 'what was not there before' and which we would miss if it hadn't been created." *Maria Gallo*

This research, based on a wide-ranging investigation that has included numerous companies from many different production sectors, has eventually focused on case studies, from which it has obtained the themes and signs dealt with here, and which highlight the value of Sustainability in cases where it is correctly integrated with the rest of a company.

It becomes clear that all the players in a production process (from need identification, to market target definition, to the concept, to the design and planning of form and meaning, to technical planning, to production, to sales, to distribution, to maintenance and so on up to end of life disposal) need to be involved in an all-encompassing chain of communication in which everything is shared, without the need to go into individual details that serve no purpose. Therefore it is important that communication between company departments is necessary for the production processes, and not just for communication's sake. Thus, for example, the importance of a 3D model goes beyond pure technical necessity, and suddenly takes on the role of communicating different knowledge and skills, using tools that provide ways to exploit them that are available to everyone, not just the technically minded.

There are many cases that bear witness to these paths, inasmuch as they are representative of symbolic processes of change that have joined elements of different forms of knowledge and, as such, could be productive all over again if grafted onto other types of knowledge. Research shows that there is a possible classification for:

- Cultural innovation: the first step is to change the way of looking at the world.
- Technological innovation: research into materials and processes opens new roads to design.
- Process innovation: creativity that is planned and directed by a precision codified process.
- Innovation in services and distribution: ideas and tools to accompany products onto the market.
- Product innovation: the best products spring from ground prepared with the right ideas and tools.

Handing the microphone over, as it were to these virtuous examples from our Lombardy territory, we can only hope that they provide a role model for all those who follow in their footsteps into the glamorous and unique world of "design for industry": a world which has to be ever more open first to young talent from schools, and then, to new generations of businesses.

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the Learning Network on Sustainability

Sustainability consideration in the Australian International Design Awards

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This paper investigates the engagement (or lack thereof) of manufacturing, engineering and product design industries towards sustainability. This was achieved by completing a content analysis of the award winners in the Australian International Design Awards (AIDA) against an independent set of Design for Sustainability (DfS) criteria established by the authors. Particular focus was given to the 2010 recipients of the Australian International Design Award™ and the Australian International Design Mark™ and the claims made in their product descriptions and key features and benefits statements. The paper reflects on the criteria used by the AIDA to assess the awards, elaborates on the positive elements of sustainable design presented, and suggests directions that the industry may utilise in order to strengthen its capacity to achieve sustainable outcomes.

Context

The Australian International Design Awards (AIDA) has been rewarding excellence in product design and innovation in the Australian marketplace for over 50 years. These industry-acclaimed accolades are presented to a number of products each year, either as an Australian International Design Award™ in recognition of design excellence and indicating superior design and investment in innovation; or as an Australian International Design Mark™ in recognition of good design and indicating quality, value and reliability in the marketplace.

The AIDA assessment criteria include innovation, visual and emotional appeal, functionality, quality, manufacture, and human factors. In 2007, a criterion on environmental sustainability has been added, questioning the need for the product, its long-lasting qualities, efficiency in use of water, materials and energy, as well as compliance with environmental best practice. In the same year, AIDA instituted a special Award for Excellence in Sustainable Design. To qualify for this award, the product must evidence that: it serves a real need; its design has been driven by a primary concern for sustainability; it is an outstanding achievement in, and a creative application of, sustainable design principles; and its manufacturer has embraced responsible business practices.

Certainly the recognition of ecologically sustainable design within the AIDA should be celebrated as a positive move in the right direction. However this paper steps back and attempts to address the impact that the award winning designs would have if they proliferated, by asking the question: how does this design contribute to a sustainable society, economy or ecology?

Several metrics exist in an attempt to quantify environmental sustainability targets ever since the Club of Rome reported in 1972 that economic growth was using up resources at a rate which can no longer be sustained by the planet (Meadows, et al., 1972). Since then Factor 4 (Von Weizsäcker, et al., 1997), Factor 10 (Schmidt-Bleek, 1999), and Factor 20 (Vergragt, 1999; Weaver, et al., 2000) have been proposed. These factors, which refer to a 4-fold, 10-fold or 20-fold increase in efficiency, suggest a substantial tar-

geted reduction in resource use in the order from 75% to 90% to 95%. More recently an emphasis has shifted to carbon dioxide equivalent (CO_2e) reduction: calculated scenarios show that a reduction of 85% of current levels in global emissions is necessary in 2050 to mitigate the risks of climate change (IPCC, 2007).

The purpose of our paper is to locate the current position of the Australian industrial design community, and question what the response of designers could be if the above targets are considered. Clune (2009) suggested that if industrial designers are to pursue design for sustainability (DfS), a shift is required to reconcile a sound interpretation of unsustainability with technical design strategies and tools; postulating that "how you define is how you design".

Vezzoli (2003) argues that 'the design activity itself needs to be redefined in order to positively and effectively contribute to the radical change required by the transition towards a sustainable society'. By default, such changes challenge the product-centric approach that is conventional to the industrial design discipline. Various tools and strategies have been proposed by design researchers to challenge designers into considering the change agency of design and their role in creating a more sustainable society. The higher forms of innovation imply a more influential consequence of design activity than do those at the technical end of the spectrum.

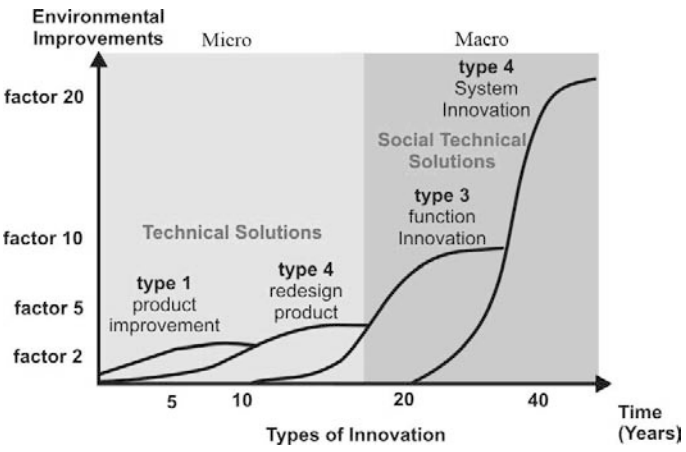
Methodology

The study examined the entries of the winners of the 2010 Australian International Design Award™ and Australian International Design Mark™, as they appeared on the www.designawards.com.au website. Information about the designs, images, and the claims of manufacturers and designers in the entry forms were copied into a relational database management system. Content analysis, using a coding protocol (Table 1), was used to evaluate the winning entries against the three theoretical tools below for locating and analysing their DfS potential.

1. the 'hierarchy of eco-innovation' by Brezet (1997) which describes four types or step-levels of innovative approaches that could enable design solutions with a high sustaining potential, as illustrated in Figure 1. These types are namely: product improvement, product redesign, function innovation and systems innovation. Product improvements only make minor changes for pollution prevention and environmental care, without changing the product or manufacturing technology. Product redesign goes further by developing or replacing components, materials, distribution, recycling or energy efficiency, although the product concept remains almost intact. Function innovation seeks alternative ways of fulfilling the function with greater environmental benefit. System innovation replaces the status quo with a completely overhauled and less environmentally impacting system. Function and systems innovation can potentially achieve Factor 10 to 20 targets of resource efficiency; they promote an important shift from conventional industrial design, in which technical solutions dominate, to the design of solutions which are far more cognizant of the complexities of context and usage.

Figure 1: Four types of sustainable innovation

Source: Brezet (1997)



2. the DfS 'school of thought' derived from a combination of the "how you define is how you design" framework (Clune, 2009) and the social, technical and socio-technical schools of thought by Robinson (2004). In this view, sustainability can be addressed through scientific development ('technical' approach) or through a cultural change in shared values and everyday behaviour ('social' approach).
3. the 'scale of resource reduction' in relation to the Factor 10 and 20 proposed targets. These factors emphasize that radical approaches to sustainability may be required, which technical sustainability alone has a limited chance of bringing into being.

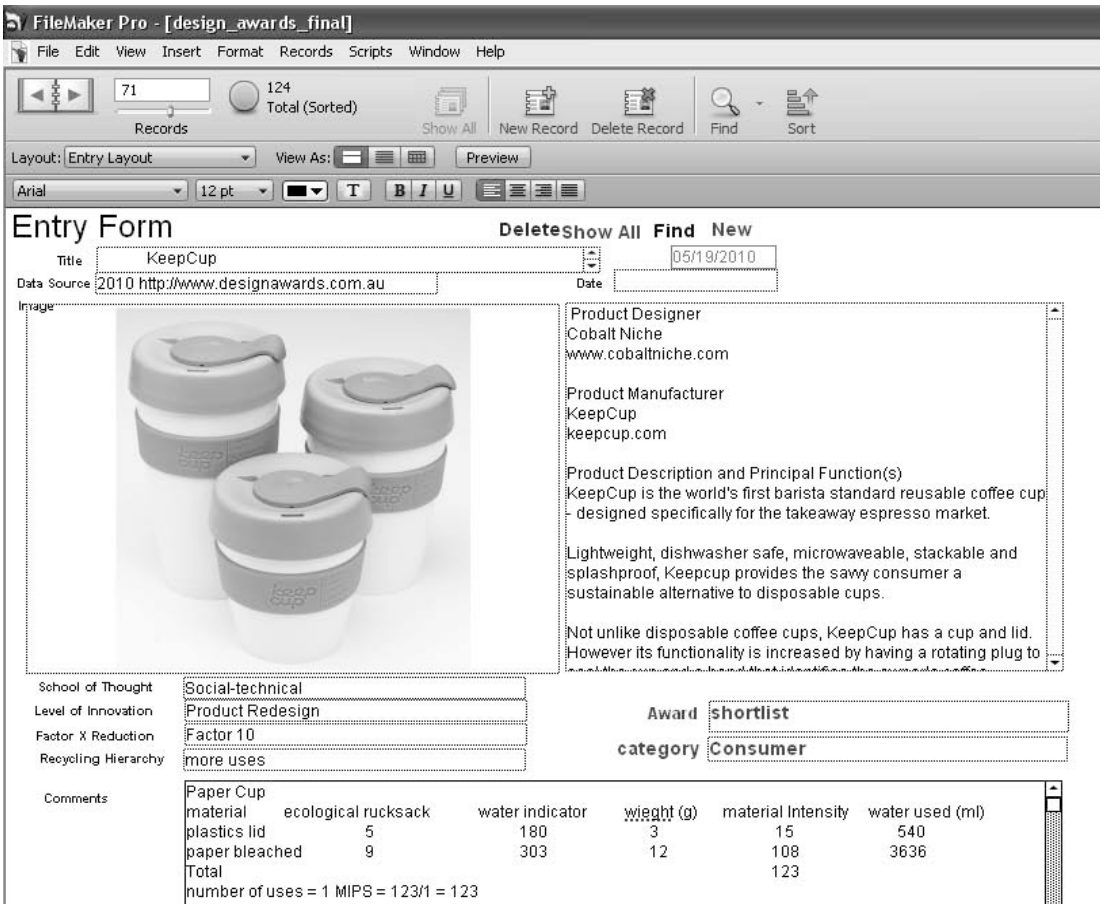
Individually the DfS assessments as revealed by these tools may be judged to be not so significant in their capability to bring about solutions of high sustaining potential; however if the school of thought and level of innovation approaches are combined then the relationship between products and their sustaining potential can increase quite significantly.

An example of the coding protocol in use in the database entry form is shown in Figure 2. All 37 winners of the 2010 Australian International Design Award™, 59 recipients of the 2010 Australian International Design Mark™ and a sample of 53 short listed products were evaluated using this process. The breakdown of product categories examined is shown in Figure 3.

Table 1: Protocol for coding of AIDA winning designs

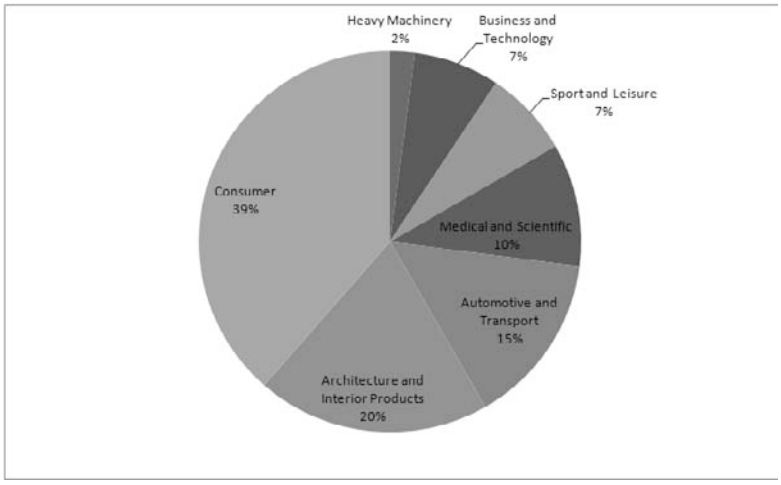
Questions	Coding
School of thought	
Does the product ask the end user to alter their behaviour in any way?	No = technical
Does it ask the end user to alter their behaviour in any way?	Yes = social or social technical
Does it incorporate technical design to facilitate the behavioural change?	Yes = product asks consumers to change behaviours
Type of innovation	
Does it incorporate product-based incremental improvement to minimise the impact upon the environment?	Yes = product improvement
Does it incorporate product redesign based on DfS principles?	Yes = product redesign
Does it question the function of the existing product or practice, and attempt to meet that function in an alternative way?	Yes = functional innovation
Does it question the function of the existing product or practice, and attempt to meet that function in an alternative way?	Yes = functional innovation
Does it propose a revision in how the function is met through dematerialising existing requirements such as transport or labour?	Yes = systems innovation
Factor X reduction	
Using a quick MIPS Formula, assume the best case scenario: Quick MIPS formula = The potential fold reduction of resources afforded by the conceptual design scenario (explain working), x the potential fold increase in use life afforded by the conceptual design scenario (explain working).	Negative factor if negative MIPS = 0-2 MIPS = 2 MIPS = 4 MIPS = 10
Recycling hierarchy	
AVOID > Dematerialise the product; Eliminate product or practice	
REDUCE > Minimise physical amount of material used; Use alternate material with lower ecological rucksack; Reduce throughput of materials over lifecycle; Designed for longer life	
REUSE > Designed from re-used materials; Designed for re-use (more uses); Designed for more users; Front of pipe solutions	Yes = encourage more users per service
RECYCLE > Designed from recycled materials; Designed for recycling	No = material selection leads to landfill; cannot be recycled
REGENERATE > Restores natural environment; Restores social interaction amongst people	

Figure 2: Sample entry in database for evaluating AIDA winning designs



It should be noted that the parameters used in this paper to evaluate the sustaining potential, eco-innovation and scale of resource reduction of the product entries are different to the sustainability criteria required by the AIDA of all entries and winners, mentioned in the beginning of this paper.

Figure 3: Categories of examined Design Award and Design Mark winners



Results and Analysis

The evaluations of the AIDA entries and winners displayed the following results with regards to the category factor X reduction (Table 2). The majority of designs were classified to have a relatively small impact in their ability to reduce resources, as 50% (n=75) had either a negative impact or provided no improvement over their predecessors form an ecological perspective. 26% (n=39) offered a 25% resource reduction or less. This contrasts starkly to the levels of reduction required by the DfS theory of 90% or factor 10. Only 13.4% (n=26) had the capacity to reduce resources greater than 50% (Factor 2 and above), of which only 4% (n=6) met the 90% reductions (Factor 10). Note the N/A results applied to products which were ambiguous to assign metrics for.

Table 2: Frequency of Factor X reduction

Factor X reduction	Frequency	Percent
Negative factor – 0	34	22.7%
No Improvement	41	27.3%
Factor 0–2 (less than 25% resource reduction)	39	26.0%
Factor 2 (50% resource reduction)	16	10.7%
Factor 4 (75% resource reduction)	4	2.7%
Factor 10 (90% resource reduction)	6	4.0%
N/A	10	6.7%
Total	150	100

The frequencies of the type of innovation (Table 3) showed that 86% (n=129) of the AIDA winning designs were product orientated (58% being ‘product improvement’ and 28% being ‘product redesign’). Only 14% (n=21) of the designs could be classified as ‘functional innovation’ where the designers had questioned the function of a product and attempted to meet that function in alternative ways. None offered designs solution that would be classified as systems innovation.

Table 3: Frequency of Innovation Type

Brezet’s Type of Innovation	Frequency	Percent
Product improvement	87	58%
Product redesign	42	28%
Functional innovation	21	14.%
Systems innovation	0	0%
Total	150	100%

With regards to the DfS school of thought (Table 4), the great majority (85.8%, n=115) of AIDA winning designs can be classified as technical. Only a minority (14%, n=19) presented social-technical solutions. An excellent example of a significant social-technical innovation is an internet-enabled vital signs monitor installed at home for patients with chronic disease conditions; this won a Design Award™.

Table 4: Frequency of DfS School of Thought

DfS school of thought	Frequency	Percent
Technical	128	85.3%
Social-technical	22	14.7%
Social	0	0.0%
Total	150	100

The majority of entrants (n=86) had no identified strategy for end-of-life optimization and from the authors experience have a high probability of being disposed of in landfill. Apart from disposal, the second most popular identified strategy was that of recycling. Again some products were ambiguous and couldn't be assigned metrics, thus the N/A.

Table 5: Frequency of End-Of-Life Strategy

End-of-Life Optimization	Frequency	Percent
Avoid	0	0.0%
Reduce	16	10.5%
Reuse	9	5.9%
Recycle	28	18.3%
Dispose	86	56.2%
N/A	14	9.2%
Total	153	100.0%

The results from the evaluations of the AIDA winning designs match other empirical studies that highlight that industrial design practice and education is dominated by product improvement and redesign. Halila and Hörte's (2006) study of 150 award-winning eco-innovations in Sweden identified that 75% of eco-innovation occurs in what Brezet (1997) classifies as "product improvement' and 'product redesign', and suggest that, in order to achieve greater reductions in resource use, exploration of 'systems innovation' and 'scientific breakthrough' would be desirable.

Brezet's schema also raises questions about the practical and disciplinary contexts of industrial design. If industrial designers are to offer functional innovations they may have to form different sorts of relationships with new clients who are more open to collaborative problem solving and innovation with a high sustaining potential.

Discussion

The overall snapshot of the Australian product design industry from the sustainability analysis above appears bleak; there is a large gap between what the literature supporting sustainability is advocating and what is actually occurring. The following section attempts to provide explanation for the results, discussing the increase in material intensity and the dominant environmental strategies used by designers.

Ratcheting of Material Intensity

An observation from completing the analysis is that the incremental increase in functionality of the products tends to lead to an incremental increase in the material intensity of the product, an inconspicuous ratcheting of 'quality'. Televisions, fridges, wine coolers and barbeques all appear larger with more functions available. This has also been matched by trends of stainless steel appliances, which dominated much of the consumer section. Stainless steel has a higher material intensity in comparison to plastic materials used in small kitchen appliances; in terms of lifecycle impacts, stainless steel has an ecological rucksack 3.6x greater than ABS (Lettenmeier, et al., 2009), the typical plastic used for appliance housings. Thus if the material in the AIDA entry offers no improvement in performance value then the products are classified as having a negative impact or no improvement.

Recycling

As noted earlier, the majority of products did not have an outlined strategy for end-of-life optimization. Of those specifying a strategy, recycling was the most popular approach. Claims of recycled content and potential recyclability, not only of the product but also of the packaging, abound among claims to satisfy the environmental criteria of the awards. For instance, one task light that won a Design Award™ claimed

that the product is "constructed primarily of eco-friendly aluminum and plastic… up to 81% recycled content… 99% recyclable… ships in 70% recycled packaging".

The Green Marketing Guidelines (ACCC, 2008), referring to the Australian Trade Practices Act 1974, and AS/NZS 14021:2000 Australian/New Zealand Standard for Environmental Labels and Declarations caution Australian businesses from making environmental claims that may be false, misleading or deceptive to consumers. Specifically, unqualified claims of being "recyclable" breaches the Act and don't comply with the Standard if collection or drop-off facilities for recycling the product or packaging are not conveniently available to a reasonable proportion of purchasers and users of the product in its area of sale (AS/NZS, 2000). The same applies if the product is not recyclable in Australia or if recycling facilities are very few or exist only as pilot plants (ACCC, 2008). Moreover, a product that whose "recycled content" does not come from post-consumer waste should be qualified with such words as "materials reclaimed from manufacturing" to avoid being misleading (ACCC, 2008).). Pre-consumer material diverted from a manufacturing waste stream can be claimed as "recycled content", provided it doesn't include rework, regrind, or scrap that can be reclaimed within the same process that generated it (AS/NZS, 2000).

Theoretically, any waste material can be recycled (Ayres, 1999), but in practice the cost of processing and sorting mixed waste into different material fractions can become so prohibitive that most materials do not get salvaged from the solid waste stream that ends up in landfill. Therefore, claims of "99% recyclable" are meaningless unless the products are designed for optimized disassembly with minimum expenditure of time, effort and infrastructure, and unless a recycling program is actually in place to facilitate recovery from end-users. For instance, take-back and trade-in programs for mobile phones, batteries, car tires, laser toners, some appliances ensure that these products can be recycled in the most efficient manner and without contamination from household garbage.

Among the Design Award™ winners, an emergency exit sign was designed for disassembly to aid recycling; it was manufactured from only two types of plastic and uses clip-together assembly instead of mechanical fasteners. Therefore the product's claims for easy recyclability are justified since the design facilitates cost-effective processing at its end of life.

Reuse

The literature suggests that reuse is environmentally preferable to recycling; unlike recycling that requires breaking down the disposed items into raw materials for manufacturing into new items, reusing the intact item can be a less energy intensive alternative.

One of the Design Mark™ recipients was a reusable connector and hinge system that enables the creative construction of objects and spaces from found materials. The constructed objects that result from this facilitation are typical of craft activities and certainly not "designerly", but the system successfully accomplishes its aim of inspiring people to see new value in the things around them, particularly by reusing and giving a second life to discarded packaging materials. We see the recognition of this approach by the AIDA as unprecedented and encouraging industrial designers to rethink how product development efforts could be redirected towards promoting a culture of reuse rather than consumption of brand new products.

Another AIDA entry which fostered a reuse culture was a reusable barista-standard coffee cup. It provides the habitual takeaway espresso customer a sustainable alternative to disposable paper cups. Manufacturing efficiency is also promoted by having a one-size lid, band and plug that fits into three sizes of reusable cups. Our calculations suggest that this product cup only needs to be reused five times before it achieves the breakeven point in material intensity as paper cups. If the cup is used 44 times it has diverted ecological resources by a Factor 10, and raised awareness of our disposable society. In spite of being a world-first and demonstrating qualities of good design, innovation, value and sustainability, this product was only shortlisted in the AIDA and did not win awards.

Efficiency

Several AIDA entries claimed efficiency in their consumption of energy, water or fuel. Again the ACCC (2008) cautions that energy efficiency claims should be quantified by comparison to objective benchmarks or rating schemes. The Australian Government websites for comparing energy and fuel consumption of appliances and vehicles (www.energyrating.gov.au and www.greenvehicleguide.gov.au) facilitate this benchmarking, although not all appliance and vehicle models can be found.

One AIDA entry was claiming to have a radical breakthrough in cooling technology, with "previously unheard of" energy efficiencies. This product is not available for comparison on the energy rating website, and therefore its power inputs, outputs and lifetime energy cost cannot be benchmarked against the 2½ or 3-star rated air-conditioning systems in the market.

In the automotive category, the average fuel consumption of the AIDA vehicles was 9.3L/100km and an overall greenhouse and air pollution rating of 12/20 (note: 20/20 is the best possible rating). After benchmarking at www.greenvehicleguide.gov.au with the most comparable representative vehicle (medium sized 5-seat hatchback), which only used 6.2L/100km and had an overall rating of 16/20, we find that the AIDA entrants were in fact 32% more fuel inefficient and scored 33% lower in greenhouse and air pollution ratings than similar ones in the market.

Compliance

Meeting eco-labelling requirements on top of the relevant safety and performance standards indicates that a product exhibits qualities of an environmentally sound design. Receiving an award for design excellence or good design further confirms that such the environmental credential of such products is recognized. The manufacturer of a Design Mark™ ottoman stool acknowledged the flooding of greenwash claims in the furniture industry, so it highlighted its independently-verified environmental certificates from the Forestry Stewardship Council, the Green Building Council Australia and Good Environmental Choice Australia.

AIDA Environmental Sustainability Criteria

The first criterion for the environmental sustainability assessment of AIDA entries is: 'Is there a need for the product?' This is the most fundamental question to ask from a sustainability perspective. The question is also the most loaded if one strips 'need' back to the fundamental human needs (Maslow, 1943; Max-Neef, 1992). The ratcheting of automobile size saw four 4WDs as AIDA finalists, along with three sports cars and two sedans. Such finalists offer far more beyond the basic "need" of transport. The model Manzini & Jégou (2003) present in their 'scenarios of everyday life' is to visualise how the needs of society may be realised in a sustainable way and is one potential model for designers to follow.

The second criterion questions: "Is the product long lasting?" This must be viewed in a context specific scenario, as it may not be desirable in some technologically obsolescent product ranges such as refrigerators, cars and televisions. Morelli (2001) suggested that if the greatest impact is within the use phase, then overtly long lasting products may be detrimental, as gains in efficiency outweigh the production stage of making a new more efficient product. Design for upgradeability may then be a more relevant strategy.

The third test is a logical one: "Is the design water, material and/or energy efficient?" However the question must be asked to what degree efficiency is judged. The results indicate that against the steep calls for material and energy efficiency such as Factor 10 (Schmidt-Bleek, 1999), the majority of finalists are not efficient. In the automotive category, the most efficient AIDA finalist ranked 77th (in the top 4%) out of all new vehicles sold, and five of the vehicles did not make the top 400 of the 1851 cars benchmarked on www.greenvehicleguide.gov.au. The results indicate that efficiency may not be measured against class leading products, or that it is not given a high priority.

Further, the focus on efficiency as a sustainable strategy is difficult. On one hand it is clearly desirable and most improvement models incorporates elements of efficiency; on the other hand the "rebound effect" attached to efficiency is problematic. For example the electronic industry increases the capacity of processors on average by 41% each year, yet an increase in consumption has reduced the effects of the gains. Consumption continues to outstrip the efficiency improvements, leaving the net consumption levels largely unchanged. This is what Manzini (2002) refers to as "rebound effect": most products are substantially more efficient than their previous counterparts however the sheer growth in consumption has outstripped any of the efficiency gain.

A more radical design approach to that of efficiency would be Fry's (2009) design-led redirective practice, where a low material intense activity is advocated to replace a high material one. One AIDA entry rematerialised a traditional baby carrying sling, potentially replacing a stroller, but was not shortlisted.

Criteria four: "Does the product comply with environmental best practice?" One would hope all entrants would satisfy this. Why would manufacturers release products onto the market that do not comply? Justifying the environmental credentials of a product by suggesting it is "RoHS compliant" and "heavy metals free" is interesting, as it is a standard requirement for sale in an international context.

Of the four criteria, "design for need" is the most fundamental from an environmental sustainability perspective. It brings to the fore an uncomfortable conversation that the Australian design community needs to have, to think through design's contribution in a society with greatly reduced material flows. With respect to the remaining criteria it may be possible for an award to satisfy the criteria and not contribute to a significant reduction in resource throughput required for a more sustainable society.

AIDA Sustainable Design Excellence Award

The decision from 2007 onwards to include an Award for Excellence in Sustainable Design represents a commitment from the Australian design industry to move towards sustainability. This has been awarded four times; we briefly reflect on each year's winner.

The 2009 winner was Electrolux's 'Refrigeration Collection', offering a Factor 2 reduction in energy across the life of their refrigerator in comparison to a 10 year old fridge. The 2008 winner, 'Slide Connect G2' by Legrand, was a world-first emergency lighting and exit sign system using a single, high brightness, long-life LED that uses a Factor 4 less power in the use phase. Of all awardees the 2007 winner, Caroma's 'H2Zero Cube Urinal' offers a Factor 10 solution by eliminating water and chemical use across the entire life of the product. This innovation presents a solution of the scale required of sustainability, moving from efficient use of resources to eliminating resource use (water).

The 2010 winner 'Enviromesh' replaced steel reinforcement in concrete with a lightweight plastic alternative, thus enabling the eradication of concrete cancer and leading to longer concrete life. In particular, it had "broad-ranging environmental benefits, smart choice of materials and cost savings for the building industry... significant advances in product life extension, durability and materials efficiency, while minimising embodied energy in manufacture" (AIDA, 2010). While the saving between plastic and steel reinforcement is notable and the ability to extend concretes useful life is positive, if viewed as a system. Portland cement has by far the largest impact in concrete production. It uses a significant amount of heat energy to produce, and also generates carbon dioxide as a chemical reaction in the production process. The overall reduction in embodied energy of concrete would be minimal from the Enviromesh reinforcement. A more important point is that sustainability must be viewed holistically, and as part of a system. This leads to the final point of the paper, which is the apparent lack of system innovations amongst AIDA entries.

Systems innovation takes into account the broader production and consumption process, including the physical and institutional contexts, the use of the product by the end user and the product artefact, i.e. the entire system (Brezet, et al., 2001). Product service systems would be classified as 'systems innovation'. There is a capacity for this type of designing within Australia. For example Melbourne recently installed a bike sharing scheme and car sharing schemes have been in operation in Australian capital cities for some time.

Conclusion

The results would indicate that at present the Australian design industry is attempting to engage in sustainability, which is a relatively new ballgame for designers. However it would be desirable for the AIDA to encourage a higher engagement in the metrics surrounding how design may contribute to a move towards a more sustainable environment. Of course, Australia is not alone in the product-focused nature of design awards (Halila & Hörte, 2006; Sung, et al., 2009). This paper should be viewed as contributing to the learning process required of the design industry. As Manzini (2003) states the move towards sustainability will be "a complex social learning process: a sequence of events and experiences thanks to which, progressively, amid mistakes and contradictions as always it happens in any learning process – human beings will learn to live in a sustainable way".

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the Learning Network on Sustainability

Design Possível

A social transformation organization

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Design Possivel (Possible Design) is a university extension project and an NGO (non-governmental organization) in Brazil. It has always carried out innovative projects regarding experimental practice in the production field of socio-environmental design as well as sustainability. It also focuses on research in order to educate designers to be agents of social transformation, in view of the new socio-economic order and the perspective for designers in the 21st century.

The history of *Design Possivel* started in Sao Paulo, Brazil, in 2004, through the development of university extension activities within the ambit of international cooperation for the development of objects in partnership with privately-owned enterprises and the third sector, seeking both social and community transformation. Initially composed of professors and students sporadically involved, the group later became stable and, having become involved in research activities as well, it started to organize different models of productive arrangements between companies and excluded communities.

Introduction

Design Possível came to existence in São Paulo, Brazil, and is composed of associates, employees, and collaborators who are, in their vast majority, professors, students, and alumni from the Industrial Design course at *Universidade Presbiteriana Mackenzie* (Sao Paulo, Brazil), where it was created. However, alumni and professionals from other institutions and with diverse education background also participate in it.

It was at times of uncertainties, of economic and financial mundialization, and planetarization of the environmental issues, that *Design Possível* was established and carried out the first series of activities of international university extension nature. The goal was to develop actions of social and ecology nature between two different worlds: Brazil and Italy. In a globalized world, it is normal to make use of design as a means of cooperation amongst cultures and having social tasks. The scope of the project was to develop projects for domestic objects in international cooperation with undergraduate students from Design courses and with communities organized into NGOs located in the outskirts of the city of São Paulo, Brazil.

The objects were varied and elaborated from solid residues, resulting from the productive process in the "glocal" perspective (MARTINS, 2006), aiming to provide communities with life improvement, income generation, and social inclusion opportunities. *Design Possível* also aims to foster undergraduate students – future designers – to put into practice what Vitor Papaneck said about the education in design in the 21st century: it must be based on ecologic methods and ideals (1995).

The projects developed by *Design Possível* normally involve educational institutions, third sector enterprises, and sometimes privately-owned companies, working together towards sustainable development, that is, a socio-economic-environmental development.

Many results have been achieved resulting from the activities carried out by *Design Possível*: it was a finalist in the contest "Planeta Casa" in 2005; it participated in the 1st Design Biennial; it was the winner in the contest "Planeta Casa" in 2006, under the Student and the Social Action categories. Exhibitions in Brazil were also organized, such as the Municipal Department of Environment of São Paulo's Showcase of Good Environmental Practices in 2006 and 2007; at Alameda das Flores (Flowers Boulevard) on Paulista Avenue in 2008, the same year in which the Brazilian House Museum organized the showcase "I am not made of plastic anymore, I am sustainable and I generate income", along with 10 different groups, involving professionals, students and NGO's. Abroad, *Design Possível* developed presentations during the period of the Milan Furniture Fair in 2006 and 2007, together with the gallery Brasilartes and IBRIT (Brazil-Italy Institute), having also participated in the International Design Biennial in 2006 in Saint-Etienne, France.

However, amongst all the activities developed, the most important thing is *Design Possível*'s intention to unite people, with different knowledge, the traditional and the technical, in the development of responsible design, for mobilizing people and knowledge with the purpose of producing objects is the important element for social inclusion and income generation in productive communities. The articulation surpasses the developed projects, becoming part of the actions and experiences of everyone involved, and gradually transforming the designers' actions and knowledge, as well as the artisans', the universities', the students' and the third sector's.

The Social Technology created by *Design Possível* and applied in networks in several parts of Brazil

Other objectives were set within the group of participants in *Design Possível* based on the experience accumulated from working closely with NGOs and productive groups. As the people involved grew and were educated, the need to construct a model that would allow *Design Possível* to go beyond the university walls arouse. A study for the group's formalization is initiated, and as a result the *Design Possível* Association came to existence in 2009.

After five years of experience, *Design Possível* established close relations amongst undergraduate students and design professionals, NGOs and companies, aiding in the development of products, and in productive and organizational management. The model was then widened aiming to reach national level.

In the contemporary world, the current model of economic system is not sustainable in the long run; thus, changes are necessary. One way to combat the society's (un) sustainability (MARTINS, 2006) is the activities carried out by *Design Possível*, promoting the development based on the opening of the economy to human ecology, to cultural anthropology, and to the contemporary political science, that is, to follow the principles of eco-development mentioned by Ignacy Sacks (2007). Eco-development means, in its essence, to aid the involved populations to organize and educate themselves, so that they rethink their problems, identify their needs and the potential resources to conceive a future that is worth living, according to the principles of social justice and ecological prudence (SACKS, 2007).

Design Possível aimed at a new relationship between the third sector and the market, which is characterized by the construction of a new models of social relationship based on entrepreneurship, cooperative income generation, and the incorporation of principles regarding ethical and fair trade, which can be observed in several countries. The third sector becomes professional and seeks the articulation with the second sector, which makes it possible to construct solutions in areas where the articulation with the Estate has already proven to be insufficient upon facing problems. We are living moments of deep change in several aspects of the human condition and, as Zygmunt Bauman (2006) puts it, we are moving from a solid modernity to a liquid one, which is based on immaterial resources.

In Brazil, during the last five years, productive communities that attend companies and corporations as suppliers of products and souvenirs have multiplied, and their work foster the increase in knowledge and income, providing decent conditions to communities and groups, which were not assisted before, or which were in vulnerable situations. These communities, so as to compete with the other sectors in the market, make use of an important differentiating tool for their products, management and products with applied design. With *Design Possível*'s aid, the productive communities have been able to value cultural and social characteristics and improve the productive response by making use of residues produced by the

group itself or by society, thus reaching a market that is qualified, demanding, and profitable, always applying the *terroir* concept. This concept comprises the products, the society that produces them, and the territory. Therefore, *terroir* defines the geographical space from complex relations organized over time. According to Lia Krucher (2009), the quality of the products has be considered in a wide way, which involves the territory, the resources used, and the community that produced them. Thus, three dimensions determine the quality of the local product: the organopletic quality, which is the characteristics that may be noticed by the human senses, such as color, gloss, flavor, smell, and texture; the social quality; and the environmental quality.

According to John Thackara (2008), we will not reach sustainability in business through traditional business. Nowadays, the intersection of businesses, of technology, of design, and of culture is the Back up Plan. It is necessary that the new generation of products and services in development brings attributes, values, and standards which are more coherent with the sustainable society standards; that is, to pursue the objective to satisfy the present needs, without compromising the future generations' capacity, as the Brundtland Report mentioned upon defining sustainable development. Consumers who are sensitive to the present attributes in the resulting products do not only consume their functional and aesthetical value, but also their history and materialized articulation. Therefore, having this view in mind, it is important to produce in a macroscopic way, and not in a microscopic one.

Ecological and social actions have become a weighty competitive advantage in the market for any company and any sector. Progressively, *Design Possível*'s partners, which initially consisted of the university and third sector organizations, also comprised privately-owned companies, though always inserted in the geographical space of Greater São Paulo.

Believing in the articulation between third sector and University may become the ideal of effective and efficient social responsibility, as long as everyone cooperates towards the elaboration of actions for sustainable development, remembering that the benefit is also collective. Everyone profits: the company profits from the social relationship and its image in the community; the NGOs obtain effectiveness in their work reaching, indeed, income generation and social transformation, and the University becomes the articulator of this process, applying knowledge as it educates new professionals articulated for a reality in construction. It is important to advance and reach a larger geographical space, that is, other areas in Brazil.

Design Possível has been leading innovative proposals regarding the experimental practice in the field of social-environmental design as well as sustainability, focusing on research so as to educate designers to become agents of social transformation in society, in view of the new social-economic order; that is, in order to educate the 21st century designer, it is the specific objective of this current research to widen these actions in a network throughout the Brazilian territory, with partnerships and educational institutions. Some of them are in states in the northern, southern and southeastern regions in Brazil, aiming to verify the cultural relations.

So as to put into practice the application of social technology to these different productive arrangements, *Design Possível* had to change its legal composition, and for that purpose it was advised by *Instituto Papel Solidário* to become an Association. *Instituto Papel Solidário* is an association located in the city of São Paulo that has participated in special projects for environmental education since 2006 and which is nowadays acknowledged internationally as a non-profit association that aims to facilitate the reflection, the legalization, and the management processes for solidarity enterprises, non-profit associations and social enterprises.

Design Possível started the process to become *Desing Possível* Association, a non-profit organization under the same name of the project that conceived it, and which aims to develop and apply design as a factor that promotes and generates social equality. This juridical change has brought new responsibilities, problems, and results for everyone, as well as it has consolidates concepts and offered benefits to the ideals and the people involved. Upon this transformation, it was possible to create the network project in the field of design, also known as *Design Possível* Network. According to Fritjof Capra (1997), social networks are communication networks that involve symbolic language, cultural limits, and power relations, and they will become, in the upcoming years, the greatest focus of attention for businesses and for society, in a general way, as an emerging global culture.

During the consolidation process, the need for structural alignment has arisen and *Design Possível* Association's mission has become even more evident, therefore it was reorganized into four areas: pedagogical, commercial, administrative and communication. These areas aim to organize the work, form the team and develop its axis (social development, research in design and sustainability). The axis or the areas and their corresponding coordinators are able to meet the needs in a more dynamic was. Three of these areas must construct sustainability based on their own work, being managed through the system of

cost centers, and they must balance voluntary and remunerated work, always paying special attention to the third sector or social areas.

One of the strategies that establish the new paradigm for the sustainable development of the Brazilian society was the creation of the Social Technology Network. Thinking of such structure, the *Design Possível* Network was put into practice – for networks cannot be considered as a social policy measure -, and it acknowledges and fosters the articulation of local solidarity networks fighting against poverty and social exclusion, besides the promotion of local development. Social networks are able to express innovative political and economic ideas as new values, thoughts and attitudes arise.

Design Possível was awarded with the Prêmio Fundação Banco do Brasil de Tecnologia Social in 2009 for the initiative to create the *Design Possível* Network and the proposal to spread the use of social technology based on the multiplication of social solutions, and the objective to contribute to the promotion of sustainable development.

So as to publicize and emancipate the projects developed by *Design Possível*, a social strategy for the network multiplication was organized under the name *Possíveis Multiplicadores* (Possible Multiplying Agents), aiming to introduce the possibilities developed by *Design Possível* in other states in Brazil. The social technology aims to meet the human dimension of the development and the collective interests, ensuring, in a sustainable way, better quality of life. As Jacques de Oliva Pena, President of the Bank of Brazil Foundation, mentions in his work "Tecnologia Social" (Social Technology) (2204), the size of the social problems to solve is big, therefore isolated initiatives from the government, from companies, or from organizations in the civil society do not solve the demands.

According to the organization RTS (Social Technology Network), social technology means products, techniques and/or methodologies which can be reapplied and are developed in interaction with the community, representing effective solutions for social transformation. In a seminar held in 2004 with the Bank of Brazil Foundation's support, it was defined that Social Technologies (STs) are a set of techniques and procedures, associated to forms of collective organization, which represent solutions for social inclusion and improvement in quality of life. Many social technologies have been put into practice for over 25 years, such as the construction of cisterns, pools for the accumulation of water; these models multiply in the northeastern backlands and have become public policies in the Fome Zero (Zero Starvation) program.

The Social Technology strategy, the methodology employed in the production on objects and in business management in productive communities adopted by *Design Possível* has been creating a model of development and community inclusion with social, environmental and economic results rarely seen. The consistent application of the constructivist method is used, which aims at the development of the content along with the educator, who needs to be positioned as a mediator between orientation and the student during the reflection and the search for solutions. During this process, it is the students themselves who organize the repertoire and understands the rationality of the work. Workshops are held, through explanatory and practical gatherings, and, thus, the proposal is that the group thinks and creates its own path.

The entrepreneurial education is very important, for it prepares the group for the market, fosters the entrepreneurial and collective attitude, and develops all the stages of the productive and the commercial process. The objective is the group's commercial inclusion and self-management through the insertion of design by means of a modular education. During the period of education, there is an educator for each module applied, which totals six, considering his/her abilities and specific knowledge. The modules are:

- Group formation: it is essential for the development and the strengthening of the team. Although it is introduced as the first module, it is present throughout the education process, for it deals with human relations, feelings, and tempers manifested throughout the modules. Thus, the integration and the approach to the individual dimension versus the collective one is of extreme importance;
- Multiplication and consolidation of the technique: it consists of a process of multiplication of knowledge, leveling the productive techniques, and defining a technical identity for the group;
- Market dynamics: it is transference of the theoretical and practical knowledge to the artisans so that they can develop their products. Market research and trends are introduced, as well as visual references, competitors, target audience, and suppliers. The local references regarding the traditional knowledge are also studied. It is the understanding of WHY products are the way they are: their colors, shapes and concepts, as well as to WHOM they are made;
- Product development: the necessary contents are applied, added to the one seen before, for the development of the group's first product line. The referential researches, the first prototypes and

the final product samples will result from this module. Parallel to the development of the product line, the group will also develop its graphic identity and brand;

- Production and commercialization: the artisans in the communities start to deal with the commercial dynamics: dealing with customers, producing samples, budgets and deadlines, delivery and payment. In this module, the group's commercial procedures are established, as well as who is responsible for what and the actions to be taken in each step of the procedure. Prime formation and drafting the first budgets for the products developed are also inserted in this module.
- Self-management: the group will elaborate its business plan, based on the objectives, goals and results expected by everyone. They receive administrative information for the group's management and on the possibilities of juridical composition.

It is expected that, after the whole process, a new social relation model is confirmed among managers, communities, and designers.

At the end of 2009, the first gathering for the creating of the *Design Possível* Network was held, taking place from July 27th to 31st. It was called First Enabling Gathering for Possible Multiplying Agents, and it happened at Universidade Presbiteriana Mackenzie, in São Paulo. Design students from several states participated, namely: Amazônia, Pará, Santa Catarina, Paraná, Rio de Janeiro, and Bahia. During this stage of the research, the activity was documented by means of photographic register and also films. The objective was to verify the participants' interests in reapplying the methodology developed by *Design Possível*, which is inserted in the sustainable development proposals, for it comprises environmental education and tge development of social-environmental design. Twelve representatives from the cities of Manaus, Belém, Florianópolis, Curitiba, Londrina, and Rio de Janeiro participated in this enterprise of putting into practice the large-scale social development. They were selected in the student activism gatherings, which is organized in the professional field of Design, by the National Council of Design Students (CONE); this is a fertile soil for protagonists who intend to deal with design in a different way, as a social transformation tool.

Therefore, the following educational institutions, represented by its students, were present in the Multipliers event: Federal University of Amazônia, Federal Institute of Santa Catarina, Federal University of Santa Catarina, Federal University of Paraná, State University of Londrina, and Federal University of Rio de Janeiro. Each of these institutions aimed to participate in the *Design Possível* Network so as to pursue the same organization of *Design Possível* in São Paulo. It is fundamental that the structure grows and creates roots in each of these places, for these cells propagated the social technology adopted along with an educational institution and a third sector enterprise, that is, NGOs representatives and communities, which discuss together the issues related to the development of objects and the productive management aimed at product design.

The goal of the event was to sensitize the participants sensitize participants into developing similar projects in their localities and provide the education for enablers so that they can act in the attended communities in the many states where *Design Possível* is present. The general objective is to enable new participants in *Design Possível*, by means of cooperative distance teaching technology, for the local and integrated development, taking into consideration the regional characteristics and elements. The specific objectives were:

- To enable multiplying agents for actions in communities by using the exchange of information via distance learning;
- To foster the sharing of experiences among the different states in which *Design Possível* is present;
- To foster the multiplying agents' actions in communities so that positive changes can be noticed in the localities;
- To create the *Design Possível* Network, providing the processes and sharing the procedures adopted by *Design Possível* in São Paulo;
- To strengthen the network of partners and share regional solutions;
- To strengthen the instruments for working in communities which take into consideration cultural elements and which respect local identities;
- To provide and verify the application of the assessment processes which take place before and after *Design Possível*'s actions in the community.

Forty hours were reckoned in terms of experiences, presentations, and activities regarding the work developed by *Design Possível* in São Paulo and the construction of cooperative methodology to be used in the other states in which the *Design Possível* Network intends to establish itself.
Besides workshops, dynamics, and lectures organized by *Design Possível*, production studios were visited in communities which are partners in social responsibility projects. This event has spread the social technology applied by *Design Possível*, which is characterized by the conception of product for income generation and the opportunity of growth in areas diagnosed as highly vulnerable, where the HDI is low and the social organizations are not enough to see to the needs of the population.

Final considerations

Some results reported by the participants in the event called Possible Multiplying Agents, such as:

- The interchange between *Design Possível*'s members from different states in Brazil, as well as the sharing of experiences among students, professionals, and artisans;
- The construction of collective knowledge for the development of actions in different regions in the country;
- The strengthening of the network of organizations which are *Design Possível*'s partners and the possibility to widen the institutions' operating area.

According to these results, it was possible to notice that the Multiplying Agents have taken to their states of origin a new repertoire, as well as new experiences and positive expectations as for the reapplications of the working methodology learnt during this five-day period. They have also incorporated changes in the creation of objects, taking into consideration the social-economic and environmental problematic, as well as the business sustainability. After this on-site enabling event, participants will continue the distance learning education during six months, and will apply the education modules in their local communities.

The process for the construction of the *Design Possível* Network is making progress and, in some states, it is already possible to verify the concretization of the model between university and third sector enterprise. *Design Possível* Santa Catarina has relations with the NGO Consórcio Social da Juventude Aroeira, and *Design Possível* Amazônia has relations with the NGO Consulado da Mulher. The most important thing in the model, which involves partners, the university, third sector enterprises and the community, is that companies develop internal demands or new dynamics supported by social projects financing, thus creating an exclusive environment that facilitates the insertion of new productive groups or communities.

For the students who participated in the events, the fruits are memorable, for they rethink and assume their roles as citizens-advisors-educators, fulfilling their roles as designers, authors, and welfare articulators, directly connected to social actions. The students, future professional, may realize the importance of their work for society and its transforming potential when it is aligned with the solution to social problems, either local or global ones.

With the work developed by *Design Possível*'s Multiplying Agents, the productive communities have been able to value their social and cultural characteristics, improve their productive response, thus optimizing the use of residues produced by the group itself or society. By developing products from discarded materials which have great added value, they reach a qualified, demanding and profitable market, being coherent with the standards of a sustainable society.

From being a simple university extension project to becoming an NGO, *Design Possível* starts to create a new possibility for designers, showing that it is possible to work with the third sector towards social development in a sustainable and continuous way, therefore consolidating a new professional niche for designers aimed at social benefits. The extension project is replaced by professional work, and the voluntary work is transformed into profession, which enables the deepening of the work and the researches towards a more solid and long-lasting result.

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the Learning Network on Sustainability

An holistic production system

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An innovative approach to production model is needed according to follow the development of the International Community that is in the middle of such great economic, politic, social and environmental transformations. Furthermore the global community, the world factories and the overwhelming evolution requires an holistic perspective in order to fully comprehend 21st century dynamics and relation between all the elements. Resources management (water, energy, food), human being and production systems processes are the big issues of this global deep transformation, although they have been faced separately up to now, neglecting their highly interrelated nature.

All these previous mentioned relations will be approached with the Systemic methodology, conceived at Politecnico di Torino in accordance to the theory of Fritjof Capra and Gunter Pauli)

Although much has already been done by some organization and company: to reduce the consumption, optimize the material use and improve the performance,(i.e. data presented by CECED Italia confirms an improvement in the energetic efficiency of home appliances form the 1995 to 2005, in Europe the emissions of the householders have decrease of the 35%, it means 17 milion ton of CO2) we know that this is not enough: these initiatives allowed a limited improvement of the environmental fallout; in fact, the continuous technological evolutions cannot ensure anymore an effective reduction in the consumption and in the emissions that products produce.

The Systemic methodological approach combined with the Design by components (DbyC) (Luigi Bistagnino, 2008), appears as one of the possible open paths to successfully face the on-going change; thanks to this approach, that critically analyses all the parts of a current industrial product, it's possible to redesign new typology of products/production chains as well as the system they are introduced in. This approach, consequently, involve the redesign of the industrial structure that evolve in a more flexible, glocal, ethical, economical and environmental model. Such strategies must be urgently met, because the lack of even only one of them could compromise the entire policy implementation and its own reaction to changes.

As mentioned before the energy issue it's just one of the multiple element that we should take into account. The amount/size of the interconnection between resources, society, culture and production, impose the adoption of an integrated approach that could drive the global governance towards a "new" responsible solution.

Introduction

The goal of this research is the possible change in the industrial production system in order to obtain a model that is more flexible and integrated with the territory.

The actual energy consumption claim new structure of product and system of production that have to be more efficient and environmental friendly.

The methodological approach of Design by Component, seem to be one of the possible paths capable to deal successfully with the on-going change, thanks to this approach all the elements of a current industrial

product are critically analysed. At the same time the holistic approach, which the designer/design should never forget, explore at 360 degree all the possible implications, causes and consequences of the detected problem.

The analysis of case studies has identified the ways in which companies have tried to implement the lean production system and policies of profit, this analysis has also emphasized the total disregard of the companies with the territory and the cultural aspect of the areas where they operate.

Actual situation

Environmental analysis

In the last years the environmental field and economic crisis have been the two main topics of our daily discussions. Someone says that these two matters are caused by the globalization, others attribute the responsibility to businesses, but there are those who say that the problem is much broader, it's social, and the cause now ingrained in our lifestyle.

"Sustainability, in a broad sense, is the capacity to endure. In ecology, the word describes how biological systems remain diverse and productive over time" (see wikipedia). But today, our society is facing a new situation; from the bought consumer goods to the industrial production is vanished the concept of level / limit.

Our society is consuming more than what we have at our disposal and we are producing more waste than the biosphere is able to absorb. The catabolic (Greer 2008) collapses we are witnessing not include a single system, but as in any system involving a network and impact on other causing a general collapse.

Even if recent European studies have shown that industrial output in electronic equipment over the past 15 years, has devoted special attention and investments to reduce consumption, conscious use of materials and improve performance, much has still to be done. The data published in "Energy and Environment Report 2008" by European Communities clearly disclose that the household appliances sector helps to produce 10% of greenhouse gases.

Although the environmental initiatives carried out by individual manufacturers over the years have allowed a limited improvement in the impact on the environment, the constant technological developments are no longer able to provide concrete reductions in the consumption and emissions that commodities produced. Data submitted by the Design Council in the annual Review of 2002 show that 80% of the environmental impacts of products or services that we use is determined in the planning stages. Materials, technologies, processing methods, systems of transportation, use, and waste products are estimated even before the object is produced. Due to the current crisis of the macroeconomic scenario, the production type approval of competing firms, but first of all the new environmental urgent needs, is rising the need of reconsider new production scenarios.

The redesign of these scenarios is due to designers' key figure because [...] positioned at the crossroads between changes in technology and consumer proposition "(Argate, March 2009), the designer's task is to summarize the industrial requirements, consumer and marketing, but also must plan and this implies a social responsibility.

The household: from tool to machine

"Hitherto it is questionable if all the mechanical invention yet made have lightened the daily toil of any human being "(John Stuart Mill in Principles of Political Economy). Following up the industrial revolution, the proliferation of mechanical and automatic machinery has been unstoppable. The overview of product enriched crowded by tools designed to limit human labor, or to celebrate the realization capacity of their builders, those are defined as "machine celibitaire".

Considering only those machines useful to alleviate the workforce of operators, it can be seen how the industrial revolution has forced a shift from tool to machine, the driving force has been transformed from energy produced by man to other kind of energy. In this new scenario the production of mechanical devices and machines continue to maintain the link with human beings seeking to satisfy their needs, even if sometimes, they are influenced and corrupted by pure marketing operations.

Looking at the manufacturing evolution from a semiological point of view two key changes are detected as related to the product machine, the social sphere and consequently to the machine communicat-

ing value In the period prior to the production of the first domestic machines, the job action was convivial, it was used to gathered to complete a job (washing, drying clothes, ...) and where was possible to develop social relationships.

The introduction of household implies the transformation of work, the shared places on the work lose their intended use, but the distinguishing feature of these sites remain in popular consciousness. The forerunner of the current appliance converts the work to be undertaken as private action in the home, undoing the social aspect of sharing.

Technological change has introduced elements of efficiency and safety for the use of machinery, but it also removed those signs that could be explanatory of the operation. The transition from an instrument (Marx, 1867) to a machine (Marx, 1867) imposed a physical detach from the appliance that involves a progressive loss of knowledge and relationship with the appliance and know-how . This relation has been left to the maintainer depriving the user from it.

Methodology

Nowadays the appeal of the product is mainly related to the outside shell and to marketing concept of innovation, but if we analyze these ideas it's clear that are insubstantial. The aesthetic value is dependent on the fashion fluctuation and the innovation is limited only to the 20% of the whole product (Dieter, 2000), for two main reason:

- the firm have to write off the cost of the plants
- the interface is considered by the user the product (Raskin, 2000), for this reason it's common to redesign only this component.

Those two factor cause of the semantic obsolesce of the object combined with the difficulties to maintain the product at cheap price are the cause of the huge quantity of products sent to the landfill.

The path proposed by Design by Components in a systemic vision implies a design where the external shape of the object is determined by the internal placement of its own components. This type of design starts from the analysis of disassembled objects belonging to the same semantic category (so as to be able to understand all their constituent parts: materials and components), considering the relationships and connections between components, production technologies and physical-mechanical laws that characterize the product. It is important to consider the approach users could have to the analysed product, taking into account the different levels of accessibility the user, maintenance technician and manufacturer will have.

Each component must be considered as a final product with its own independent life cycle, and must be considered in relation to the other components.

It is subsequently analysed according to a functional scheme, where its composition is revealed by aid of follow-up abstractions, firstly in accordance with an operating scheme, and afterwards with an essential one, allowing for the isolation of the necessary and sufficient functional groups.

Acting on the basis of this criterion, it is possible to comprehend the complexity of the relationships which exist between functional groups and the system as a whole, and to recognize the various different types of problems which need solving.

On the basis of the complexity of these relationships we can affirm that Design by Components intends to focus primarily on the system of which it is a part, and to which it belongs.

Design by Components is, to all intents and purposes, the up and downstream conception/planning existing behind and throughout a more complex process that looks at the finished product as the concrete exemplification of ideas, thoughts and the more diverse strategies, all entangled and interrelated into one with the others, in strict connection with the life cycle of the designed item.

Last but not least, is the concept of shared responsibility, also promoted by the 2002/96/EC *WEEE-Waste Electrical and Electronic Equipment* directive. The protagonists who contribute to the ideation, design and manufacture are designers, industrialists, law-makers, economists and final users. They will be asked to collaborate responsibly.

New products created thanks to this mental path represent the execution of relations and functions of the appliances. Being aware that all household electrical appliances are part of an integrated system (with the territory, the society, the environment, the residential units, …) and not only of the individual production chain, will entail a new product design conception.

Application of the Dbyc methodology to the whole system

The environmental system, as Lewis Thomas suggests in his book “The Lives of a Cell: Notes of a Biology Watcher”, is composed by living creatures related to the whole environment; if this web of life is compared to all the production system, it is possible to assert that these combined elements create a complex network, correlated with the flow of knowledge, information, materials, energy, etc..

Looking forward the beginning of the next industrial revolution, where the industry will try to emulate the natural cycles, rather than hope in increasing production of the earth, we must learn to do more with what the earth provides. All the outputs of firms can be converted into value added or used as feedstock for other industries or processes, doing so industries will have to reorganize in clusters. The elimination of waste represents the last solution to the problem of pollution, which threatens both locally and globally (l. Bistagnino, 2003).

- With the advent of industrial evolution it has seen a slow change in the ratio between the object product and production: at the beginning of the industrial history the main company was producing and assembling all the goods inside its structure, but with today’s industrial gigantism this solution is no longer applicable nor feasible. The current production systems delegate to external producer the components realization (many competitors are supplied by the component producer) leaving the final assembly to the main company. This approach involves not only the significant emissions from continuous movement of products, but also an effort to seek suppliers increasingly economical affordable according to sell more economically attractive objects.
  Alongside the historical analysis has identified numerous changes and transformations occurred in the nineteenth century thanks to the various tools provided by industrial production, but the first real change of direction is attributable to Frederick Winslow Taylor. From Taylorism to this day there has been a follow one after the other of models designed to optimize production times and increase profits. The policies of profit are translated differently depending on the culture, territory and time in which you operate:
- Taylor → production line
- Ford → product standardization
- Wollard →synchronized supplì
- Sloan → shared platform
- Toyota → Just in time and total quality
- Honda → innovation and flexibility
- Ikea → self service and self assembly

This historian path underlined the awareness of the industry in the importance of cost reduction, but it also stress out capacity to evolve or create new type of production model. All the analyzed model highlight the ability to increase: the economic efficiency, time reduction, dead time in the supply chain, quality, innovation, …. Unfortunately all this element are only related to the price factor that means a limited solution of the problems (linear approach).

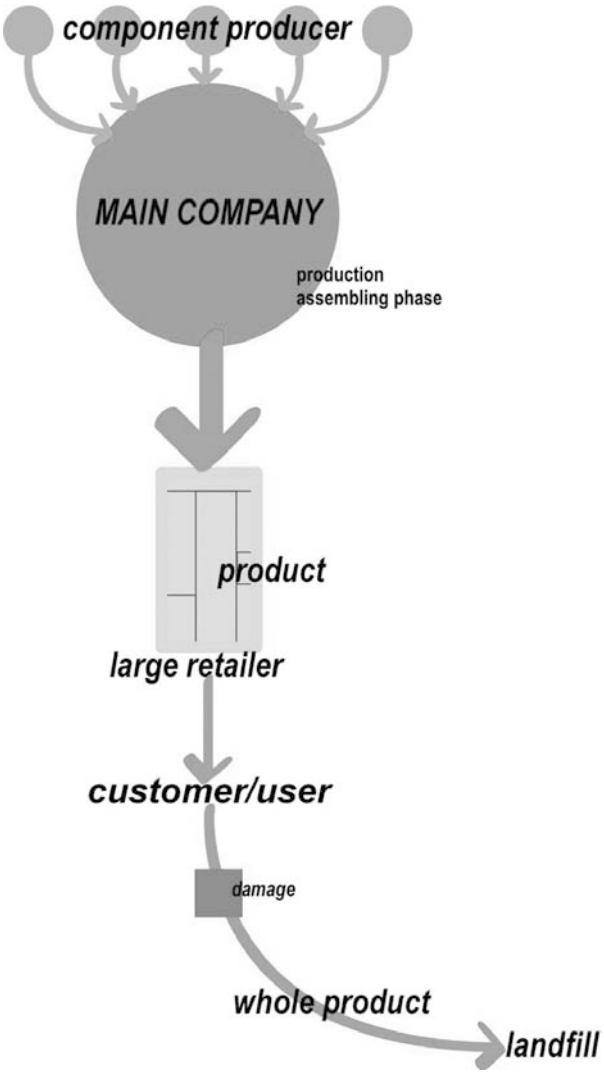

Figure 1: Actual production systems (linear approach)

The application of the Design by Component methodology combined with the positive extrapolate from the production model evolution (from taylorism to hondism and the Ikea model) generates a new holistic manufacturing model:

- the main company will control the whole production systems thank to its know how;
- the producer of the main components will be organized thanks to the main company know how according to create the "heart" of the product;
- the "foreign" supplier will be turned in local producer, that means that they will just produce the accessory or the out side shell of the product according their cultural background and technologies, because they will sell it locally.

The new model induce all the actors to operate according ethical value, the components producers are actively involved in the design phase, all the production are local and the component repaired can foment the second hand market.

This sort of revolution of the industrial mentality will certainly be neither easy nor immediate. In the year to come, it will be necessary to predict and plan all the constituent part of a product, their material, duration, replacement and all there is to know about the life cycle of an object.

This transformation would get a flexible and adaptable object to the cultural needs and it will achieve a productive structure capable of reducing fuel consumption in transport and supplying of raw materials, which will instead be linked to local production context.

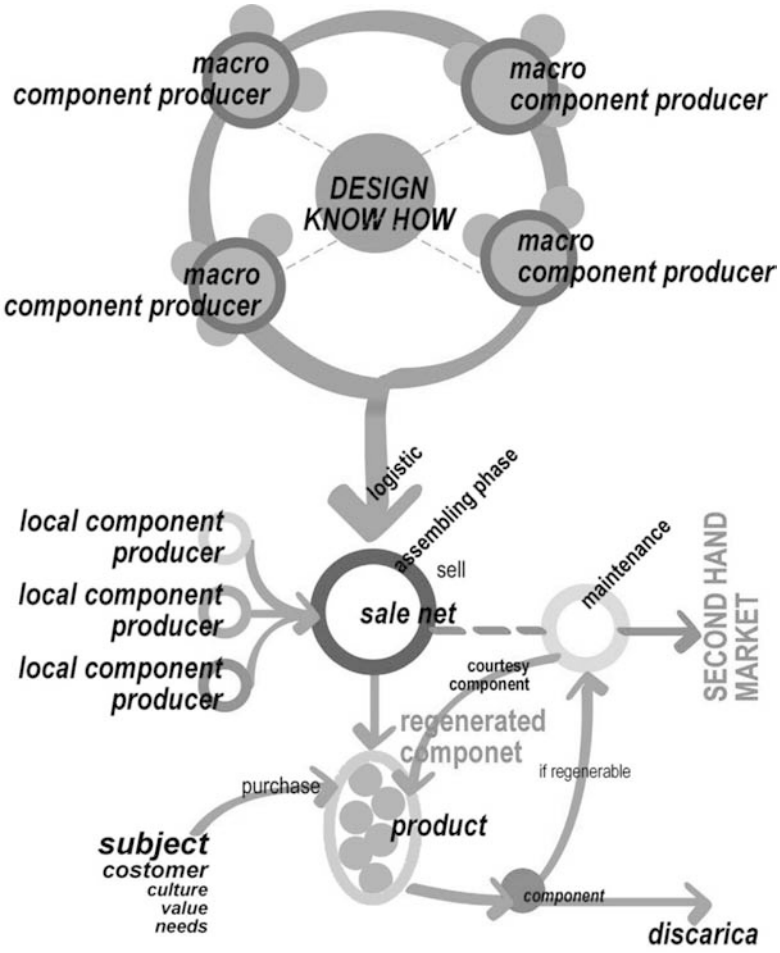

Figure 2: New production systems (systemic approach)

In conclusion, it is mostly up to large size industries to make the sharpest change and to drift away from logics of goods designed for the end markets, by focusing on the technical and quality evolution of components and by changing the production rules in favour of systemic strategies deeply integrated with their own territorial, social and economical contexts.

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PAPERS PRESENTED AS POSTERS

Design Research for Sustainability (DRfS)

the Learning Network on Sustainability

Filming a new beginning

Prototyping a critical thinking practice with Indian families in Chennai

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In this paper we reflect on the design process of the Filming a New Beginning workshop, a critical thinking practice designed with families in Chennai, India, to promote personal growth and individual development through the mobile production of short mobile video films. We consider the workshop and the way it was designed as empowering to raise sustainability inside a community. We highlight identified design opportunities based on challenges and practices found in Chennai, and describe the key lessons learned from testing a pilot workshop, which resulted in the designed workshop. We conclude by providing our future vision of how to understand the impact of the workshop on the family learning culture.

Introduction

The *Filming A New Beginning* (FNB) workshop is a guided activity where individuals first recognize their own position in difficult or uncomfortable situations; second, acquire an understanding of the other persons' motivations and intentions in these situations; and third, ideate alternatives to produce more favourable situations for all. Because individuals are not isolated but live in a socio-cultural environment, a 'do-it-together' approach to create sustainable social practices is fundamental in the critical thinking practice.

The pedagogical foundations of this paper are Paulo Freire's (1970) well-known pedagogy of the oppressed, and the theoretical approach emphasising learning to be a complex socio-cultural process of situated activity to gain understanding and new meanings (Säljö, 1996; Engeström, 1987; Hakkarainen, Järvelä, Lipponen and Lehtinen, 1998; Paavola, Lipponen and Hakkarainen, 2004). In sustainable societies and communities individuals are free to explore, ask why and look for solutions – simultaneously. The individuals have a voice and may improve their living conditions. They are empowered to build sustainable communities with sustainable cultural conventions.

In this paper, critical thinking refers to the inquiry of practical and social situations that a person experiences, leading to the understanding that each individual is a "maker of culture" (Ackermann, Decortis and Hourcade, 2009: 296), and resulting in a behaviour that can make a difference in one's personal life. Because an individual is a "maker of culture" (Ackermann, Decortis and Hourcade, 2009: 296), clear positive changes in personal behaviour through critical thinking may create an effect in a whole family, the community and society. The culture may become sustainable in the broadest meaning of the term.

When looking for lucid and motivating learning methods with critical thinking practices, mobile phone video was selected as a potential learning tool. According to Narayanan (2007: 8) video as a learning tool may "allow for learners to develop their imagination, to be able to play, have fun, and to be able to tell stories in different and exciting ways". Therefore, the technology can be a resolution to move away from a situation where learning is tied to school, and move closer to learning as something that develops individual and personal growth.

During the participatory design research conducted in the Ramapuram village in Chennai, India we identified challenges – based on the Conventions on the Rights of the Child by the United Nations (1989) as universal framework for the development of children – that clearly prevent children from reaching their full potential. We found the children who participated in the study to grow up in an impoverished environment where external objectives dominate their home learning culture. This leads, for instance, to a family culture where physical discipline of the children is common. Further, it was found that immediate livelihood concerns were discussed in front of the children without offering them constructive dialogue. Lastly, we found the omnipresent reluctance to engage with specific social and physical settings to cause an inhibition to critical thinking and empowerment. How these challenges and issues are addressed in the resulting design is discussed in more detail later on.

The FNB workshop presented in this paper is an informal learning practice that aims to serve as an example of how children can develop personal learning strategies, and enter a critical dialogue with everyday practices through digital media design. The underlying practice of the workshop, and the way in which the workshop was designed illustrate a practical aspiration for social sustainability.

Background

Chennai, the capital of the Indian State Tamil Nadu, is composed of village-like neighbourhoods, one of them being Ramapuram. Ramapuram was where the FNB research was conducted from August to December 2009. The village had an estimated population of 30,000 people (Tamil Page, 2010) and was – as Narayanan (2007) has described her study site – neglected, impoverished, and unstable. In her study, Narayanan (2007) concluded that basic human rights like hygiene and health are withheld from the people who live there. The FNB study was conducted with a local non-profit organization, the Pudiyador Association for Community Empowerment (Pudiyador).

Pudiyador is a Tamil expression for 'a new beginning'. The non-profit organization works as an after school centre for children from low-income families. In 2009, Pudiyador supported 35 children between approximately 6 to 14 years of age, with individual care for their personal learning interests. In conversation, Pudiyador's director mentioned that contrary to other learning centres in Chennai, Pudiyador has absence of violence and low monthly fees with attached educational financial plan.

The FNB workshop emerged from a first approach to this community with a project called *NokiaExpand*. The project happened in the context of a study course at the Helsinki University of Technology (currently: Aalto University School of Science and Technology) and was sponsored by Nokia. It aimed at designing a mobile device for learning needs The results included software and industrial design prototypes, and recommendations for further research. The FNB project originated from the authors' personal learning, and is unrelated to the previous project aims and practical results.

Design Practice

Practitioners of participatory design widely see that, even if their backgrounds and areas of concern are so diverse that there can be no single definition of participatory design ("CPSR – What Is Participatory Design?," 2008; Schuler and Clement, 2004), there are issues they agree on. In participatory design, design ideas arise in the collaboration of stakeholders with different backgrounds. Those using or expected to use technology are recognized as the prime source of innovation. Because of this, participatory designers prefer to spend time with people in their everyday life situations rather than test prototypes in laboratories. In participatory design, design challenges are recognized from the real context of people's lives. Neither the challenges nor the solutions should ever be imposed from the outside (Leinonen, Toikkanen and Silfvast, 2008).

Narayanan (2007) identified that people who live in precarious situations in India are largely overlooked when new artefacts are designed. To stop this exclusive design practice, Narayanan (2007) maintains that their practices should be considered in the design process.

The wider methodological approach of the research was based on Freire's 'Pedagogy of the Oppressed', which states that liberating transformation can only happen through practical, dialogical, and

joint participation of individuals intending transformation and the people in the environment under transformation (Freire, 1970: 75, 158).

The FNB workshop was designed with an "intergenerational design team", (Druin, 1999). In addition to the designer (one of the authors) who entered the field from Finland and led the research, the team consisted of ten children, five mothers and two interpreters. The local design team members were involved with Pudiyador, and many lived in Ramapuram. All participants became equal design partners throughout the study.

The kin and friendship relations of the children in Pudiyador were the criteria for asking people to join the design team. The child-participants were between 9 and 13 years old – ages cannot be stated exactly. Of the ten children, six were girls and four boys, all with various educational histories. The five mothers were between 22 and 35 years old, with school education from 0 to 10 years. Most of the children participated regularly in the design meetings, but the mothers participated non-regularly. To overcome the language barrier between the families and the designer, two Pudiyador facilitators joined the design team as interpreters and design partners.

Contextual Inquiry

According to Beyer and Holtzblatt (1998: 46-47) contextual inquiry in design is a planned set of actions where designers inquire and learn by following and participating in the practice of their customers. In the following we describe how the contextual inquiry took place in the study, starting from the first meetings with the design team members to more formal work in common design sessions.

Identifying everyday family activities and meeting spaces

According to Noe (2009: 70) the living environment of a person offers the opportunity to develop. In this study, it was assumed that the living environment of the design team members opened up in different ways to each individual, and understanding their conceptions of it is valuable for the design result.

In the course of two weeks the designer walked with each design team member through their everyday environment, including their homes. During the walks the participants took pictures of their living spaces with mobile camera phones, which were introduced to them before the walks. In a similar way as the photographer Zana Briski (Kids with Cameras, n.d.) taught photography to children to give them a possibility to document their living spaces in the red-light district in Calcutta, the participants of the design team in our case were asked to provide their perception of their environment. Initial doubts about ethical implications of introducing supplementary technology into the environment, were refuted. The design team members were not reluctant to return the technology. Most participants enjoyed the photo activity. Only one participant returned the technology without taking pictures.

The resulting images were printed and shared within the entire design team. In the design team, we discussed topics related to family meeting spaces, shared day-to-day activities between parents and children, and family conversations. We also drew pictures of the situations. The aim of the photo sharing, discussion and drawing sessions was to capture an understanding of the present practices and learning culture between parents and children, to be used in following research and design activities.

Visualizing the mood of the shared activities

In these design sessions we explored the shared everyday practices of the parents and children further. We recognized and categorized negative and positive experiences, although the activities were sometimes experienced and interpreted differently.

During the design session each participant chose one negative and one positive activity, and created a visualization of each based on personal experiences. For the visual expression we used the printed images and prototyping material available in the environment, such as color pencils, color paper and "pipe-cleaners", as recommended by other researchers designing with children (Guha, Driun, Chipman, Fails, Simm and Faber, 2004; Montemayor, Druin and Hendler, 2000). During the presentation of the visualizations the participants became aware of a number of challenges, but also recognized enjoyable activities. For example, Figure 1 illustrates 'Playing at home', a negatively experienced activity, and Figure 2 illustrates 'A family discourse', perceived as positive.

Figure 1: Playing at home

Figure 2: A family discourse

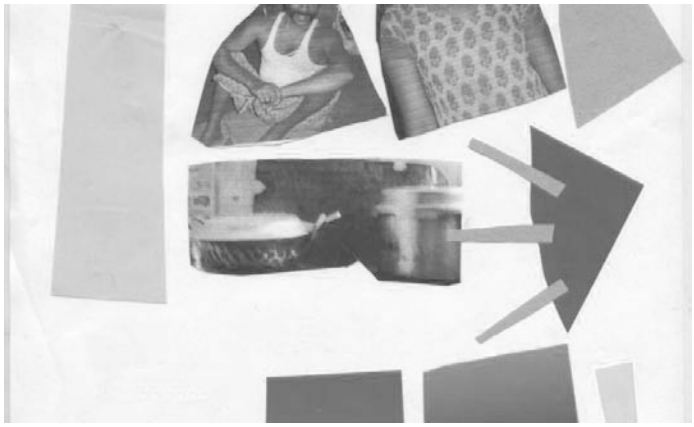

Image theatre

To understand how the shared activities happen in everyday life, we chose to stage them in the design team using image theatre. Image theatre, developed by Boal as part of the "Poetics of the Oppressed", is a form of theatre performed in three stages, focusing on the "feasibility of change" (Boal, 1979: 117). In the first stage, the participants arrange a frozen image with their bodies to visualize the experience of a situation. Then, they stage an "ideal image" of the same situation. Finally, a transitional image is formed, representing how the change could happen. During each stage, the participants can express their values concretely. (Boal 1979: 112-113)

According to Boal (1979: 116), placing oneself in to the scene supports the participants' understanding that they are themselves "part of that reality". In our case it was left to the participants whether to place themselves into the scene, or solely arrange other participants. And unlike Boal's (1979: 112) suggestion, the design team members were allowed to speak while arranging their frozen images. Scenes such as doing homework, playing at home, and gardening were staged, played and discussed.

The design team members did not have earlier theatre experiences. Probably because of this, we were not able to arrange the transitional image. However, the activity served to understand how the participants interpreted everyday activities, and clarified the design team members' values of shared family activities.

Prototyping the workshop concept

The concept of the FNB workshop was ideated in design sessions with the Pudiyador facilitators who were also design team members. The original concept included steps such as choosing a theme, filming everyday experiences related to that theme, viewing, reflecting and re-filming scenes, interviewing people outside of the design team, and showing the resulting films to an audience.

To test the concept we arranged a pilot of the workshop in form of 9 prototyping sessions with 12 design team members. The children and the facilitators participated, but the mothers did not. The sessions

were held daily, and lasted approximately 2 hours each. To enable immediate prototyping of emerging difficulties, the proceeding was open and revised as the workshop went on.

The participants worked within two teams of six persons. One adult joined each team. The teamwork enabled the participants to relate their own experiences to those of other persons, and to ideate suitable representations together.

The pilot gave insight on the practical application of the workshop, and provided more contextual information that was not considered or understood when defining the initial concept. The lessons learned from the pilot workshop were used to define more precise design challenges, and to design the workshop model.

Identified Design Opportunities

During the contextual inquiry, drawing on the Convention on the Rights of the Child and the Human Rights by the United Nations (1948, 1989), we recognized several design challenges preventing the community members, especially the children, from reaching their fullest potential.

For instance, parents and teachers applied physical discipline in the hope of solving fights between children, or to get them to study. Interviews with community members and discussions with design team members illustrated that school was considered as the only stakeholder responsible for learning. Learning at home was dominated by external objectives given by the school and children were often denied to learn or to discover skills by playing. For instance, one child expressed that he did not like to play at home, because his mother would hide his toys and threaten to hit him. In practice, play was considered a waste of time.

Based on the recognized challenges we were able to define design opportunities. These are presented in the following.

Relationship building with a common language

The design team found that the feeling of familiarity reduces inhibitions. Whether it is familiarity with an artefact or with another person, the design team noticed that relationship building is an opportunity for learning free from inhibitions. A relationship means casually knowing something for example another person, but also a domain of knowledge (Papert 1993: 135). When people can converse with each other, by interrogating and sharing their descriptions of the world, there is an opportunity for an effective form of learning (Sharples, Corlett and Westmancott, 2002).

The design team found that a common language between children and adults fosters relationship building and empowers everyone with a voice to speak about their perception of the world. In practice, a common language can be a certain way of talking with each other – a form of dialogue leading to mutual understanding. In the search of a common language, external visual tools can play an important role.

Embedded play

The explorative character of play is beneficial for developing a personal learning strategy. A practice of play, which is shared by the adults and children alike, can help people to communicate. However, because of the stigma among the participants, of play being useless, the practice should not be recognized or titled with the notion of play.

During the contextual inquiry, after gathering information about leisure activities, the design team discovered that, although the learning culture is not inclusive of play, recreational activities are an integral part of a person's life. There was a diversity of storytelling and narrative spaces in the village. Storytelling appeared to be an accepted free time activity by children and adults. We concluded that the element that informs all shared activities is storytelling.

In the design team, we started to call 'play' that is not called play, or even recognized as play by the participants, as 'embedded play'. When designing the FNB workshop we carefully considered how the

activities could include ‘embedded play’ that is building on and close to the existing storytelling tradition and practices widely accepted by the community.

Practicing change with performance

In order to make a difference, a person has to identify what to change. However, difficult situations are deeply rooted in the day-to-day life of a person, and strenuous to recognize (Illich, 1971: 51). Also, a change of practice needs to be embedded into the mutually established body of knowledge, to become a genuine characteristic of the same.

Performance of everyday life can make personal knowledge explicit. A person can gain insight about what they would like to change and how. Boal (1979: 119) illustrates that theatre can be a “rehearsal for revolution”, because the performance of an invented action is a carried out action that can encourage an everyday practice. In communion, difficult situations can be resolved, and change can be practiced.

During the contextual inquiry we notice that performance is seen as opportunity to understand others and to develop empathy. In the design team, we recognized that the performances of everyday life events represented situations that were familiar and close to all participants. The stage and the practices were shared points of origin for all. Performance added to the establishment of a common language between the people, because we saw that staging everyday situations, and sharing them this way with others could help the community members to discuss difficult issues. By documenting the performances we thought to gain a wider audience and an extra layer of reflection for them than in the case of using live theater.

Re-contextualizing technology

Re-contextualizing technology refers to the use of a technical artifact, such as a tool, in a way in which it has not been used before. Discussions with the team members during the contextual inquiry revealed that 5 of the 30 families engaged with Pudiyador activities own camera mobile phones, and that the children use the phones in their everyday life. During the design workshop we thought that joining the camera mobile phones with the already existing narrative practice of families in Chennai, the phones could become tools for embedded play, practicing change and relationship building. With this approach we could operate by not putting the technology into focus, but by looking for ways to mediate and cultivate practices, which are able to empower people with the opportunity to understand that the actions of each individual can shape personal and mutual established realities.

Prototyping the FNB Workshop

The nine sessions of the pilot workshop that we organized with the design team to further test and design the workshop were structured in three types of sessions: five filming sessions, three prototyping sessions, and one screening. The lessons learned from the pilot workshop are described here.

In the filming sessions, the participants filmed everyday situations they intended to change. To identify the situations, the teams filmed the activities of a day until they encountered a difficult situation. From this, we concluded that the workshop should support a slow filming approach.

After watching the initial films, storyboards were created that included ideas of how to better visually represent the scenes. Storyboard development was considered as integral practice of the workshop, because the storyboards supported the decision making during the filming.

In one filming session the teams conducted interviews with shop-owners in Ramapuram, to access their opinions on the theme ‘Play in Ramapuram’, determined by the design team in advance. However, one team asked the interviewees about their experience of physical discipline by their parents. A debrief with the design team concluded that physical discipline was conceptually linked to play. Further, we found that showing the films to the interviewee before asking the questions could frame the theme of the interview.

During the prototyping sessions, we noticed that unintentionally recorded instructions often caused film dialogue to be inaudible. However, because the instructions included ideas, such as camera angles, film locations, and actor positions that could be applied when re-filming a situation, the instructions only disturbed the final films. We concluded that the FNB workshop should support two modes of filming.

One mode of collecting information, in which instructions can be recorded, and another mode of careful filming, in which instructions can only be given after the filming.

Lastly, the screening session was intended for sharing the children's films with their parents at the centre, but the parents did not follow our invitation. Reasons, such as inaccessibility of the meeting space, impossible schedule coordination, and fear of public exposure based on uncertainty about the film content, were suggested. To make sharing possible for future workshops, the design team ideated a road show scenario, in which the children would show their films to passersby in public spaces and request immediate feedback.

FNB Workshop Designed

The FNB workshop was designed for educators and persons working with children all over the world. During the workshop, difficult everyday situations are identified and favourable situations are practiced in dialogical communion through the creation of mobile video films. The goals are to develop a personal critical thinking practice, and to gain a voice to speak about personally relevant topics by establishing a personal film language. This section describes the FNB workshop as it resulted from the design practices performed in Chennai.

The workshop structure

Figure 3: Timetable of the FNB workshop

The FNB workshop is structured in a preparation stage, where resources and locations are set, and a practice stage, where participants make four films thematically titled with 'Remember', 'Encounter', 'Resolve', and 'Broadcast'. Each film is created in three steps: 'Access', 'Reflect', and 'Discover'. Excluding the organizing stage, the FNB workshop amounts to twelve steps, and each is recommended to last about 2 hours. The workshop timetable, illustrated in Figure 3, depends on the unique conditions of the environment where it is organized. It is progressively structured during the production. For example, encounters with other persons, referred to as supporting filmmakers, can only be scheduled after difficult situations are identified. The equipment needed to facilitate an FNB workshop is paper, pencils and a video camera, such as a camera mobile phone. No previous film making experience is required. During the workshop participants are referred to as filmmakers, and can freely chose a role, such as film director, actor and cameraperson, as to support their development of a personal film language.

Iterative process: Access – reflect – discover

The content of the films originates from personal everyday situations that the filmmakers detect as problematic. To support the filmmakers in finding their own pace of approaching their films, each film is created in three steps. They are explained in the following.

Access

Here, information is collected and everyday life is investigated with the mobile camera. The camera is used as a virtual sketchbook, and the filmmakers neither need to pay attention to the aesthetics of their films, nor a filming plan. Viewing the films that resulted from collecting the information is a good opportunity to share experiences.

Reflect

In this step, the information is carefully discussed and analyzed. The filmmakers identify the main points of the collected information, and combine several experiences to one story, by organizing scenes in a storyboard. Listening to the learning experiences of the facilitator was found to be a good way to initiate the reflection.

Discover

The storyboards are filmed during this third step. The intended repetition of a reflected problematic helps the filmmakers in their learning process. The camera is used as a medium of expression and not anymore as a sketching tool. The filmmakers develop their personal film language and use their creativity freely. After the filming practices all filmmakers gather to view and discuss the resulting films.

The Four Films of FNB

The four films for the FNB workshop thematically build on one another by following the three-step iteration. Here we illustrate how the three steps relate to the four films.

Film 1 ‘Remember’

While making this first film, the filmmakers are intended to ‘discover’ their own positions in difficult everyday situations by filming them from their point of view. The content of this first film directs the focus of the following three films.

To create the first film, the filmmakers ‘access’ relevant information, then ‘reflect’ on their own role and identify the difficult situations they want to change, and lastly re-film the selected situations.

Film 2 ‘Encounter’

‘Encounter’ means that filmmakers face other people in the situation. All parties from the identified problem are now included in the filming practice, in order to identify different viewpoints of the problematic and understand that many motivations exist in one situations.

First, the ‘Remember’ films are shown to the supporting filmmakers in a location of their choice. Building on the difficult everyday situations, the filmmakers ‘access’ the intentions of the other persons, and make them visible by staging and filming them. The filmmakers then ‘reflect’ on the gathered information, and identify the motivations of the supporting filmmakers. By staging and filming the situation from the perspective of the supporting filmmakers their positions are ‘discovered’.

Film 3 ‘Resolve’

For this film, the filmmakers and the supporting filmmakers practice, stage and film favourable situations together. The filmmakers learn that challenging situations can be transformed with a change of practice.

The ‘access’ step of the ‘Resolve’ film consists of viewing and discussing the ‘Remember’ and ‘Encounter’ film. Possible resolutions are ideated, during the ‘reflect’ step. Through filming the ideated change, it is made concrete, which means ‘discovered’, and the favourable practice becomes accessible.

Film 4 ‘Broadcast’

The final film is about understanding how realistic the filmmaker’s change is for persons who encounter the ideas for the first time.

The filmmakers and the supporting filmmakers present their previous created films to passersby in public places, such as parks or playgrounds, via the camera screen, and ‘access’ their opinions and com-

ments. To better 'reflect' about the audience's feedback, this interaction can be filmed. Lastly, the filmmakers 'discover' how realistic their resolution was perceived by filming the audience's suggestions.
The FNB workshop closes by viewing all four films, and reflecting about the learning outcome of the workshop.

Conclusion

The design team members considered the FNB workshop to initiate discussions about personally relevant topics, and to establish an atmosphere of change. However, it is too early to evaluate the impact that the FNB workshop has on the family learning culture. In the following, we provide a future vision of how this could be evaluated.

The films resulting from the FNB workshop contain knowledge, for example an ideated resolution, which the filmmakers gained in the course of the workshop. The films serve as mental scaffolds of the 'access-reflect-discovery' iteration that the filmmakers experienced, and can be appropriated as a communication medium, in much the same way as words. The films are accessible to the filmmakers, in the widest sense through their memory of the workshop. For example, during the contextual inquiry, the designer gifted a printed photograph of the frozen image 'Playing at home' to the family members who staged this scene. When returning to the family a few days later, the mother reported that when she was about to physically punish the child for playing, the child would present the photograph to her, and she would refrain. The child said that a family joke developed around this everyday situation.

Studying the appropriation of the films in everyday family life after an FNB workshop could serve to identify the kind of impact the ideated resolutions have on the family life, and could shed light on the role of the digital artefact in social transformation.

Furthermore, we consider the FNB workshop to be a practice capable of being utilized by any person. It is our intention to identify communities for which the FNB workshop could be a valuable practice.

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the Learning Network on Sustainability

Nanotechnology as a futuristic approach to architecture

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The architecture of the world is at a cross roads with the advent of new technology. Nanotechnology, the understanding and control of matter at a scale of one-to one hundred-billionths of a meter, is bringing incredible changes to the materials and processes of buildings. Materials will behave in many different ways as we are able to more precisely control their properties at the nano scale. Nanotechnology stands to change and advance the practice of design in a multitude of ways – where architectural progress is being made at the molecular level. What impact it shall have on the futuristic architecture is discussed in the paper.

> "Architecture has been slow to embrace nanotech innovations, but this isbeginning to change, and architecture is awakening to a new industrial revolution."
>
> Source Unknown

The biggest ideas in Architecture today are coming out of the science of the small. Nanotechnology, the manipulation of matter at the molecular scale, promises to transform architecture in ways we can hardly imagine today. Nanoarchitecture can bring dramatic improvements in building performance, energy efficiency and sustainability to building projects.

Introduction

It is potentially the most transformative technology we have ever faced, generating more research and debate than nuclear weapons, space travel, computers or any of the other technologies that have shaped our lives. It brings with it enormous questions, concerns and consequences. It raises hopes and fears in every aspect of our lives—social, economic, cultural, political, and spiritual. Yet its potential to transform our built environment remains largely unexplored. What, for instance, is the future of building if each of us possesses thermoprotectant skins that shelter us from the elements? How do we interact with our environment, and with each other, if walls and roofs become paper-thin, permeable, or even invisible? For the architecture profession, nanotechnology will greatly impact construction materials and their properties. Materials will behave in many different ways as we are able to more precisely control their properties at the nano-scale.

Nano is a Greek word meaning*" Dwarf*". The way NANO Car is expected to revolutionize the world, the same way Nanoarchitecture is set to change the perspective we perceive the buildings today. Nanotechnology will have profound effects on the way we live. For the architecture profession, nanotechnology will greatly impact construction materials and their properties. Nanotechnology, the understanding and control of matter at a scale of one-to one hundred-billionths of a meter, is bringing incredible changes to the materials and processes of buildings. Materials will behave in many different ways as we are able to more precisely control their properties at the nano scale.

Nanotechnology shall dramatise the architecture of the whole world. Nanotechnology is concerned with the management and specifically the study and use of very small structures <100 nanometres in size. By way of comparison, a human hair is 50,000 times larger in diameter than a nanometre. But what is so promising about this technology for it to be considered a key technology of the 21st century? Can it also facilitate innovations which will noticeably advance environmental and resource protection? There are many unanswered questions about the opportunities and risks of this technology.

For an industry that trades in the very, very small projections about the potential scope of nanotechnology are gigantic. Estimates are that the industry will grow at a staggering pace, reaching close to $3 trillion globally by 2014. The National Nanotechnology Initiative, created by President Bill Clinton in 2000, has called it **"the next industrial revolution."** (Source: www.nrdc.org)

The remarkable effects are achievable because matter behaves differently at the nanoscale, where the laws of quantum physics take hold. In this quantum world, objects can change color, shape, and phase much more easily than at the macro scale. Fundamental properties like strength, surface-to-mass ratio, conductivity, and elasticity can be engineered to create dramatically different materials.

Nanotechnology and new materials

In the near future, it may take building enclosure materials (coatings, panels and insulation) to dramatic new levels of performance in terms of energy, light, security and intelligence. Even these first steps into the world of nanotechnology could dramatically alter the nature of building enclosure and the way our buildings relate to environment and user. The development of carbon nanotubes and other breakthrough materials could radically alter building design and performance. The entire distinction between structure and skin, for example, could disappear as ultralight, super-strong materials functioning as both structural skeleton and enclosing skin are developed.

Biomaterial structural composites

Biomaterial structural composites are made from flax and cellulose, turn renewable resources into recyclable building components. (See Fig.1)

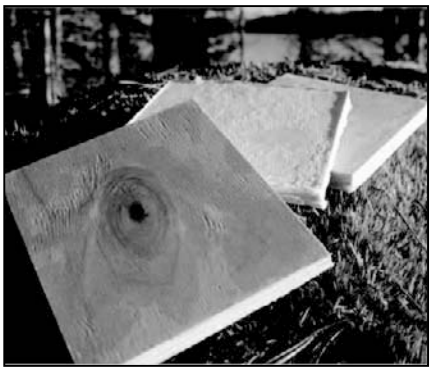

Figure 1: Nanocomposite Panels

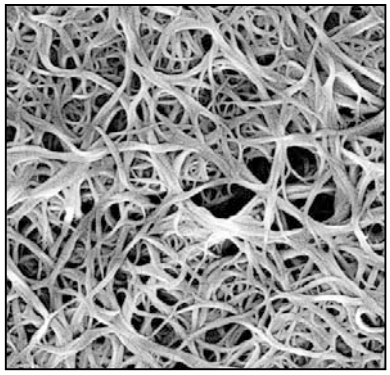

Figure 2: Carbon Nanotubes

Source: www.arch.uiuc.edu/elvin/nanotechnologyindex.htm

Nanocomposite steel

Carbon nanotubes are used to make nano composite steel. They are up to 50 times stronger yet 10 times lighter than steel. Carbon nanotubes may be paper thin but may be able to hold the entire building. As a result, carbon nanotubes will have significant influence on the architecture industry as such materials can act as "a switchable conduit, a light source, a generator of energy and even a conveyor of matter". (See Fig. 2)

Nanopaints

The complex blend of microscopic hollow ceramic spheres that makes up these paints have a vacuum inside like mini-thermos bottles. The use of paints on the exterior walls is more dramatically effective since it blocks the extreme heat of the sun. The ceramic materials have unique energy savings properties

that reflect heat while dissipating it. The hollow ceramic microspheres reflective quality affects the warming phenomenon called “Mean Radiant Temperature,” where heat waves from a source such as direct sunlight cause a person to feel warmer even though the actual air temperature is no different between a shady and sunny location. (See Fig.6)

Nanoglass or self cleansing glass

Nanoprotect Glass is a special nanotechnology product, manufactured by Nanotec, with a long term self cleaning effect for glass and ceramic surfaces. The NANO-particles adhere directly to the material molecule and allow the surface to deflect any dirt and water. (See Fig.3 and 4)

Key Benefits: Water-repelling, Dirt-deflecting, Lime-rejecting, Weather protection, UV – weather-resistant, Prevents fungus growth, Easy to clean- Self cleaning effect

Figure 3: NanoGlass

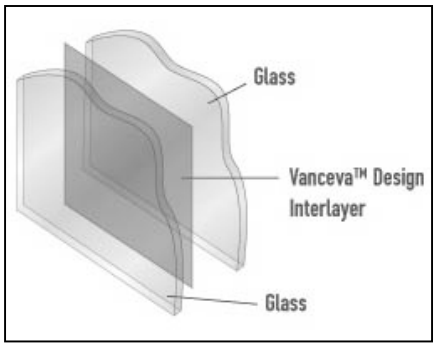

Figure 4: Section through the Glass

Source: www.arch.uiuc.edu/elvin/nanotechnologyindex.htm

Nanofabric

Nano-protex is a water-based NANO impregnation with very high penetration depth for textile. The product is repellent to water and the adherence of foreign matter to the surface is decreased. The Nano-particles adhere directly to the substrate molecules, deflecting any foreign matter. (See Fig.5)

Key Benefits: Water-repelling, Dirt-deflecting, Weather protection, UV – weather-resistant, Easy to clean- Self cleaning effect.

Figure 5: NanoFabric being used in parking

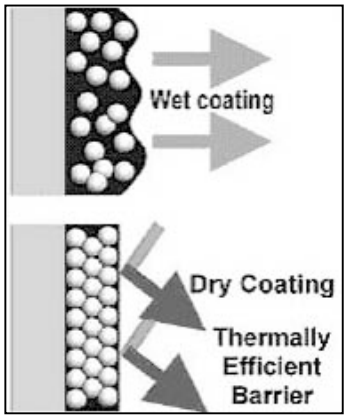

Figure 6: NanoPaints

Source: www.arch.uiuc.edu/elvin/nanotechnologyindex.htm

Smog eating concrete

The façade of Richard Meier's Ruby Jubilee Church in Rome is self-cleaning, due to titanium dioxide nanoparticles built into its precast concrete panels. The panels trap airborne pollutants in a nanoparticle matrix on their surface, and then decompose them.

Figure 7: Façade of Ruby Jubilee Church, Rome where self cleansing concrete panels have been used.

Source: www.arch.uiuc.edu/elvin/nanotechnologyindex.htm

Energy coatings

Similar to the way a plant absorbs sunlight and turns it into chemical energy to fuel the growth of a plant, energy coatings absorb sunlight and indoor light and convert them into electrical energy. Energy coatings are produced by working on the nano scale by injecting a dye into titanium dioxide, a white pigment commonly used in toothpaste and paint. The dye, applied to a flexible material, absorbs energy from both the sun and indoor light. This light energy travels through the titanium dioxide and a series of electrodes and is converted into electrical energy.

Heat absorbing windows

Heat absorbing windows offer solar performance superior to that of previously available laminating systems. Alone, or when combined with solar management glass, this new glazing interlayer provides the architectural marketplace with new, cost effective options to control heat and energy loads in buildings. By selectively reducing the transmittance of solar energy relative to visible light, these solar performance interlayers produce glazing systems that can result in savings in the capital cost of energy control equipment as well as operating costs of climate control equipment.

Key Benefits: Energy efficiency, Safety and security, Ultraviolet protection, Design versatility.

Nanotechnology will profoundly affect the industry of architecture at all scales; and, interior design, building design and city design will all benefit. Architecture will have the ability to function at more optimum levels – revolutionizing the way inhabitants live. Generally speaking, nanotechnology will give architecture superior interactive functions as occupants select and communicate what transient states they would like to experience. As new materials and construction methods emerge, the advent of everyday use of nanotechnology will definitely unleash the designer's imagination.

Figure 8: The Futuristic House using nanomaterials and nanotachnology

Source: www.greentechforum.net

Some examples of buildings where nanomaterials have been used

Ruby Jubilee Church, Rome, Italy

Jubilee Church, known in Italian as La Chiesa del Dio Padre Misericordioso (God our merciful father), is one of 50 new churches with community centres built in Rome as part of the Vatican's Millennium project. The 27,000ft² building in white concrete and glass, is located at the Tor Tre Teste area, six miles east of Rome, on a flat, triangular site in an isolated lower middle income housing development. The $10m project was inaugurated in 2003, and was American architect Richard Meier's first church. The building was commissioned by the Archdiocese of Rome, which made Meier, a Jew, a controversial choice of designer to work with the Vatican.

The most distinctive feature of the church is the three curved shell walls, or 'sails' that soar to a height of nearly 90ft above the building. These are made from concrete shells, with a marble-like finish, reinforced with steel and are held together by post-tensioned cables horizontally and vertically. The concrete used in the building is a self cleansing one.

The future of the architecture of Chandigarh with reference to nanotechnology

On the near horizon, the architecture of Le Corbusier in Chandigarh is set for a change. If Le Corbusier had been conversant with nanotechnology at the time Chandigarh was built, his buildings in exposed concrete would have been very different. The concrete facades would not have weathered with time and the elevations would not have been so gigantic. He would have used self-cleansing, smog-eating concrete panels which consist of photocatalytic titanium dioxide nanoparticles in the precast panels. This concrete has a marble-like finish and remains unaffected by the weathering of time as the airborne pollutants are trapped in a nanoparticle matrix on the surface and then gets decomposed.

Figure 9: The *Brise Soleil* Façade of the Secretariat, Chandigarh

Source: The Author

Figure 10: The Grand entry to the High Court, Chandigarh

Source: The Author

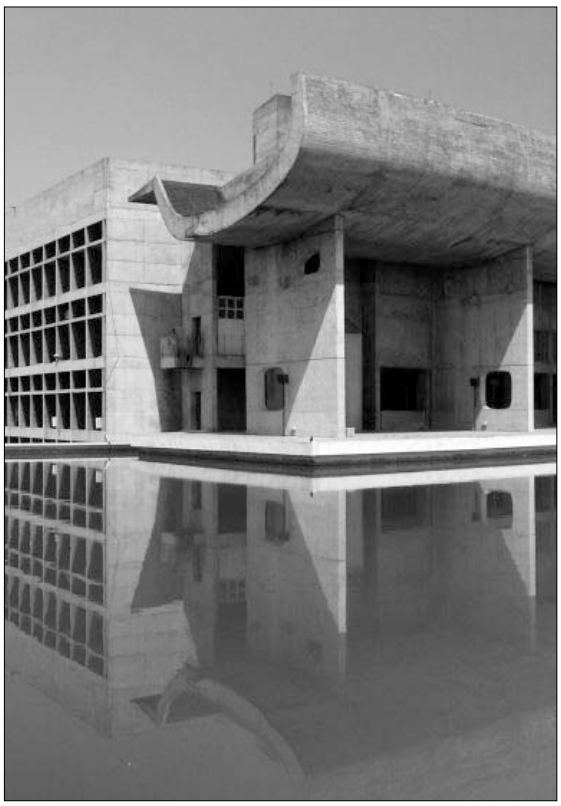

Figure 11: The sickle porch of the Legislative Assembly, Chandigarh

Source: The Author

The use of 'brise-soleil' on the exterior of the buildings of the Capitol Complex and Govt. Arts and Architecture College would have been avoided. The horizontal and vertical louvers were used to provide adequate shading to the windows from the harsh sun of the composite climate. The heat absorbing glass produced by the nanotechnology would have been the alternative. This glass controls heat and energy loads in buildings due to the solar interlayer which blocks upto 99% of the sun's UV rays while allowing the important visible light to pass through.

The huge columns used in the Capitol buildings and those in the City Centre, Sector 17 shall have been minimised by the use of Carbon Nanotubes (one of the materials of nanotechnology). These sheets of graphite, just one atom thick, if formed into a cylindrical column are not only 50 times stronger than conventional steel but ten times lighter also. The conventional steel to be used in a ten-storeyed Secretariat building would have been reduced drastically by using carbon nanotubes intead. Only paper thin sheets of column might have been able to hold up the entire load of the buildings. Interestingly, the architecture of the buildings designed by Le Corbusier would have been totally unusual.

The tiny embedded nanosensors in the building materials will make the architectural features responsive and will be able to track the movement and detect temperature changes, humidity, toxins, weapons and even money. Communication will occur between object and object, between occupant and object, between object and environment and between occupant and environment, making 'fields of interaction' a major focus. Thus, all the security personnel installed at the Capitol Complex and other buildings shall no more be required. The buildings shall be self-secured and self-sufficient.

These dynamic environments will be organic in their ability to respond to changes, so the architects will need to learn to design for change.

Future of nanotechnology

Nanotechnology, fast becoming a three-trillion-dollar industry, is about to revolutionize our world. Unfortunately, hardly anyone is stopping to ask whether it's safe. Before we hurtle off toward a nano-utopia, we need to step back and ask ourselves whether this is a direction in which we really want to go.

When an industry grows this quickly, there may be neither the time nor the inclination to ask some tough questions about possible risks. First of all, there are the health and environmental hazards. Would nanotechnology bring unacceptable risks to workers making these materials or consumers who use the final products? Would it affect air or water quality near where the nanomaterials are dispersed? The technology is potentially transformative, but we want to use it in a way to take advantage of that while reducing the risk. We are at the crossroads.

The new science of nanotechnology is poised precariously between two vistas. In one direction, scientific researchers and industry scramble to capitalize on the technique's alluring potential; in the other, regulatory agencies and environmental groups debate ways of keeping risks to a minimum. Complicating the tasks in both directions, the exploitation and the regulation, is something that can be thought of as Nano's Paradox: The qualities that make nanoparticles a potential threat to health and the environment are the very same qualities that offer a wonderful opportunity to improve that same health and environment.

It is proposed that specific nano-regulations should be made by the governments so that standardised engineered nanoproducts can be manufactured. As nanotechnology explodes, and as Government agencies wrangle over whose responsibility it is to deal with an essentially unregulated industry, it's all the more crucial to take stock of the emerging field as soon as possible.

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the Learning Network on Sustainability

An aesthetic for sustainable interactions in Product-Service System?

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Eco-efficient Product-Service System (PSS) innovations represent a promising approach to sustainability. However the application of this concept is still very limited because its implementation and diffusion is hindered by several barriers (cultural, corporate and regulative ones). The paper investigates the barriers that affect the attractiveness and acceptation of eco-efficient PSS alternatives, and opens the debate on the aesthetic of eco-efficient PSS, and the way in which aesthetic could enhance some specific inner qualities of this kinds of innovations. Integrating insights from semiotics, the paper outlines some first research hypothesis on how the aesthetic elements of an eco-efficient PSS could facilitate user attraction, acceptation and satisfaction.

Eco-efficient Product-Service System (PSS) innovation: a promising approach to sustainability

It is widely shared that the transition towards sustainability will require a system discontinuity, meaning that a radical redefinition of the current structures of production and consumption is needed. In the second half of the '90s a series of studies and analyses led to a clearer understanding of the dimension of change necessary to achieve a society that is effectively and globally sustainable. These studies indicate that in 50 years, considering the raising consumption levels and the doubling of the world's population, a sustainable society should use 90% less resources than industrialised countries are doing today (Factor 10 Club, 1994; Schmidt-Bleek, 1996; WBCSD, 1996). In other words, conditions for sustainability can only be achieved by drastically reducing the consumption of environmental resources compared to the current average consumption in mature industrialised contexts.

Given the dimension of the required change it is therefore clear that innovations on a process and product level, although being fundamental and necessary, are not alone sufficient to obtain the just mentioned radical shift. In fact, although it is true that these innovations can improve environmental performances of products (by a factor of 2-4 for Charter and Tischner, 2001), it is also true that these improvements are often negatively counterbalanced by an increase in consumption levels (Haake and Jolivet, 2001). In addition it has to be underlined that in the traditional production and consumption model, based on the traditional sale of products, producer's economic interest usually does not converge with an environmental interest in optimizing the resources consumed (Mont, 2002; UNEP, 2002).

For these reasons, if we want to effectively tackle sustainability, there is a need to move from a focus on product improvements only, towards a wider systemic approach that takes in consideration new potential ways of satisfying the social demand of wellbeing. In this perspective, as suggested by Stahel (1986, 1989), we should move from an industrial economy, in which the central value is based on the exchange of products to be consumed (e.g. cars; boilers and methane; washing machines and powder), to a functional economy, in which products are mere means of providing functions (e.g. mobility; thermal comfort; having clean clothes). Its economic objective is to create the highest possible use value for the longest possible time while consuming as few material resources and energy as possible; thus it is potentially more dematerialised than the present economy, which is focused on production and related material flows as its principal means to create wealth (Stahel, 1986; 1997). In other words a functional economy can potentially bring about a reduction in the current levels of resources consumption, without minimizing consumers' level of satisfaction (UNEP, 2002; Mont, 2004a; Tukker and Tischner, 2006).

Within this perspective several authors consider promising to look at the concept of **Product-Service System (PSS) innovation**, understood as the result of an innovative strategy that shifts the centre of business from the design and sale of (physical) products alone, to the design and offer of an integrated system of products and services that are together able to fulfil a particular demand of satisfaction (UNEP, 2002). In fact, if properly conceived, this kind of innovation can potentially bring companies to improving their competitiveness and at the same time to separating resources consumption from its traditional connection with profit (Goedkoop et al., 1999; Brezet et al., 2001; Manzini & Vezzoli, 2001; UNEP, 2002; Tukker & Tischner 2006; Mont, 2004). These PSS can be defined eco-efficient PSS (UNEP, 2002; Vezzoli, 2007), meaning that is the economic interest of the socio-economical stakeholders (involved in the PSS offer) that foster an optimisation of the environmental resources consumption, i.e. PSS are potentially eco-efficient since they are capable of decoupling resource consumption and environmental impacts from value creation for both the company and the customer (Tischner, Rayan and Vezzoli, 2009)

An illustration of the potential environmental benefits of a PSS is clear in the "Pay-per-use" solution offered by Ariston (an Italian washing machine manufacturer). Here, rather than selling a washing machine, Ariston provides access to it enabling clients to get their "satisfaction", i.e. "having clean cloths". The payment is based on number of washes and includes delivery of a washing machine at home (not owned by the customer), electricity supply (not directly paid by the customer), maintenance, and end-of-life collection. Within this business model Ariston is economically incentivised in reducing as much as possible the washing machine energy consumption (in order to reduce operational costs and maximise profits), and in designing and providing long lasting, reusable and recyclable washing machines (in order to postpone the disposal costs and the costs for the manufacturing of new washing machines).

From what has been said it is possible to identify three key elements that characterise this kind of innovations:

- they are rooted in a satisfaction-based economic model, i.e. instead of the traditional forms of selling, ownership, use and disposal, an eco-efficient PSS is focused on delivering a particular satisfaction to the user, even referred as "unit of satisfaction" (Vezzoli, 2007); and this through an integrated set of products (owned by the producer/s and/or provider/s) and services. In other words there is a shift from a ownership-based consumption to an offer based on access and (in some cases) sharing;
- they are stakeholder interactions-based innovation, i.e. they are radical innovations, not so much as technological ones, as new interactions/partnerships between the stakeholders of a particular value/satisfaction production system, showing a fundamental shift in the relationships between the user and the producer/provider; it is in fact a relationship that does not end right after the sale, but continues during the whole duration of the service.
- they have an intrinsic eco-efficiency potential, i.e. they are innovations in which is the company/companies' economic and competitive interest that may leads to an environmental impact reduction (system eco-efficiency: decoupling the creation of value from resources consumption).

In the last 15 years the European Union has dedicated special attention to this kind of innovations: a wide number of research projects in the field of PSS and sustainability have been supported by EU funding. These researches brought to clarifying the concept of PSS, understanding its characteristics, potential benefits, drivers & barriers, possible rebound effects, etc., and to developing (and partly testing) different methods and tools to orient and support the design of eco-efficient PSSs (see for example: Brezet et al., 2001; Manzini, Collina and Evans, 2004; Van Halen, Vezzoli and Wimmer, 2005; Tukker and Tischner, 2006; Tischner, Rayan and Vezzoli, 2009).

However, despite all the knowledge developed at academic level, and despite its win-win potentials, the extent to which companies have adopted this kind of business model is still very limited. In effect, even if the concept of PSS is recognized as a potential win-win solution (winning for the producers/providers, the users and the environment), its adoption by companies faces different barriers. This is because eco-efficient PSS are usually radical innovations: innovations that challenge existing company models and existing regulatory framework, and at the same time foresee new relations between users and producer/provider. Within this perspective different barriers can be identified (UNEP, 2002; Mont, 2002). On the company side, usually there are difficulties in changing the corporate culture and the traditional business concept, because there are uncertainties about cash flows, and because new design and management skills are required. From the customer point of view, the main problems are the cultural shift necessary in accepting an ownerless consumption, and the lack of knowledge about life cycle costs. In addition, on the regulative side, there are difficulties in implementing policy measures to create corporate drivers to facilitate the promotion and diffusion of this kind of innovations.

Starting from these considerations the paper firstly investigates the barriers that affect the attractiveness and acceptation of eco-efficient PSS alternatives. Then the paper opens the debate on the aesthetic of eco-efficient PSS, and the way in which aesthetic could enhance some specific inner qualities of eco-efficient PSS, i.e. facilitating and enhancing their wider diffusion. Through the analysis of some case studies, and integrating insights from semiotics, the paper then outlines some first research hypothesis on how the aesthetic elements of an eco-efficient PSS could facilitate user attraction, acceptation and satisfaction.

Eco-efficient Product-Service System (PSS): user acceptation barriers

Consumption behaviour is a matter of individual choice, influenced by social norms and institutional settings. The diffusion of alternative eco-efficient PSS solutions is hindered by the current and dominant consumption behaviours. Let's summarise the most important factors that determine this opposition (in industrialised contexts); we will follow Mont (2004b) line of thought, dividing these factors in economic and socio-psychological ones.

From an **economic perspective,** Røpke (1999) states that the current consumption behaviours are firstly determined by the entire history of industrial development. The industrial revolution brought to increased production volumes and reduced products prices, determining the need to sell more and more new products. This brought to create the demand for all the produced artefacts and therefore strategies were defined to encourage and boost consumption. In relation to this, Kilbourne et al. (2001) state that the economic and political institutions have persuaded people to believe that higher material prosperity is the expected behaviour.

Another cause that is bringing to reinforce material consumption levels is related to the so called externalities. Since environmental and social costs connected to products are not included their market prices, it becomes hard for eco-efficient PSS solutions to compete with the industrially produced products (Mont and Lindhqvist, 2003; Ceschin and Vezzoli, 2010). Moreover the prices of labour intensive solutions (and eco-efficient PSS is most of the time included in this category) are increasing, and therefore it is cheaper for customers to buy product-based offers (e.g. washing machines) instead of PSS-based offers (e.g. clothing care services).

In addition it has to be underlined that users show a lack of knowledge and understanding about life cycle costs (Mont, 2002). For this reason it becomes sometimes difficult for them to understand the potential economic benefits of a PSS oriented solutions. PSS-based offers are usually (and erroneously) perceived by the end-user more expensive if compared to the purchase of products (even if sometimes it is true the contrary), since the use, the maintenance, the repair and the disposal costs are in fact not taken in consideration during the product purchase.

Economic studies are traditionally based on the assumption that consumers are rational decision makers whose choices are driven by utility maximisation, with price and income factors as the most important ones in taking choices. However, as underlined by Mont and Plepys (2008) consumer behaviour has been found to be far more complicated than just a rational response to prices, being influenced by different internal and external drivers induced by **human psychology**, **social norms** and **institutional settings**.

Sociological studies underline the role of *habits* in influencing consumption behaviour, arguing that consumption choices are dependent by prior consumption patterns. In relation to eco-efficient PSS, the problem is that solutions based on sharing and access contradict the dominant and well established norm of ownership (Behrendt et al., 2003), making consumers hesitant in accepting ownerless-based solutions. And this is especially true for particular types of satisfaction (e.g. for washing our clothes we are not used to think that we could have in our home a washing machine that does not belong to us), while in other cases ownerless-based solutions have entered in our routines (e.g. the use of public transport services).

Another barrier to the diffusion of ownerless-based solutions is the fact that the quantity and quality of accumulated goods is perceived as a measure of success in life, because they represent an indicator of a certain position in society (Mont, 2004b). Moreover, as underlined by Halkier (1998), the current trend towards individualisation is boosting the consumption demand, because person's identity is no longer defined by a community, rather by the goods she/he owns (goods that represent the signals of one's own identity).

In addition, the hesitation towards offers based on ownerless access and sharing can also be linked to the perception of independency, hygiene and intimacy usually connected to one's own products.

Even if there are barriers that obstacle the acceptation of ownerless-based offers, it has also to be underlined there are also some windows of opportunity (Mont, 2004b) that can be exploited to favour the acceptation of such a kind of solutions. Firstly, while traditional economics argues that users demand physical products to satisfy their needs, the works of some sociologists (among other Max-Neef, 1991) tells us that needs can be fulfilled by material and non-material "satisfiers". Moreover material consumption is not linked to happiness; in fact more materialistic people are not always more happy than less materialistic ones (Belk, 1985; Max-Neef, 1995). In addition, some studies state that increase in consumption levels represent the need to satisfy psychological and social aspirations rather than material ones (Jackson and Mark, 1999). On the same line of thought, Hacker (1967) argues that the purchase of the same brand represents a substitute for a lost sense of community. Moreover, in relation to goods possessions, even if is true that this is perceived as a measure of a certain social status, it has also to be said that ownerless solutions may also represent a certain status; let's think for example to the use of taxi, access to education or cultural events (Mont, 2004b).

We have seen that different barriers on a user level may obstacle the acceptation and the satisfaction related to ownerless-based solutions. At this point the key questions that arise are:

- how it is possible to make the user to accept the (radical) behavioural changes linked with this kind of solutions? How is it possible to favour the embedding process into his/her habits?
- during the purchase choice, how could we make the user to be more attracted by an eco-efficient PSS rather than a traditional product-based offer?
- during the use, how could we make the user to perceive an eco-efficient PSS more satisfying than a traditional "product-based" offer? In other terms how an eco-efficient PSS can be perceived as a solution that produces more comfort, usage pleasure, etc. than a traditional offer?

A potential role of aesthetic in enhancing the attraction, acceptation and satisfaction related to eco-efficient PSS?

The first consideration that can be done is that an aesthetic of an eco-efficient PSS (that is to say the way in which it is perceived by the user) may play a key role in enhancing user attraction, acceptation and satisfaction. In other words, it is fundamental to focus on the way in which the different elements of an eco-efficient PSS are perceived. And as we have seen before, an eco-efficient PSS is a quite complex artefact, made up of different elements: **products**, **communication**, **services** (interactions between the user and the producer/provider) and more in general **interactions** (between the different socio-economical stakeholders involved in the PSS value production system). So, the attraction, acceptation and satisfaction related to a PSS depend on how its system of products, services and interactions (and its inner qualities) are perceived by the user.

We know that aesthetic has an important role in product design and in user acceptance and satisfaction. So forth aesthetic has a role to play in product design for sustainability as far as a new generation of

products has to substitute the unsustainable products we are surrounded by (in industrialised contexts). Moving on a system innovation level the question is: in which sense it possible to think about an aesthetic of eco-efficient PSS? This question is not only related to the debate on design for sustainability, but more widely on the role of design.

A preliminary assumption (justified by all has been said in the previous paragraphs) is that there is a need to explore aesthetic potential role in this field.

A following understanding is that such an aesthetic should take in consideration not only the products related to a PSS, but also the services and more in general the various interactions. We could talk of a **system aesthetic**, i.e. an aesthetic as the integrated perceptions of the "expressions forms" of the different elements of the PSS: an aesthetic that therefore integrates in a coordinated way the aesthetics of products, communication, services and interactions.

Starting from these considerations the question is: how the aesthetic elements of an eco-efficient PSS could facilitate user attraction, acceptation and satisfaction? In order to try to outline a framework for possible answers, we will analyse some cases of eco-efficient PSS (to get some insights), and we will put forward some working hypothesises.

Insights from case studies

Wash bar

Wash bar (Tamborrini, 2009) is a LG Electronics laundry, inaugurated in 2005 in Paris. Users have access to washing machines and dryers, but also to a bar and various recreational-cultural services, like wi-fi internet connection, short films projections, and participation to organised events. The interior spaces appear like a bar or a game room in which the last generation washing machines and dryers are integrated.

The environmental benefits connected to this kind of solutions are clear. The question is: what are the differences between *Wash bar* and the traditional laundries? First of all it is possible to say that in Wash bar there is the intention to approach a wider range of users, and stimulate more persons to adopt this kind of solution. The adopted strategy is simply to make pleasant the waiting time during the washing and drying cycle. The various elements of the system (the furniture elements, the communication elements, and the service elements) are thought and arranged in order to create a sense of hospitality. Users can feel at home: they can read, listen to music, surf on internet.

Figure 1 and 2. Wash bar: pictures of the interior spaces

Source: Tamborrini, 2009

But the main aspect is linked to the social dimension of the solution. In fact the different tangible elements (sofas, armchairs, tables, etc, and their layout), coupled with the various available services (bar, wi-fi connection, etc.), together determine the possibility for users to develop interpersonal relations. And it's just this relational aspect that represents the key point of the PSS solution. It is the social quality of the innovation that can potentially contribute to make the solution perceived as more satisfying compared to the traditional laundries (and maybe also to the domestic wash).

Car sharing/pooling system for the Vehicle Design Summit project

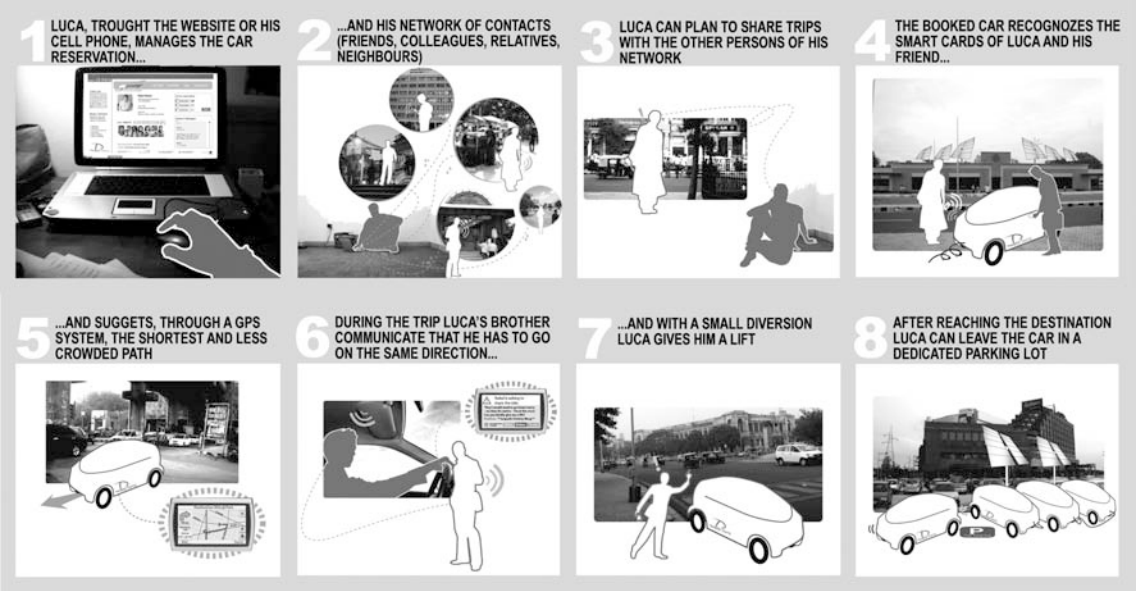
The second case we present is a urban car sharing/pooling developed as a master degree thesis by Lorenzo Davoli within the research project Vehicle Design Summit[1].

In synthesis (Vezzoli and Ceschin, 2008) it is a system through which users have access to a fleet of low environmental impact cars, and in which users are stimulated to share trips with other persons. User, once registered, receives a smart card that allows the access to the fleet of electric cars as well as to the public transports. The reservation of the car (displaced in dedicated parking lots made available by the public administration), is done via internet or cell phone. During the use of the vehicle a GPS system suggests user in choosing the shortest and least and crowded route. The payment of the service is based on the kilometres covered.

The peculiarity of this system is that through internet user can create and manage the own network of contacts (friends, colleagues, relatives, neighbours, etc.), and through this network organise the own trips, and plan to share them. Moreover, through the cell phone it will be possible to know in real time the position of the friends that are using the car, and in case ask them a lift (sharing the service costs).

Figure 3. Car sharing/pooling system designed for the Vehicle Design Summit project: storyboard of one of the possible user interactions

Source: Elaboration starting from images made by Lorenzo Davoli (Davoli, Fiocchi and Lin, 2008)



The environmental advantages of car sharing/pooling systems, compared to use of a private car, are obvious. The question is: what are the differences between this system and the traditional ones? Like in the previous case, there is the intention to make the solution more satisfying if compared to the traditional car sharing systems and the use of private cars. And even in this case the fulcrum is represented by the aspects linked to the relational qualities. The key point is in fact the possibility to create and manage a network of contacts with whom share trips. In this way users can build new contacts as well as feel part of a community. And it is this social dimension of the service that could act as a stimulus to modify user habits and behaviours.

It has also to be said that, to support this change, the system is designed also to create awareness about environmental issues. The service in fact on one hand supports user in choosing the less crowded paths (with a consequent resources saving) on the other explain the environmental benefits connected to the system. And this represents a further element potentially capable to strengthen the acceptation of such kinds of solutions.

[1] Vehicle Design Summit is an international consortium made up of 27 universities and coordinated by MIT of Boston. The consortium objective is to design and realise a low environmental and "open-source" car, as well as the definition of the conditions for its market introduction through innovative and sustainable mobility offers. The role of Politecnico di Milano team (Lorenzo Davoli, Francesca Fiocchi and Jun Lin, coordinated by Carlo Vezzoli and Fabrizio Ceschin), was to design an innovative and eco-efficient business model, as well as a transition path to introduce and diffuse this model into the market.

A design research working hypothesis

At this point a proper question is: which effects should the aesthetic of an eco-efficient PSS produce on the user?

First of all it has to be remarked that eco-efficient PSS are satisfaction-based offers, meaning that what is designed is a "unit of satisfaction", rather than the product that permit to obtain it. In this perspective:

- the aesthetic dimension, and so forth the delivery of the perceived value can be designed onto the ultimate and profound level of the offer (i.e. the satisfaction rather than on the various means to reach it); in this sense the same aesthetics (as attraction, acceptation, and satisfaction) is more "honest" and "transparent" to the user.

Moreover, as we have seen before, since eco-efficient PSS are based on ownerless access (of products or final results), and sharing (of products), it is on the advantages connected to these characteristics that it is necessary to focus on in order to make such a solutions perceived as better than the traditional product-based offers. In particular eco-efficient PSS can potentially favour:

- the interactivity between the various users (of the PSS). The sharing of products between more persons can in fact bring to the development of new interpersonal relations (let's think for example to the previous described cases). The direct contact between persons, that take place during the use of a PSS, can determine a greater participation of the user, who can feel "part of a community": let's think for instance to the solidarity purchasing groups (organised groups of people which buy food directly from local farmers) and the relations that take place between the users.
- the interactivity between user and the PSS producer/provider, because the relationship does not end after the purchasing (as happen in the traditional product-based offers) but last in time for the length of the stipulated contract/agreement.

These elements (the relational qualities that can be built between the users of a PSS, and between them and the producer/provider) are the ones that usually cannot be found in the traditional product-based solutions. Therefore they represent some distinctive traits of eco-efficient PSS. Thus, these relational qualities should be the elements to be valorised if we want to enhance user attraction, acceptance and satisfaction.

This is coherent to what we have seen before. In fact, if goods purchase can be linked to the need to satisfy social aspirations (Jackson and Mark, 1999), and can represent a substitution for a lost sense of community (Hacker, 1967), it is especially on these social processes that a PSS should focus on (in order to be perceived better than a product-based solution).

In addition to these elements, an eco-efficient PSS is also characterised for its intrinsic environmental and economic benefits. The problem is that, as underlined in chapter 2, most of the time user is not aware about these qualities. As consequence it is necessary to focus also on these aspects if we want to enhance the attraction and acceptation of these kinds of solutions. In particular:

- it is necessary to favour users in understanding the environmental and economic benefits connected to the use of eco-efficient PSS solutions;
- as consequence, users will become aware of having acquired and adopted a more responsible and sustainable behaviour; and this could represent a flywheel for a wider diffusion of the solution (because users could inform and stimulate other persons in doing the same).

It has also to be said that eco-efficient PSS, compared to traditional ownership-based solutions, usually bring to users further benefits, as:

- the release from the problems and costs connected to the products maintenance repair and disposal.

As consequence even this aspect should be emphasised and made more visible to the users.

Finally it has to be remarked that eco-efficient PSS not only have to create satisfaction during the use phase, but they also have to be more attractive (compared to ownership-based offers) during the purchase choice. In other words eco-efficient PSS should be capable to "invite" and "intrigue" users (and attract their interest) more than the product-based solutions.

In synthesis, how the aesthetic elements of an eco-efficient PSS could facilitate user attraction, acceptation and satisfaction? Some working hypothesis (to be verified):

- during the purchase choice, the aesthetic elements of an eco-efficient PSS should stimulate users in attracting and inviting their interest;
- during the use phase, the aesthetic elements of an eco-efficient PSS should valorise its relational qualities (stimulating interactivity between users, and between them and the PSS producer/provider);
- during the use phase, the aesthetic elements of an eco-efficient PSS should facilitate users in understanding the advantages related to the release from the problems and costs connected to the products maintenance and disposal;
- during the use phase, the aesthetic elements of an eco-efficient PSS should also facilitate users in understanding and enjoying its various economic and environmental benefits.

Semiotics, aesthetic and eco-efficient PSS

The meaning of relations

Relationships are of central importance to semiotics. The meaning of words and things always arises from the way the different elements of human experience meet and associate. Both in text analysis and in product and service design, a particularly important type of relationship is that between the *expression plane* and the *content plane* (cf. Hjelmslev, 1943). The expression concerns the way in which things occur: the form they take, the syntactic arrangement of their components, the materials of which they are composed. Expression is both the logical organization of the products and their perceptible appearance. Instead, the plan of content covers the entire semantic background of the artefacts: the range of their possible meanings and the meaning of their existence, but not only. When we talk about products and services, the semantic dimension also concerns the sphere of those social relations in which they are located and, thus, those functions and modalities of use that make them operational.

The social use of products identifies another type of relationship, which we define dialogic: the one that is established between the different social actors of any communicative act. The dialogicity leads, in fact, much of our social and communicative act, and not only when it assumes the explicit form of conversation. The entire organization of culture is dialogic (cf. Lotman, 1985).

Hence a third type of relationship, that in design involves the designer and the user: it is a dialogical relationship, not directed but mediated by the product. In this sense, the artefacts are presented as the time when the *designing logic* (the purposes and criteria that support the project idea) interacts with the *user logic* (the way in which artefacts are understood, appreciated and used).

From the product of sense to the effect of sense

The *satisfaction* obtained by using a product, whatever it is, is of paramount importance for the user. Satisfaction is a "subjective" requisite and covers the anthropological, psychological and perceptible dimension of the human-environment and human-artefacts relationship. It is not difficult to see how the satisfaction degree of a product is largely determined (a) by the relationship between the sensory nature of expression and the cognitive nature of content, (b) by the dialogical relationship between different semantic worlds and between different communicative intentions; and in design, (c) by the relationships between the *objective of sense* of the designer, the nature of the *product of sense* and the *effects of sense* on the user (Zingale, 2009).

All this is even more evident when you move from the "traditional" idea of product – a tangible object, provided with form and matter – to that of the Product-Service System (PSS), where the artefact's form of expression is largely immaterial, although still *mediated* by communication tools, organized environments, forms of social transactions, etc. Here, the *semiotic mediation* is aimed to the production of decisions to be taken on lifestyles and behaviour practices to adopt. No more products to be owned, but actions to be implemented. In PSS the form of items, the shape of communication and the form of service are a single interference set.

This interference set involves an update of the aesthetic-semiotic approach to design. In fact, although as regards the "product-item" the aesthetic dimension passes entirely through the formal and material qualities of the artefact, as regards the "product-service" the aesthetic dimension follows other routes.

The problem arises when it is necessary to study the sense of a product, taking into account not only its structure, as a concluded and defined body, but especially the open set of its possible effects: not only its shape but the consequences that could arise from it (Peirce, 1878, CP 5.402).

Observation of the logic of events

If, in this way, a product can be thought of as a "text" defined by boundaries, with its own semantic consistency and syntactic cohesion (cf. Marrone 2009), then, on the other hand, the product-service is indeed a "semiotic text", but its borders are variable and its outcome undefined. It is a text open to occasional events of experience, in which the pragmatic dimension – the interaction – appears as a decisive value.

The semiotic study is, in this case, approaching the ethnographic observation methods, where the user experience is being investigated. Experience as *logic of events*: the actions that are performed during the use of a PSS and the pragmatic concatenations that the PSS organization produces.

This observational character may be applied in three phases:

- *before the project*, in the observation, of ethnographic or ethno-semiotic kind (cf. Marsciani 2007), of the existing social practices;
- *during the project*, in the verification and testing phases of PSS;
- *after the project*, in analysis of already tested PSS case studies, with more or less positive results.

In particular, the observation of the user experience should include:

- *levels of understanding:* what and how the service offered is understood by the user;
- *expectations about the expected benefit:* what the user shows to be able to do or wants to get;
- *attitudes:* how the user is approaching it and what types of conduct he puts in place;
- *choices of action:* what the user chooses to do and why;
- *programmed responses:* whether and how the user respects the order of actions in the design program;
- *interpretative cooperation:* what the user can add to the use modality of the service;
- *interpretative responses:* the reactions and judgments made about the service received.

From experience to design

Here, the semiotic way of looking at things is helping to *translate* the observed data in social practices, in design choices that can outline innovative, efficient and satisfactory solutions. The difficulty of this translation is mainly in the *degree of novelty* of the PSS, or in the implicit request of *breaking* behavioural patterns and models. As regards the use of products, in fact, individual and social habits are pretty entrenched and, generally, implemented on the basis of automatic or traditional adjustments.

Instead, the PSS innovation requires:

- *a cognitive shift* towards unknown habits and programs of use;
- *a semantic reformulation* and then a reconfiguration of the values traditionally associated with artefacts;
- *a didactic clearness* of communication forms of the PSS.

For this reason, the elaboration of plausible solutions will mainly concern the way in which the PSS is able to design the new use of artefacts, marking a difference with tradition. In particular:

- *new habits* that the subject-users must make their own;
- *access roads* to the PSS, which deviate from traditional ways of acquiring a product;
- and *sharing rules* of the PSS, or the idea of shared and intersubjective ownership;
- *learning forms* of new use modalities;
- *elements of satisfaction* derived from PSS and that only this one can provide.

Sense and satisfaction

This last aspect leads us to the heart of one of the most critical points in the PSS proposal. Indeed, if the PSS marks a discontinuity with traditional forms of use and consumption of products, and if this discontinuity is aimed at transition to more sustainable forms, in which aspects of PSS will a user identify the source of the actual benefit?

So we return to what was said on semiotic relations at the beginning. The plane of expression plays a strategic role in all forms of communication. It is both what *represents* the content and what *introduces* the content. In PSS the plane of content is to be identified (a) in either services offered to users, and then in the actions of use that it requires, in the benefits which it brings about in terms of performance, and especially (b) in the request for change of lifestyles in view of a commitment, whose benefit is collective.

But in eco-efficient PSS it is possible to draw a third *line of sense*, which may decide the very success of the PSS. We can imagine it as the *line of satisfaction*, the one that affects the sensory, emotional and motivational sphere of the user.

Some may say that the existence of this third line of sense is what has always characterized design, which has entrusted its aesthetic sphere with the task of giving a differential value to industrial products. What changes here, however, is the role of the *aesthetic function*. Recalling Jakobson's functions of language (Jakobson, 1963), the aesthetic function is the one concerning the form of the message, its expression.

If we assume that the aesthetic function has the task of catching the sensory and cognitive attention, in PSS it should be designed and developed in two further ways: first as the gateway that helps the user-recipient to understand the overall sense of PSS, and secondly as a form of introduction to the instructions of use and the manner in which the user enters the game of untold social relationships.

This easily shows us how the aesthetic function of PSS is largely responsible for the communication and understanding of the profound values of the eco-efficient project: it can be entrusted with a task of great responsibility in the establishment of design practices, in view of the transition to sustainability.

Pragmatics of aesthetic function

Hence, the proposal of a more pragmatic and social view of aesthetic function. In fact, although there is, among the innovative features of the PSS, the overtaking of consumption as possession, the primacy of service on product, favouring the idea of sharing assets, the aesthetic function extends from objectivity of things to types of relationship between subjects (between service providers and users, between users of the same service).

But what does "to take care of the aesthetic function in human relations" mean?

It means, first of all, emphasize the dialogical nature of these relationships and, therefore, bring attention to the forms in which dialogicity is expressed. Not only through acts of speech, as in normal conversation, but also through a different perspective that subjects-users have to develop using products. Any use, as a matter of fact, leaves a trace of the user on the objects. In shared artefacts these tracks do not disappear, they are on the contrary *foreseen* by the structure of the product: it belongs to *everyone and it is for everyone*. This means that the product should be thought of as the place where the user interacts directly or by implication, with other users, the place where he can feel part of a community. In this perspective, each product needs to be designed as part of a common language, a language that everyone can talk and, above all, through which each subject has the opportunity to communicate with other subjects.

This effect of sense (community feeling) must be understood by design as the priority and most communicable content. Again, it is the form of expression of the product that *represents and introduces* to such content.

Future research directions

In this paper we have outlined a possible new frontier for the research in design and semiotic. The working hypothesises we defined have of course to be consolidated. However the opinion of the authors is that this is an important and fertile research ground.

Important, because of the role that aesthetic can and must play in the transition towards sustainability. In fact it is not enough to develop sustainable innovations, but it is necessary to make these innovations to be perceived as better than the existing and unsustainable panorama of artefacts.

Fertile, because it opens a debate that does not involve only sustainability, but is related to the foundation of the design role itself.

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the Learning Network on Sustainability

Critical notes about sustainable design

A discussion with cases and examples

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In recent years, the seriousness of environmental problems has motivated a number of governments, business and civil society initiatives in order to reduce and even eliminate its causes and consequences. The hegemonic consensus of the discussions on social and environmental sustainability poses a contradiction between the material finite world and unlimited development, the endless production, the consumerism and the pollution as the main reasons of ecological imbalance and socio-environmental crisis. Like other areas of knowledge, the design has to propose a set of solutions and ethical principles in accordance with this consensus and defining the Design for Sustainability. These solutions can be summarized in products and services based on the minimization of eliminations, the optimization of product life and reducing the use of energy resources or non-renewable raw material. However, several intellectuals groups argue that the problem is not technical, nor primarily technical, but social and economic. There are even questioning if indeed lives up an environmental crisis and whether this was caused by the human king. Without a broad discussion about the purpose and the solutions presented in the universities and companies around the world, Design for Sustainability is limited, in the last word, to the *technical analysis*, in other words, to the physical-material production (mainly industrial) and your consequences, with no depth and neither a critique that makes it evolve. This paper confronts some currents of thought of sustainability with a experience with a group of artisans and seeks to know some design limits on demands of ecological thinking.

> "... what distinguishes the worst of architects from the best of bees is this, that the architect raises his structure in the imagination before heerects it in reality.."
>
> Karl Marx

Introduction

The growing concern in stopping the pillaging of natural resources and industrial pollution has raised in recent 30 years in different areas of knowledge, the notion of the importance of reaching a sustainable society. The argument that there is an insuperable contradiction between a world with infinite resources facing an infinite rate of growth of production and consumption is convincing and did emerge a number of disciplines related to the topic. Thus, sustainability has permeated shares in agriculture (Permaculture), architecture (sustainable architecture), economics (environmental economics and ecological economics), in engineering (environmental engineering) and in other areas.

When it comes to studies of contemporary environmental crisis, most of them makes it clear that it is industry a major culprit, making mention of the level of technological development of society and not the structure of its social relations. (FOLADORI, 2001).

With the design is no different. Directly connected to the productive process, the design is part of the discussion of sustainability in a privileged way. In this regard, Gillo Dorfles (1963) comments:
What is required for a finding that an object belongs to the industrial design is: 1) its manution in series, 2) its mechanical production, and 3) the presence in it of an aesthetic quotient due to the fact that it was originally designed, not to a subsequent manual intervention. Here is why it is not permissible to think of industrial design in relation to the objects belonging to times prior to the industrial revolution (...) upon which there is always a moment of design, creation by design, and a moment of repetitive mechanized production and in series.

The design concept closely linked to industrial scale production is shared by Gui Bonsiepe (1982):
The industrial design is a design activity, responsible for determining the functional, structural and aesthetic-formal one product or product systems for mass production. It is part of a broader activity called product development. His greatest contribution is in improving the quality of use and aesthetic quality of a product being compatible with technical and functional requirements with technical constraints and economic order.

Understood that way, or deeply connected to industrial society and this responsition by environmental problems, from the second half of the twentieth century, began to think a new design proposal that took into account not only the industry and consumption but the individual.This form of design later would win the contours of sustainability.

More modernly, Ezio Manzini, Carlo Vezzoli (2002) propose a design based on Life Cycle Analysis (LCA) of the product and balance of the production system to the needs of social welfare, optimizing processes and products' shelf life, minimizing the use of natural resources.The main focus is therefore to reduce environmental impacts. (Cavalcante, 2007, p. 3)

Armed with this theoretical tools, many designers, students and professionals, have advanced the study and implementation of techniques, methods and materials that could enable the Sustainable Design applied to the design. On the one hand, creating products that would minimize the use of natural resources and waste generation. On the other, designing products and services that would provoke a behavioral change and cultural society. Although both design practices often come together, Manzini & Vezzoli (2002) consider that there are four steps or levels to be followed.

At first, you should seek the *environment redesign of the existing*, measures that improve the overall efficiency in terms of consumption of matter and energy, and facilitate the recycling of their materials and reuse of components.

At the second level, the orientation is the *design of new products or services*, it is the development of new products and services based on a technical-productive innovation and emerging ecological concepts openly (in the case of eco-car for example refrigerators or economic, ecological packaging etc).

The third level requires the *design of new products, services inherently sustainable*; in this stage, the product-service offered should be socially acceptable and at the same time, "radically" favorable to the environment. These solutions have a greater risk, but are more consistently sustained, beyond what they could mean the opening of new markets.

Finally, the fourth level, the *propose of new scenarios* that correspond to "lifestyles sustainable; are, in this case developed in cultural activities that tend to promote new criteria of quality that are sustainable for the environment, socially acceptable and culturally attractive. This step is not necessarily linked to production, but with a role as a cultural trait (such as articles, books, conferences, debates, etc.).

Possible Design?

In Brazil, the actions for sustainability coincide with the opening up policy and the emergence and regulation of Non-Governmental Organizations – NGOs, the passage of the 80 to 90. Is not the intention of this paper to analyze the history of the formation of NGOs in the country. It must be said here, briefly, in the words of Fernandes [2003] which features and promotes the emergence of such a civil organization (the italics are ours):

> There are a number of marks that distinguishes contrasting NGOs: Non-governmental, nonprofit, not part of larger structures, are not representative, do not finance. To be posi-

> tive, however, we must remember his short but characteristic history. In our restricted sense, NGOs are born into circuits of global cooperation. Provided unofficial channels for international support to *social projects typically run on local or on a microlevel*. Were not the only ones to do it (churches and unions, for example, were also involved), but became subject matter experts. *Independence facilitated unofficial international connections and its small size was favorable for the immersion site*. Thus, they were free to mediate between the local and international agendas, specializing in designs that make sense on both ends of the program of "development." (FERNANDES *apud* Universia Brazil, 2003)

It is from the environment to meet social and environmental demands that at the beginning of the current decade, appears the NGOs involved in the area of Sustainable Design called ***Design Possível*** (Possible Design). Initially, as an university extension project linked to the Presbyterian University Mackenzie, in São Paulo, and most currently as an NGO itself, with its functions acting independently of the University.

Design Possível operates using the Sustainable Design in three distinct areas that are complementary: the *core of communication*, responsible for developing communication strategies for both the actual design as possible to other NGOs and foundations, the *core teaching*, responsible for transfer programs knowledge and training of groups of associated producers, the *commercial core*, which basically combines the products of these groups, companies or directly with the consumer markets.

The basis of the activities of the Design Possível is in the member farmers groups. These groups are formed, in general, share of low-income population without access to employment, marginalized by a complex economic process of social exclusion and urban segregation known as *the organic composition of capital* and that will be seen in greater detail later.

The various groups served by the Design Possível, one of them will be given special attention. This is the *Cardume de Mães* (Mothers Shoal) group that develops objects (such as bags, bins, boxes etc.) made from the reuse of pads used in advertisements. It is the work of this group which will be seen below.

Cardume de mães: experiences and observations

Is it possible to exist a sustainable production inside the capitalist economy?

When dealing with moves toward sustainability in the production of goods, namely, extraction-production-consumption-disposal, work with NGOs, social projects or impoverished productive groups receive special attention from middle-class urban university.

In the case of handmade production, it still receives even greater care. In general, cooperative artisan producers attended by universities gather what is conceptually more sustainable: **a)** are generally formed by poor people, who organize themselves in order to minimize socio-economic difficulties experienced, **b)** for your condition, employ few or no machine to manufacture the products, **c)** for the low investment capacity, the groups use as raw material, almost always, donated leftovers industrial or commercial, artifacts arising from the urban waste materials or low value and social marketing, **d)** live near large urban centers, the surrounding factories and plants, which facilitates the action of both political than conventionally be called the *social responsibility* of firms and universities themselves. **e)** are groups that acts collectively giving them an aura of unusual social equality in capitalist social relations.

The productive group Cardume de Mães consists of five artisans living in the Campo Limpo, a neighborhood in the southwest of the city of São Paulo, whose main activity is the production of bags, purses, pouches, wallets and stationery made of canvas (made out of vinyl plastic) and reused received through donations from private companies. This is a material widely used in advertising and media in the form of banners, billboards, etc. (Nicolaiewsky, 2010).

It is therefore a group that caters to the general definitions mentioned in the previous paragraph.

From the standpoint of design for sustainability, the group's production of Cardume de Mães is a sustainable production, or at least, with strong sustainable guidelines. After all, the production recycles the waste generated by other productive sectors (1) gives a survival or prolongs the life of the material would be discarded (2), owns a manufacturing process with extremely low power (3) generates income and independence for people once economically marginalized (4).

It happens that the economic laws governing the capitalist production are not alien to the relationship of mankind with the environment, but conditionates it. So it's not possible to understand the problems of

predation, pollution and social exclusion without paying attention to economic trends. To continue in our statements, we consider an element of commodity production: *competition*.

When reaching the market to be exchanged for money, sustainable products are faced with several producers of other commodities. Including sustainable goods from other productive groups, artisans or not. Here it gives a phenomenon known as competition.

The market competition is the ultimate expression of capitalist production (Foladori, 2001). The competition takes place on three levels of the economy. For this paper purposes it will be analyzed only the first level of competition, the so-called intra-branch.

The intra-branch competition occurs within each branch of production and sets market prices.The consequence is that there prices equal to costs and different production conditions. The results of paying the same price to those who have different production costs is the impoverishment of many and enrichment of few. To be able to compete, the producer makes use of cheaper production costs. Thus, lower wages, the increased production, the incorporation of products and natural resources without having to pay them or the possibility of generating waste in public spaces, are forms of degradation or pollution that constitute a negative effect on society whole. (FOLADORI, 2001)

Until a few decades ago, it was believed that unemployment was something circumstantial and can be overcome. Today it is a structural problem, the point of no serious economist in any current ideological and political or economic school is able to say that it is possible to give full employment to all people. Capitalism inaugurates the first time in the history of mankind, the structural unemployment.

The relationship between the value of work and the value of means of production employees in the production process is known as the organic composition of capital. Both elements are costs for capital and lowering costs is no iron law of capitalism. In this quest for lowering costs is the speed which capital revolutionizes its technology. Technology is here said as a way to supplant human labor, as it develops technologically capitalism generates unemployment. As a company improves its capital assets and exempts workers, others appear absorbing part of the manpower available. Stands out the fact that many of these workers will never be reabsorbed and make up the surplus population in the orbit of capitalism. And it is these workers that in the absence of job opportunities, jobs are organized in informal cooperatives and production groups for income generation that are, most times, helped by big businesses that create exclusion.

Not coincidentally, according to Mészàros, poverty and misery in the world have increased both in relative and absolute dollars in the last 50 years, from 900 million poor people, or 17% of world population, to 1.7 billion, or 23% of people living in poverty.

Conclusions

Capitalist relations lead to forcible behavior on the environment. The search for profit as a goal of capitalist production itself leads to an unlimited production. This is not intrinsic to human nature. Both the competition, the increased turnover of capital leads to the plundering of nature. And that’s not a question of will: it is a necessary relationship exists when a market competition.

In general, design for sustainability rests on a substantive examination. It happens that this analysis is based on the hegemonic consensus on the consequences of a non-sustainable production. Such consensus, loaded with common sense, are rarely discussed with a critical spirit even by teachers and professors in universities.

It urges to discuss the Design for Sustainability and break with the unison views. Only then, the knowledge around the subject may, in fact, evolve and get away from common sense, as has been shown so far.

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the Learning Network on Sustainability

Method development and design of modern bamboo product

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Bamboo is a sort of typical eastern resource as one of the symbols of eastern culture. The use of bamboo in production contributes to a sustainable environment by everlasting. From the view of modern design, this thesis proposed the principle of modern bamboo products design and development. Also, eight design method of bamboo product development is summarized: human-orientation; learn from nature, bamboo appropriate selection, making the full use of each natural bamboo source, optimizing design of traditional handicraft to fit modern process, being established in the material to make concept generation, reflecting on the culture context.

Prologue

Bamboo is a sort of typical eastern resource as one of the symbols of eastern culture, and the whole Asia area had utilized bamboo as writing tools. The hollow stem and the straight shape give expression to special meaning. The bamboo produce' design and development is a processing of changing material shape or using method, which usually shows the designer's choice and leads an attitude of life. With the descending use of bamboo produce' in daily life, it is very important to renovate design principle and method to make the full use of this perfect recycle material.

Bamboo products development principle

Bamboo products development has to fit the modern life style and the trend of aesthetics. It will lead to open up new product for development by taking production costs into account as the basement, balancing the practicability and artistic.

Material craftwork and modularize

Designers should make much account of eco-balancing and eco-sustainable. Bamboo produce should be light weight fabrication to save source; Product design should take the possibility of commissioning and production process complexity into account. The product form should maintain the natural texture of bamboo and make use of the special characteristic of bamboo, spare the application of chemical accessories, such as inks, adhesives, bleacher, dye, coating and so on[1].

Design should be preceded by the full understanding of production technology and processing equipment level. The designers should combine culture meaning, traditional material, modern craftwork with apperception of the production operation process, strengthening the bamboo properties and modern technology. The same time, one should apply oneself to explore the bamboo utilization possibility of each part, each species in different physical statement. This above is the fundamental of the development of easy to use, simple, elegant bamboo products.

Functionality and user experience

Product functionality and user experience are always united. Successful product is a complex gather of smallest needs which cannot be split anymore. The function definition of bamboo product cannot be limit in totaling, however, the fit for proper function of a natural match is required. In order to create simple, elegant forms, designers should keep a clear mind to choose the product function. A new design should balance profit and costs by considering consumers economic range, and guide consumers get a good life taste and pleasure experience instead of shallow material appearance.

Cultural reconstruction and aesthetic innovation

Except normal product perception, including functions, production feasibility, aesthetics and innovation, bamboo products development and design should pay more attention to convert the Eastern culture particularity to product differentiation. It is necessary to integrate national character and culture feature, in order to create products which will highlight the Oriental aesthetic. Beginning of the bamboo to product design, the new products could be the medium of showing personal characteristic, imagination, design philosophy which lead a joy lifestyle and experience.

Bamboo development design method

Human-oriented design principle

With technological growing in society, more and more people get into a trouble of contacting with others in real world which caused by relying on equipment and computer systems. At the same time, these people neglect of family, spiritual, own development. Designers have the responsibility and obligation to scan the relation between human-being and objects which are made for human-beings. Take a user-centered approach to designing bamboo produce and focus on the entire lifecycle of a product, from the idea of creating a new product, through requirements gathering, conceptual design, physical design, testing, and implementation. By the end of design process the products should be low costs, function application, technical simplify, sustainable environment by deducing all aspects disturbing the original point of consumers-oriented. Human being is the subject of the products, and user-centered is the basis. The fundamental function of the produce is located at helping to get a pleasant life experience. [2]

Learn from Nature

Always the expression of art is comes from nature. The man who can find it out, the one will finally get it. Nature is an information sourcebook of function, color and shape which can inspire design and creation. Studying the form and functional characteristics of a natural object can provide inspiration for product design and help to improve the marketability of manufactured products. There are several usability-related methods, material quality, exquisite craftwork, procedures that require careful consideration when designing and developing new products. We are the creature of nature. Learning from nature and doing things abiding of the nature rules leads to a gentle design philosophy.

Bamboo gives us a clear, natural feeling. At the same time, this kind of material gives a bridge between human-being and nature by the cultural connotation. Bamboo's natural hollow form makes it an obvious choice for many products forms. And from the texture, the color experience, the connotation of bamboo will inspire of design ideas. The user will get a thriving life from the bamboo products. [3]

Bamboo appropriate selection

Bamboo products are highly appreciated by customers because of its unique pureness, elegance, special grain and color. Unique designs also bring surprising effects. These properties cannot be found in other material products. More and more designers have made a choice to devote themselves to producing bamboo products for the benefits to the society and economy. Bamboo as a versatile material is demonstrated by its use in modern bamboo products. The products just take the bamboo advantages such as simple

feeling, elegant form and the natural material texture, instead of using of gold foil, silver printing process. The product will leave an impression of fabric structure and the context which it wants to express. Taking one word, during each step on the planning process and technical process of bamboo products developing, it is the details decide the destination.

In accordance with the product characteristics and the origin of personality, the product should combine the function value of bamboo by taking full use of morphological principles or arrangement. As the same time, deducing the waste of material, source and space is impossible. From this aspect, bamboo appropriate selection is an important and necessary step. [3]

Making the full use of each natural bamboo source

To avoid create the waste is the principle of whole nation whether in now or past. And it is the principle of designers to express their care of human-beings. Bamboo is more than 70 genera divided into about more than 1400 species. Some of them can grow to 100 cm, some can grow to 2000-3000 cm, and some of them is liane. Most of them have the empty hollow in the stalks, with a straight configuration which the culm begins to sprout branches and leaves from each node. According to own material properties, structural features and size of different types of bamboo, it is necessary to create various design to fit the material. Just take a raw bamboo into account, the distance between each node is different, and the thickness of bamboo is different, so it will take some difficult change in the standardization of mass production. On the other hand, it prompted us to challenge the concept of bamboo products which will prompt the products grow to a series or knockdown style.

The bamboo product development knows from the other products development. Taking the essence of product design as fundamental, it is request more comprehension of native traditional culture, deep research of modern aesthetics, and the same knowing about modern marketing, consumer psychology and bamboo crafts. Taking new design language and style with the knowledge of upper, it is possible to develop modern products combined passion and sparkle which will fit our consumer.

Optimizing design of traditional handicraft to fit modern process

In the dialectic of change and fixedness of design, the change is product, the fixedness is design idea. The conclusion is the revelation of history, and the same just the fact of history. Bamboo used for purposes from construction to daily appliance as the material has the advantages as good splitting, small contractibility, good elasticity and tenacity. In the long history of this material exercise, there are many excellent products characteristics due to its combination of modern manufacturing processes and traditional crafts. However, with the industry developing, bamboo product deducing in modern family as more and more bamboo products cannot follow the step of the modern process of producing. We should optimize design of traditional handicraft to fit modern process, devote to develop new bamboo products to unite modern product process and traditional handicraft on the basis of making the full use of this economical material. We should focus the new opportunity which ignited by modern science from the stand of bamboo products tradition. The new products should communicate the bamboo culture, structure, material semantics effectively from the product concept to the real product. During the research processing of bamboo product using area, from the catalog we can find out there are richer connotation in the appliance which lead us to dig out. Therefore bamboo design is not only the design itself, but the tradition of creating objects in the culture as the first thing, and the simple life method and concept which concealing in the processing also. Then fully apply all the concepts to the design of today bamboo developing. It is a certain way to strengthen the ability to copy and optimize in design, improve concept of the traditional form in bamboo appliance and heighten the products feeling and interest communication. To get an aim of forming an aesthetic style of Chinese and unique cultural identification, we should accommodate and sublimate product and the material which show the commonness of history and reality, tradition and modern society in a short time.

The decline of traditional bamboo products has objective reasons. And design techniques and technology has a large difference between the ancient age and modern society, however, the design ideology presents a kind of parallel beyond time and space. Designers who take history as a mirror will feel clearly that during bamboo products development process, the design constraints should pay more attention to developing society, and should take pertinent factors into account, such as the

local culture, geographical factors and so on. Only maintain an objective attitude to respect the distinctness of different culture and understand the relation of design and costumer, will it be possible that ecological sustainable development exist.

New use of old material

Bamboo products in the tradition present as three forms, the original state, simple processing, carefully decorated. The products embodies the oriental traditional aesthetic concepts in three trends, without decoration, to take the natural beauty of nature, decoration does not cover up the natural, harmonize gentle beauty. These three trends coincide with the modern environmental requirements as well.

Bamboo used in tradition sometimes maintain its original as tress or after processing of carved and polished, sometimes directly take the section of hollow stem, and sometimes knit thin bamboo strips after splitting. All methods give modern bamboo redesign very good sparkles. To extend applications of bamboo products is important, especially for the aim to use the old material successfully. According to different objects constraints in design concept, one should design and produce various objects on the base of bamboo natural characteristics. [4]

Generate lots of design concepts of bamboo on the fundamental of understanding of traditional bamboo appliance in the relevant scope. To guide the design by starting from the shape of natural bamboo, designers can seek the match elements by breaking up, analyzing and researching the product elements. We should strive for a design of simple semantic as far as possible to reduce energy waste, The product structure should also make efforts to carry out simple processing and reducing the bamboo quantities. It will be the match mode to catch the problem of decoration and recycle problem.

Technology as a vehicle

The idea and the objects should be the same. Bamboo products give a fresh sense to modern society with traditional verve. the transmission of culture is full of vitality. Create new forms which combine culture sense and traditional culture on the basis of assimilating of good traditional products. Let the product be the bridge communication of modern technology and culture connotation.

At the same time, it is the era of merging. To seeking and generating craftwork which can merge bamboo with other material is same important. It will give a brand-new visual impact and experience with integrated bamboo natural beauty and modern materials technology.

Vivid and Gentle reflecting on the culture context

As a part of Chinese traditional culture, bamboo demonstrates cultural connotations by a simple way in modern social life. The design and development of bamboo products will take the part of communication of Chinese traditional culture, philosophy of natural to the whole world.

Products made from bamboo enrich rendering impression of modern products which will show a more profound cultural foundation. Chinese people sublimate bamboo’s biological character to the spiritual life, such as modesty, integrity etc. in the long-term production practice and cultural activities. The connotation of bamboo has been the formation of the Chinese nation character, talent and aesthetic symbol of the spirit which the special aesthetic value of bamboo comprised. The unique bamboo culture will enhance the spiritual content of modern bamboo products. The bamboo appliance should merge the culture soul into the form which is not just the fashion configuration or ordinary sign of culture character, but the intersection of ancient oriental civilization and modern life. Thus it will lead a creation of new culture marking and identification. [5]

Conclusions

The fact is a pity that rich countries export design while poor countries export resources. To promote the development of China-made original design and to underlines the oriental culture, bamboo products development is a very suitable opportunity which will drive “made in China” to “design by China”. From

the perspective of modern bamboo design and development, the relationship between human beings and nature return to harmony once again. The theme attempts to develop history culture of philosophic theory to sustainable development with an Eco-development background. Seek an opportunity to bamboo product prosperous by introducing modern design concepts and methods to bamboo product design, which try to emphasize the specialist characteristic of bamboo, such as natural, simple and the culture sense itself. The pursuits of expanding new scope of bamboo products shall keeping in gradual stages.

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Northern sustainability in clothing design

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The department of Textile and Clothing design has been part of University of Lapland only 14 years, but during that period sustainable responsible design has been a natural goal in our education, research and practice of our students and teachers as well. In Finnish Clothing Design Tradition natural fibres, uncomplicated form of clothes and very thoroughly taught functional details represent naturally sustainable design. At the moment we are focusing on designer's responsibility; how can we help the designers of tomorrow to accomplish their task in designing sustainable products. Our focus is to solve, what every designer should know about sustainable materials, sustainable, classical and yet well-selling designs in everyday clothing. In this contribution we are approaching these subjects by variable angles; my personal point of view (Marjatta Heikkilä-Rastas) is designer´s point of view in sustainable, classical designs while Laura Seppälä is researching sustainable methods of designing outdoor clothing.

Introduction

As head of Clothing Design and professor of Fashion and Clothing Design in University of Lapland I will present my ideas and principals which I have always carried along in my over thirty years lasting practical working career, in educating university-level students as well as in my own research as Doctor of Art. My subject is the research of Finnish Fashion, its aesthetic, ethic and ergonomic tradition and the sustainability of these features, which are based on design know-how. (Heikkilä-Rastas, 2003) In addition I will give some examples about our research project called Body Fit –project as one way of designing, measuring and producing customized working clothes in sustainable way for special groups (policemen).(Body Fit tutkimushanke, 2009)

My student and researcher in Clothing Design department, Laura Seppälä, Master of Art is joining this proceeding by telling about her research of responsibility in designing sustainable outdoor clothing, and forming a theoretical model for designing functional outdoor clothing in sustainable materials. Seppälä is leaning the arguments of this proceeding on her master´s theses, her work in Sumac –researching project as well as her starting doctoral studies.

As united goal we both want to produce new information about sustainability and responsibility in Northern clothing design, which we believe to be one way to help designers all over the world to work in more sustainable way.

Sustainability in Finnish Clothing design tradition

In researching the Finnish Fashion and Clothing design tradition I feel that I have a great opportunity to examine the short history of this phenomena through my working career which started as student of fashion design in late sixties. In our studies in University of Art and Design Helsinki we were taught the main principals of functional clothing design which was supposed to contain ergonomic, aesthetic, economic, ecological and ethic points of view. Those ideas have stayed in the Finnish clothing design through decades, but the world wide massive fashion business may faint them now and then.

Today in times of global pollution and climate change everyone, not the least a product designer has to think carefully the best means to design new products which would cause as little waist as possible and be sustainable, rightfully produced and of high quality. In these goals designers of today have to underline the idea of ecologic design, but hopefully the other good themes will stay in picture, too not forgetting designer´s own original artistic and innovative ideas, based on designers design know-how. This means a lot of responsibility for designer.

Figure 1: Designer's responsibilities

Source: Heikkilä-Rastas, 2008

Finnish Design with distinct visual expression 1950-1970

Thinking about the Finnish Fashion and Design, there is a clear period of strong aesthetic, visual expression in the early years of Finnish Fashion 1950-1970 which contained simple, architectural lines, natural fibres, graphic black-and-white or colourful prints and uncomplicated styles. Undoubtedly it was Marimekko and its establisher (1951) Armi Ratia who created these lines with her skilful Scandinavian designers, especially textile-designers like Maija Isola and Vuokko Nurmesniemi as well as the Japanese designer Fujivo Ishimoto, who is still designing graphic, purified and colourful prints for Marimekko.

Figure 2. Marimekko-designs in the 1960's

Source: Marimekko

Form follows function 1965-1985

Next period, which underlined functionality in Clothing design, happened partly at the same time; I would schedule it in 1965-85. Functional, ergonomic ideas were leading principals in all product design even in clothing design. The main idea was that everything, every product that designer designed was supposed to have a certain purpose and the products, even clothes should above all be functional. This is not a bad idea if the users´ needs and hopes are taken in consideration. However in the field of fashion and clothing the power of fashion cannot be ignored; even the functional clothing must be aesthetic and somewhat fashionable, it should follow Telesis, spirit of time.

Personally the above mentioned period was the most important period of my designers career; I did my first designs for the family company in 1967-68 and I must say, that I had free hands in designing and it is only much later, that I have fully understood, what a delightful, innovative, ecological period that was in the Finnish Clothing design and manufacturing tradition! (Heikkilä-Rastas, 2003) It is obvious that my personal design know-how was developing at that period. I never tried to close fashion out of the collections, that I designed, but my aim was to give every product an individual original look at the same time as I was following company's image and line. Many sustainable principals were logged in the operations of the company and in activities of the employees, although everything happened more or less subconsciously.

The Family Company, Kaisu Heikkilä Oy was a relatively small company doing everything itself. The company was established in 1953 and I joined its leading group in the end of sixties. The idea of local production was obvious in every level: The whole production happened in my home town Tampere. Even most materials were produced in same city, cottons, linens and wools. We used printed materials designed by local textile designers and clothing design was realized in the early days by my mother and later on by me. Considerable part of production was marketed in Finland through our own retail shops and qualified retailers all over Finland. Gradually in seventies and eighties the selling did grow and

achieve export markets as well. This conventional production concept could work even today, when researchers and scientists are longing for local production designed by local artists and produced by local employment. This would be ideal concept considering a short ecologic footprint of products while these classical dresses in local materials are sustainable even in the sense, that daughters are using their mothers´ and even grandmothers´ design dresses. So there is going to be only very little garbage when designers work is done as well as possible.

Figure 3: Cotton dress, 1976, designed by Marjatta Heikkilä-Rastas, manufactured in Tampere Finland

Source: Heikkilä-Rastas, 2008

Mass production, waist and consumption 1980-2000

The next period of Finnish Clothing tradition is scheduled to 1980 – 2000 and that period, in my mind is the most challenging when thinking of the sustainability. The period is one of glamorous fashion, high consumption, waist and cheap import, which of course is still the reality. The best effect from that period is the opposite, positive reaction that it awakened considering sustainability, responsibility and ecological thoughts. In Finland the end of eighties and the beginning of nineties was moreover time of strong economic downturn and depression which brought down thousands of small enterprises containing numerous textile and clothing enterprises. The economic worry was so comprehensive, that ecological problems stayed at the background of social discussion.

Sustainability, ecological demands, designers responsibility 1995-2010

Ecological questions, mass pollution and climate change with their challenges have really come forward starting end of nineties and during past few years it has come clear, that designers, among other professional workers, have to learn what sustainability means in designing and producing new products or dealing with old products or used materials. The educational challenge should focus into instructing designers to use sustainable methods and yet design easy-selling products without forgetting high quality of design. It is also question about designers self –confidence and professional skill. Designers should absorb the sustainable design know-how which contains professional skills and ability to do the design work as well as possible; naturally designer must have vast knowledge of sustainable materials, methods and sustainable ways of production to be able to accept the production chain, that the product will pass through. Awareness of these problems is there – now the designers must act in the right way.

Body Fit Research Project in University of Lapland 2009 – 2011

In University of Lapland, Faculty of Art and Design we feel that we should concentrate our research and education in the specific sectors, which are typical and natural in our northern environment and climate. One of our projects which is under way and where I am working as the responsible leader, is the interesting Body Fit project where our researchers and teachers are operating with Bodyscanner and 3D- design technology programs. Our case study concerns policemen in Finland and the goal of the research is to be able to design them cold protection working garments with exact measurements done by the bodyscanner. Policemen are measured and interviewed, prototypes have been manufactured and tested, more tests are to be done and more interviews of the users are still ahead. Final goal contains also the idea of sustainability in producing garments for special groups by the aid of Bodyscanner and its Morfo Army Program, which counts the ideal size distribution of measured users in order to avoid any unnecessary production. The use of Bodyscanner also enables mass-customized production to different bodytypes. The estimate time for ready cold protection garments for policemen will be in autumn 2011. (link to the Bodyscanner-project, University of Lapland)

The model of sustainable responsible outdoor clothing design

Nobody can deny that climate change is under way and environmental problems are an ever greater and more serious threat. At the moment we are stripping nature at an unprecedented rate and we need to take much better care of the planet, because we have no other realistic choices. (Välimäki 2007; World Wildlife Fund 2006; See also Toiviainen 2007.) The Outdoor industry makes its living selling equipment and apparel to those who want to enjoy the beauty of nature. Outdoor companies acknowledge that the wild world on which they are basing their business is disappearing. There has been a marked growth in the development of highly functional materials in sportswear and outdoor leisure clothing (Shishoo 2005, 4). Public interest in nature and sustainable development has increased, thus awareness of environmental issues and corporate social responsibility has increased among outdoor companies. Climate change and

environmental problems also affect the outdoor clothing industry and sustainable, responsible design is becoming more important (O'Connor & Cox 2005, 72).

The purpose of the study was to draw conclusions on what the outdoor clothing industry can do for sustainability and what aspects should be taken into consideration in the design and manufacture of environmentally friendly outdoor clothing. This issue of sustainability in outdoor clothing is very complicated. My point of view initially was the designer's point of view: what a designer should know about sustainability to be able to design environmentally friendly outdoor clothing. It is very hard to get objective material information and place materials in order of environmental friendliness without a specific life cycle analysis tool. The life cycle analysis tool is only useful when all the factors are known.

Often a designer cannot obtain objective information about a fabric manufacturer's production facilities, dyes and finishes used. The entire production chain should be evaluated from the footprint of processing raw materials and the manufacturing conditions through transporting and packaging to retailing. There are several stakeholders on different levels, which affect sustainable development in the outdoor clothing industry. It is very important for designers to know these stakeholders and their actions to understand the challenges of green production. Governmental stage, domestic and international legislation, standards, associations, organizations, textile manufacturers and outdoor clothing companies are not isolated from each other. Textile manufacturers and outdoor clothing companies belong to different types of associations and organizations, which try to influence legislation and standardization

The issue of sustainability in outdoor clothing is very complicated. The Sustainable Innovative Materials in High Tech Applications (Sumac) research project establishes a conceptual framework offered by the theoretical bases of the design research, ergonomics and material technology for sustainable goods and services relative to their environmental impacts. The empirical research subject is focused on sustainable and safe products, product chains and life styles in the frame of outdoor sport and leisure time activities.

I and Hanna Söder co-operated in Sumac research project and wanted to figure out what a designer should know about sustainability to be able to design environmentally friendly outdoor clothing. Our aim was to create a tool to help designers in environmentally friendly choices. The model of sustainable outdoor clothing includes three parts: design, functions and sustainability (Fig. 4.).

The model is a combination of well-known tools and models already existing, such as Papanek's six-sided function matrix, sustainable development, lifecycle of outdoor garment and design facts we found out in our end-user interviews. Papanek's six-sided function matrix was first introduced in 1970. In 1995 revised version takes in consideration all the functional aspects that should be considered, when designing functional clothing. Those six aspects are: method, association, aesthetics, need, consequences and use. A designer can use our model to confirm what functional and environmental aspects he or she should consider. (Papanek 1995, 34.)

Materials and processes used for outdoor clothing have several potential environmental risks. When surveying environmental impacts of clothing, impacts can be divided into four main groups: manufacturing, delivery, consuming and end of life. The model includes all four aspects of sustainability (Fig. 5.). Environmental sustainability is divided in raw materials, manufacturing production, transporting, packaging, use, office recycling and final end of life (Fig. 6.). (Seppälä & Söder 2010.)

Environmental sustainability is only one aspect to consider when designing optimal outdoor clothing. The companies should also take care of social sustainability as well as animal rights. Moving production to low-cost countries has caused many problems in achieving ecological manufacturing in functional outdoor garments. Using suppliers in poor economic countries requires additional responsibilities from outdoor brands. Often the legislation is not as strict in poor economic countries and companies there are sometimes interested in just making a profit. People want to reach the same standard of living as people in western industrial countries, before making environmental efforts. Even local politicians in poor economic countries take the view that the industrial countries have caused the climate change problem and it is not their business to take care of it. This attitude requires a great deal of responsibility from outdoor brands. It is a challenging situation for them to supervise their suppliers' manufacturing conditions and demand their suppliers follow environmental standards. (sourceit Gmbh 2008 ;; Grundström, Haltsonen; Hausen, Mykkänen, Möttölä & Särkkä 2004.) This, of course, is also an economical matter. If the company is merely surviving, they have fewer opportunities to make their manufacturing process more environmentally friendly. Buying sustainable materials is more expensive for outdoor companies than conventional materials.

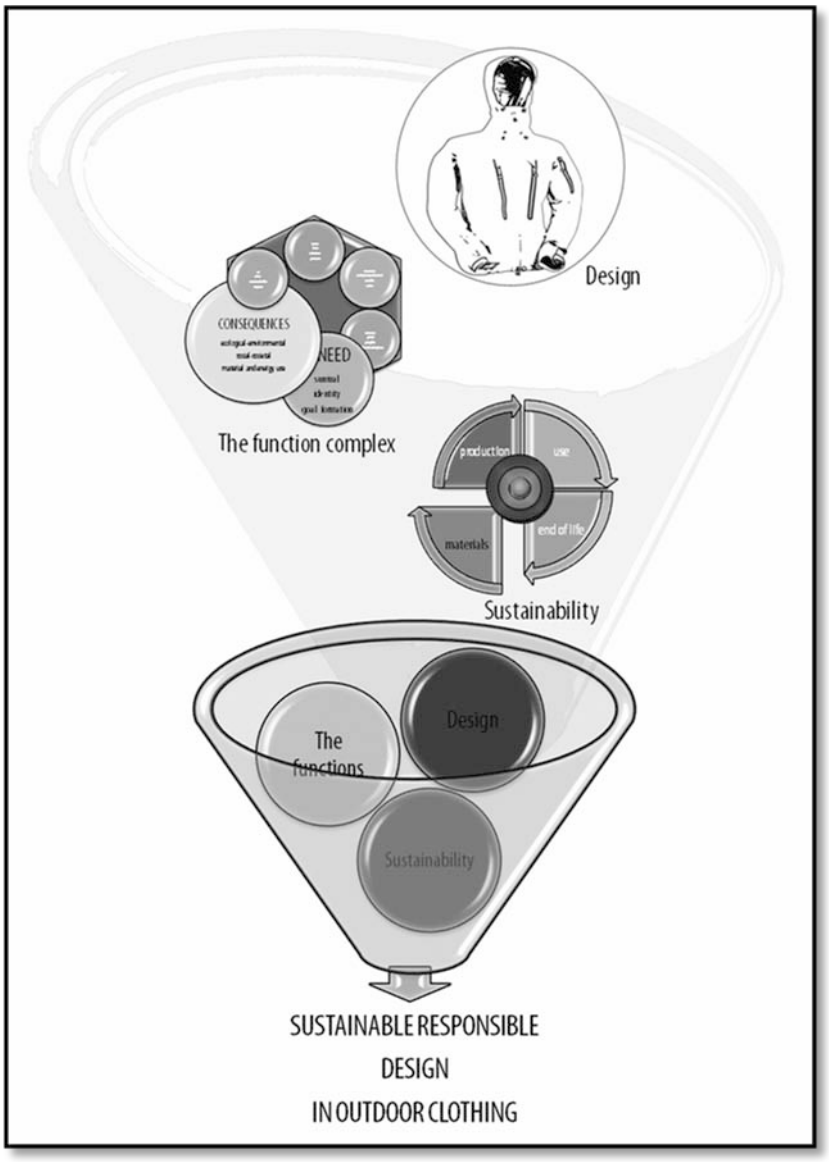

Figure 4: The model of sustainable responsible design. The model combines design, functions and sustainability in outdoor clothing to tool for designer to be able to design sustainable responsible outdoor apparel.

Source: Seppälä & Söder 2010

In past years there has been an enormous increase in materials claimed to be green. There is development in both natural and synthetic fibers. There are many natural and organic fibers available that are said to have ecological benefits compared to conventional ones. Synthetic fibers have also been developed to be more environmentally friendly, especially concerning their recycling. I think that growth of the population, shortage of raw materials, increasing amount of waste and environmental problems as well as restrictions in CO2 emissions because of climate change will force the outdoor industry to concentrate on end-of-life solutions. Everything they make should be recyclable and support the closed-loop system (Fig. 6.). The need for new material would then decrease. The materials in the future should be recyclable and eventually biodegradable. For outdoor clothing company, choosing material that is considered green is an easy road to take, but it can be seen as pure marketing-driven greenwashing. It is just not enough for an outdoor brand to offer a shirt made from bamboo, coconuts, hemp or PET bottles, if it is their only action (Huber 2008, 3.). The outdoor companies should, of course, provide sustainable products, but they should also incorporate environmentalism into all their actions. (Seppälä 2010.)

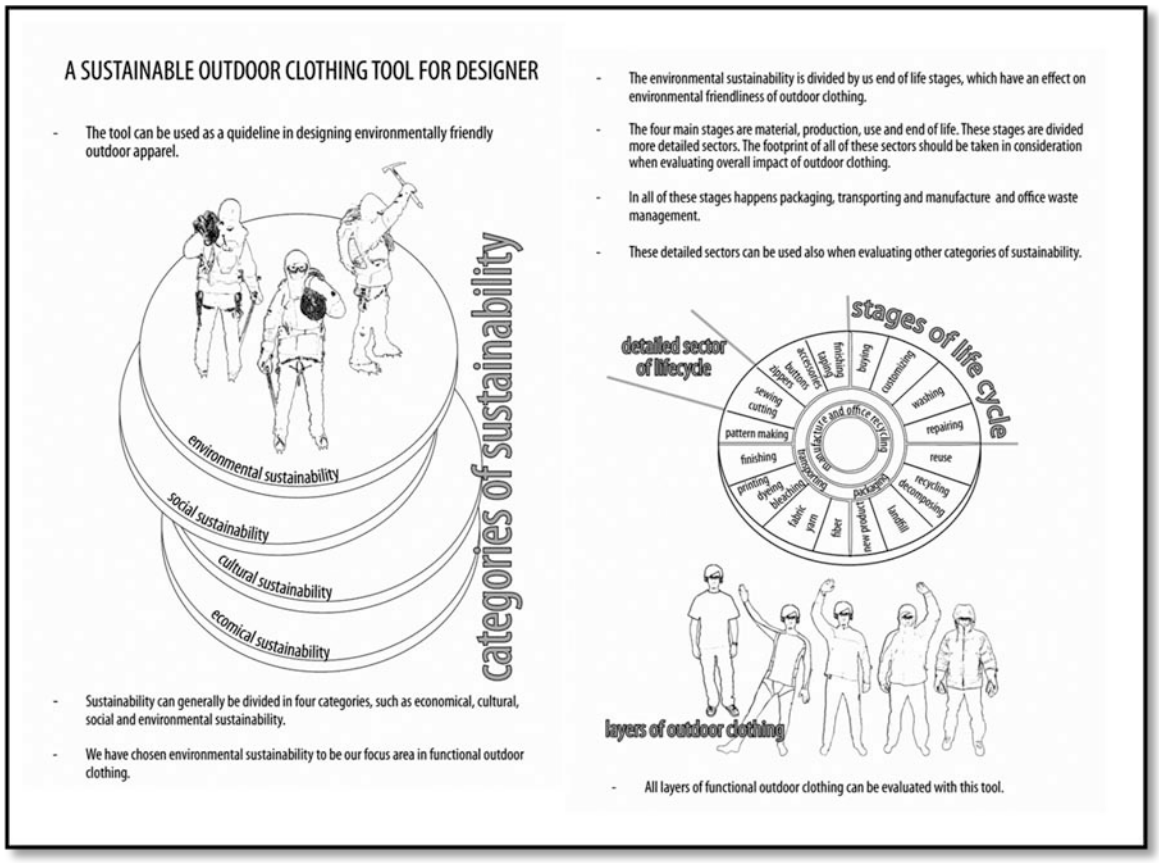

Figure 5: Seppälä & Söder model of sustainability in outdoor clothing
The concept of sustainability is enclosed within four aspects of sustainability, which are environmental, economic, social and cultural sustainability.

Source: Seppälä & Söder 2010

Outdoor apparel has very specific performance requirements. Effective material selection and apparel design requires deep understanding of these requirements. The requirements vary from comfort to protection. (Blair 2007, 60.; See also McCann 2005.) The modern functional outdoor clothing concept is based on a layering system. Each layer has a specific function and they are designed to work together to offer overall comfort and protection. (Bramel 2005, 33.) Good design, quality materials and the possibility to repair outdoor clothing will increase the life cycle of outdoor apparel. A satisfied end-user is more likely to be sustainably responsible. If the garment is well designed and the end user is satisfied with it, it is more likely that he will take better care of it. Correct washing and care will extend products' life cycle and decrease their impact on the environment by decreasing the need of new raw materials. Taking care of clothing is also economical for the consumer. The outdoor clothing manufacturer is responsible for manufacturing quality products in an environmentally friendly way. According to my study, many outdoor clothing companies stated good design is the key factor to promote sustainability.
The responsibility of consumers is to pay attention to the proper care of the garment when purchasing outdoor clothing and consumers should also make sure that the design and details suit their purposes. According to the interviews with end-users, functionality is the most important factor in outdoor garments. The price also affects the decision to buy. If green products were available with the same functions and at the same price, many users would choose the more environmentally friendly alternative.

Reduction of environmentally impact is not incompatible with saving manufacturing costs or adding brand value. Actually green design and manufacturing can strengthen the brand and save money. Reducing waste, usage of energy, water and other natural resources as well as using substitute materials instead of conventional materials in production lower costs and make more actual profit. In the outdoor market it is not possible to build a life style brand in the future without being ecofriendly. However, companies should avoid greenwashing. Customers have started increasingly to demand proof of commitment to nature. Joining environmentally programs and getting eco standards is an opportunity for companies to show their sincere environmentally beliefs and convince their customers that their manufacturing is sustainable responsible.

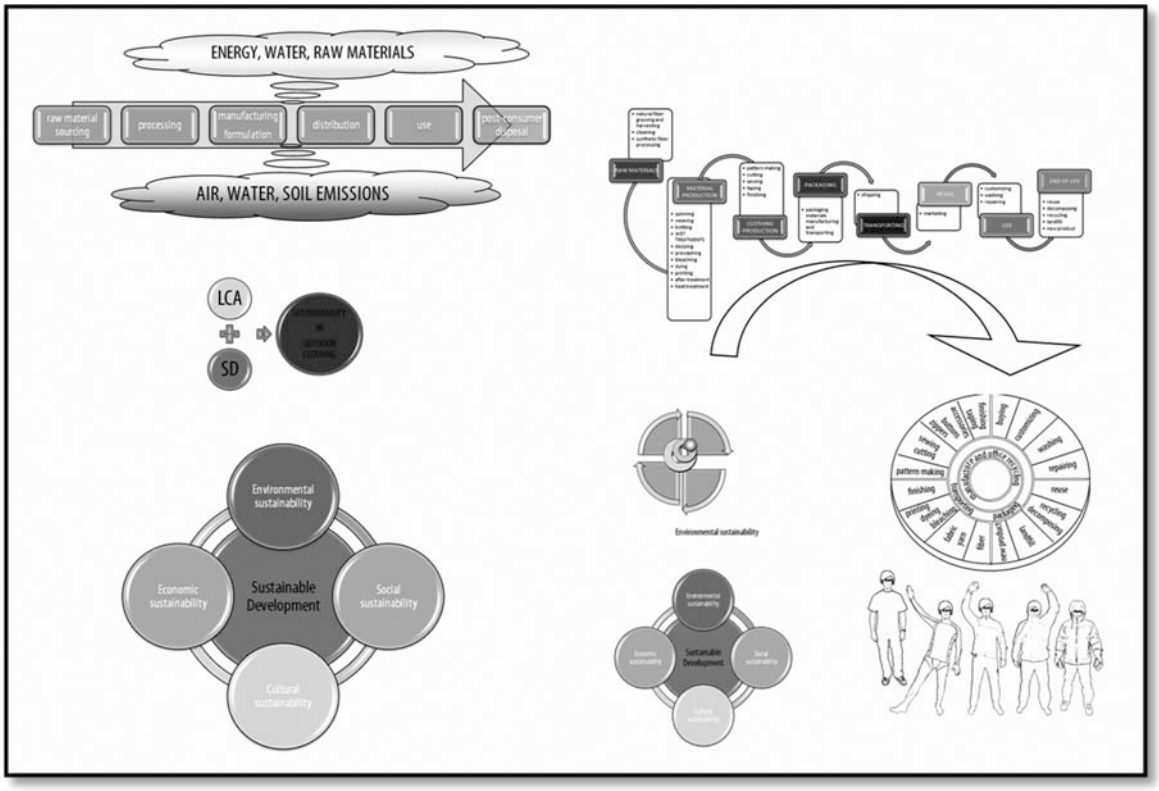

Figure 6: The tool for designing sustainable responsible outdoor clothing is combined from ideas of life cycle analyses and sustainable development. The model combines four aspects of sustainable development with the life cycle of all the layers of outdoor clothing.

Source: Seppälä & Söder 2010

Figure 7 (previous page)**. A detailed picture of environmental sustainability. Inputs and outputs of whole life cycle of outdoor clothing are in the middle. In our life cycle model packaging and transporting are in the circle, because they happen in all the stages of the life cycle.**

Source: Seppälä & Söder 2010

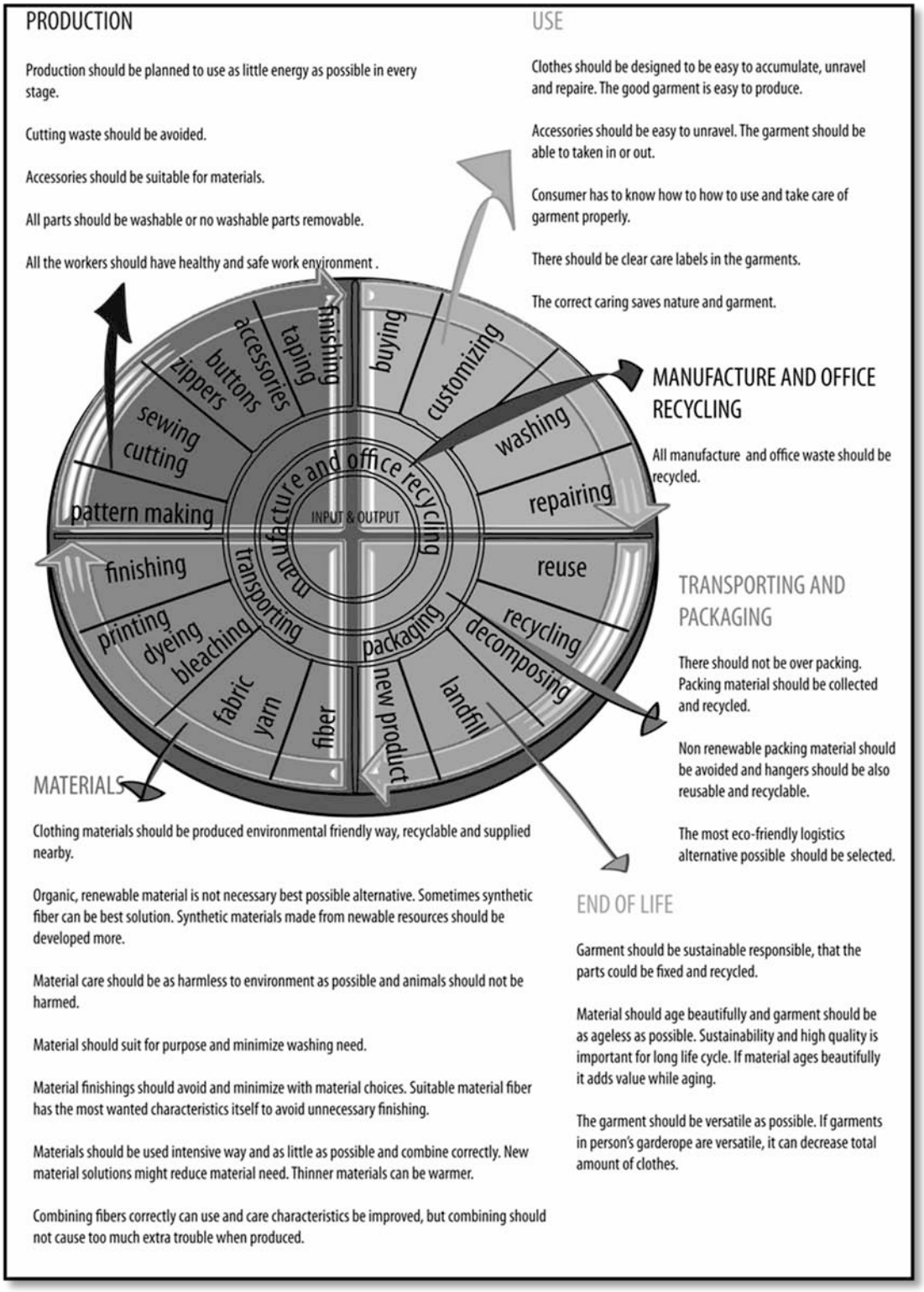

Figure 8 (above)**. Some of the things every outdoor clothing designer should consider**

Source: Seppälä & Söder 2010. According to outdoor companies studied 2009; Paakkunainen 1995 & Fletcher 2008.

Conclusions

There is no longer any doubt that climate change and environmental problems will be one of the biggest challenges that humankind has ever faced. Climate change is happening faster and its extent is wider than the world's leading scientists predicted. This state is a serious worldwide, catastrophe situation and everyone should concentrate on preventing it.

According to my study the amount of materials advertised to be environmentally sound has increased, but it is very difficult for end-users and even designers to evaluate their environmental impact. Good design, quality materials and the possibility to repair outdoor clothing will increase the life cycle of outdoor apparel (Fig. 8.). End-users are becoming more environmentally aware, but the outdoor clothing features they appreciate most are functionality and safety. The outcome of the research was that lifestyle outdoor brands cannot survive in the business without acknowledging environmentally friendly practices.

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the Learning Network on Sustainability

New York City (Steady) State

Excerpts from New York City (Steady) State Book

Terreform Inc
A Non-Profit Organisation, NY, USA

Speakers:
Auptha Surlidev, Shirish Joshi

Is it possible for the city to become completely self-sufficient within the five boroughs? To answer this, Terreform is devising a plan in which the city's ecological footprint and its political footprint is completely co-terminus. The project includes investigations of food, energy, water, building, manufacturing, air and climate, waste, movement, and social economy. The first purpose of the study is to demonstrate that this kind of radical responsibility-taking is actually possible, the second is to compile a catalogue of habits and technologies that would enable this, and the final goal is to investigate the morphological and social consequences for the city.

New York City (Steady) State is an alternative plan for New York City based on a single predicate: it is possible for the city to become almost entirely self-sufficient within its political boundaries. Our project posits that the key to sustainability will be found by dramatically reorienting our collection, delegation, and use of human and natural resources by asking the question: what if we decide to rely on what is accessible nearby, within the city itself?

The city is New York, home to 8 million people, covering a territory of approximately 790 square kilometers. Our nine areas of study – energy, building, movement, social economics, water, food, air, waste, climate, and manufacturing – each assess the history and development of the system, and the current demand and supply behavior of New York City as a point of departure for reinventing our city's metabolisms. We will set into motion the development of a sustainable urban culture through the introduction of dynamic instigators in a projective timeline: the effects of changes in the water infrastructure will feed through schedules and shifts in the connected, interdependent systems, and this model of interconnectedness will dominate the argument and design of the project. The timeline for New York's transformation becomes the indexical tool for integrating our research into a synthesized argument for change. The writing has been designed to read like an encyclopedia text, clear, well-researched, grounded in facts, informative. It will serve as an evaluation and access device, a tool and an educator. Current design guides typically perpetuate models of sustainability that are too discipline-specific, too superficial and/or too divorced from context. New York City (Steady) State is a deep reflection on the character of sustainability and on current models for development and change. It will provide both a full catalogue of immediately practical solutions, augmented by a theoretical text that will look at the economics of self-reliance and import substitution as a driver for this transformation. The city is increasingly the logical increment for resistance to environmental and political degradation, for realizing individual expression, as well as a key medium for taking responsibility for the fate of the global environment.

New York City (Steady) State seeks to provide a new standard for writing and analysis on sustainability, one which is inseparable from and grounded in a strong awareness of the particularities of place and will provide a model for other cities to follow. It is thus a means of taking inventory for cities currently relying on and striving for more limited forms of sustainability, a model for planning, a handbook of techniques, and a speculation about synthesis. We believe that this systemic, integrated, large-scale approach is exactly the type of reorientation that governments, planners, developers, architects, engineers, designers, and citizens urgently need to consider. The study aims to produce not simply a dramatic new plan for the future of New York, but to compile an inventory of best practices that are relevant to cities around the world.

About the authors

Michael Sorkin is founding President of Terreform and Distinguished Professor of Architecture and Director of the Graduate Urban Design Program at the City College of New York, where he has taught since 2000. Michael Sorkin was born in Washington, D.C. and received his architectural training at Harvard and MIT. He also holds degrees from the University of Chicago and Columbia. From 1993 to 2000 he was Professor of Urbanism and Director of the Institute of Urbanism at the Academy of Fine Arts in Vienna. Previously, Sorkin has taught at numerous schools of architecture including the Architectural Association, the Aarhus School of Architecture, Cooper Union, Carleton, Columbia, Yale, Harvard, Cornell, Nebraska, Illinois, Pennsylvania, Texas, Michigan and Minnesota. Dedicated to urbanism as both an artistic practice and a medium for social amelioration, Sorkin has conducted studios in such stressed environments as Jerusalem, Nicosia, Johannesburg, Havana, Cairo, Kumasi, Hanoi, Nueva Loja, Ecuador and Wuhan, China. In 2005 -2006, he directed studio projects for the post-Katrina reconstruction of Biloxi and New Orleans at both CCNY and the University of Michigan.

Sorkin lectures around the world, is the author of several hundred articles in a wide range of both professional and general publications, and is currently contributing editor at Architectural Record for which he writes a regular column. For ten years, he was the architecture critic of The Village Voice. His books include Variations on A Theme Park, Exquisite Corpse, Local Code, Giving Ground (edited with Joan Copjec), Wiggle (a monograph of the studio's work), Some Assembly Required, Other Plans, The Next Jerusalem, After The Trade Center (edited with Sharon Zukin), Starting From Zero, Analyzing Ambasz, Against the Wall, and Indefensible Space, and Twenty Minutes in Manhattan. Forthcoming are Eutopia, All Over the Map, New Orleans Under Reconstruction, and New York City (Steady) State.

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Shirish Joshi was born and raised in India, Shirish Joshi holds a Bachelors of Architecture degree from the CEPT (Center for Environmental Planning and Technology) University in Ahmedabad India and a Masters in Urban Planning degree from the City College of New York. He has previously worked with the Ahmedabad Heritage Centre which was involved in the conservation and restoration of the historic walled city of Ahmedabad. His interest lies in understanding the 'Urban' vis-a-vis what is sustainable urbanity and the idea of 'Density' as something beyond just the unit of number of persons in a given area. Parallel to his profession Joshi has also been actively involved in public art and exploration of space through the medium of theatre.

Auptha Surli Dev, LEED-AP. Born and brought up in India, Auptha was raised in a diverse and rich cultural environment, which shaped her interests in art, music and dance. She obtained her B.Arch degree from BMS School of Architecture, Bangalore nand Masters in Urban Planning from the City College of New York. A Registered Architect of COA-India, Auptha has previously worked with Jaisim Fountainhead and SMLXL Urban Design and Architecture, Bangalore, India. Currently, working as a Research Associate at Terreform, her interest lies in exploring ideas of Sustainability and Quality of Life – a design approach that can bring people together, and support a peaceful cohabitation and integration.

Francis Milloy is an architect, urbanist, and researcher with over 15 years experience in his field of study. He received his Bachelor degree in Architecture from the University of Strathclyde, (Glasgow, UK), his Post-Graduate Diploma at the University of East London, (London, UK), and has completed his RIBA professional practice examination. Francis has worked as an architect and lighting designer for over ten years on various projects throughout Europe and the Middle East. In 2007, fuelled by an interest in social and environmental justice and the opportunity for research into the forms these issues might take, Francis moved to New York to obtain a Masters in Urban Design at the City College of New York.

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the Learning Network on Sustainability

Integrated planning approach for sustainability of urban complexes

Case study: Chandigarh metropolitan complex

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Chandigarh and its periphery, quite contrary to Corbusieur's vision, have undergone much urbanisation over the past few decades, thereby leading to the formation of Chandigarh metropolitan complex (CMC) that spreads over three administrative entities, namely, Punjab, Haryana and Chandigarh UT. Due to the increased intensity of activities on one side and an uncontrollable urban sprawl on the other, it has become difficult to provide a matching infrastructure. Clearly we need a new paradigm for addressing the sustainability as also the development concerns of such urban complexes. In this regard, the paper attempts to undertake a thorough investigation of the CMC area in terms of land utilisation & landuse distribution pattern, population and employment projections, physical & social infrastructure, spatial distribution of activity nodes, major policy issues, etc. In order to address the various sustainability concerns emerging in this context, recommendations are made emphasising an integrated planning approach at CMC level.

Introduction to urban complexes

The term and phenomenon of 'urban complex' is becoming more and more common with the increasing urbanization and interdependency of urban settlements. Urban complexes are the result of functional linkages between two or more than two settlements determined by the interplay of physical, social, economic, administrative and infrastructural factors; number and intensity of urban activities within a unified area; and size, nearness and urban productivity of settlements. According to R.E. Dickinson, "Urban Complex seems to reach as far as a sharp break at the outer limits of the compact rural urban fringe". The term signifies an approach, a planning philosophy and a strategy; and provides a frame of reference for integrated or complimentary development between different areas and area levels.

Emergence of Chandigarh metropolitan complex

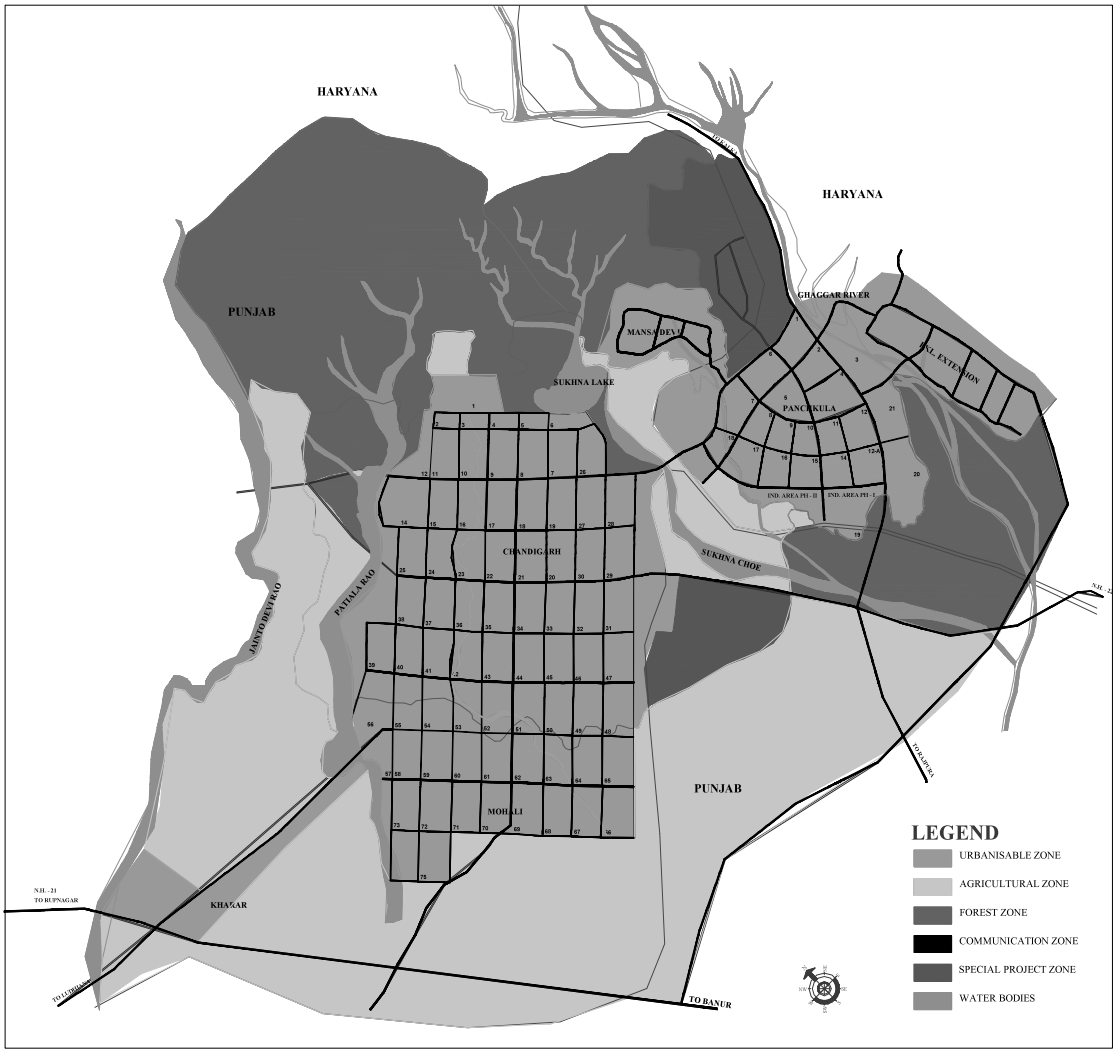
Chandigarh, the City Beautiful was envisaged by Nehru to be 'a symbol of free India unfettered by the traditions of the past and an expression of the nation's faith in the future'. Conceptualized by Le Corbusieur, a French Architect, Chandigarh was planned over an area of 70 sq. kms for an overall population of 5.0 lakhs. The Punjab New Capital Periphery Control Act, 1952, envisaged a permanent green belt around the city with the sole idea of regulating the development within five miles (8 miles) radius beyond the Master Plan area. The Act was amended later in 1962 to extend the periphery to ten miles (16 kms) radius beyond the city. As per Le Corbusieur, "In order to maintain harmony between the city and the periphery area their functions must not be interchanged otherwise chaos would prevail". The city was to provide all the social, physical and civic amenities and the periphery was to provide a support system to the city. Thus not only a mechanism for ensuring planned development of the city was provided

but enough safeguards were ensured to regulate and control the development in the periphery of Chandigarh.

However, with the reorganization of the State in 1966, the periphery fell in the jurisdiction of new governments- Punjab, Haryana and UT. Instead of enforcing the law, the new governments built the satellite townships of Panchkula and SAS Nagar thereby violating the Periphery Control Act. The violation further continued with the establishment of the Western Command Headquarters, the Airforce Station, Hindustan Machine Tools (Pinjore), Mansa Devi Complex and the Mani Majra Township. This resulted in the escalation of land values and further attracted new builders in colonizing the surrounding areas. These developments in turn, put additional pressure on the urban infrastructure of Chandigarh, thereby changing the character of City and its surroundings resulting into uncoordinated and uncontrolled development.

The urban complex hence formed and having crossed a million mark is hereby referred as 'Chandigarh Metropolitan Complex' that comprises of the Chandigarh, SAS Nagar and Panchkula as the primary urban settlements besides several villages and smaller towns. Chandigarh Metropolitan Complex (CMC) is unique in the sense that it spreads over the jurisdictions of three administrative entities, viz. Chandigarh UT, Punjab and Haryana.

Map 1: Land utilization pattern in CMC



A glance at the land utilization pattern (refer map 1) of CMC based on satellite imageries for the year 1998 (source: CISMeR Plan 2021 Report) reveals the rapid urbanisation of the Chandigarh periphery. As may be observed, a substantial area is occupied by forests, water bodies and agricultural land, most of which is in the Punjab portion of CMC. Since any intervention into the natural systems may have adverse environmental and ecological implications, so these forests and water bodies pose a potential constraint in expansion and development process.

An overview of main urban settlements of CMC

As of today, Chandigarh is a premier centre for education & medical institutes, and is emerging fast as a major IT/ITES hub in North India. The city is having highest per capita income in India. A modern and well-planned city, it is attracting IT and other industries and is undergoing an economic surge. It is also fast emerging as an important tourist destination. SAS Nagar is a developing city conceived broadly as an extension of the master plan of Chandigarh. Panchkula is also a developing city with new areas viz. Panchkula Extension and Mansa Devi Complex (MDC) having been developed. Planning Authorities of these cities have proposed several new sectors in their respective areas to accommodate ever rising populations and provide upgraded scale of services to its inhabitants. Various industrial areas and other economic activities are being planned and developed in the CMC and nearby towns that will increase employment opportunities. These cities would be attracting a large number of people from the region for their employment, shopping, trading, education, medical and other requirements.

Population trends and future projections

An overview of population trends in the main urban settlements of Chandigarh Metropolitan Complex from 1971 to 2001 (refer table 1) reveals a rapid growth rate of SAS Nagar and Panchkula in the last few decades. In the process of urbanisation of this region, these cities have acted as a cushion for absorbing the overspill from Chandigarh which by virtue of its being a modern and a well planned city attracts lot of immigrants.

Table 1: Growth of class-I urban settlements in CMC (1971–2001)

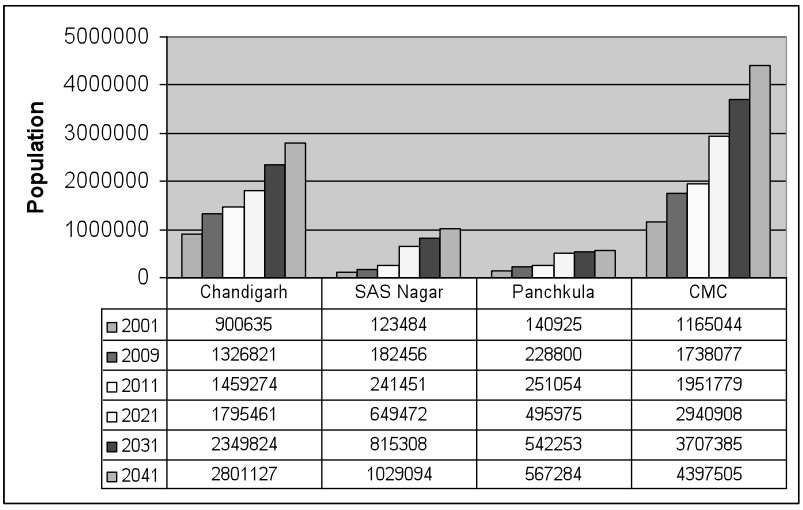
Source: CISMeR Plan-2021 Report and Census of India, 2001

Settlement	Population in lakhs				Growth rate
	1971	1981	1991	2001	1991-2001
Chandigarh	2.54	4.51	6.42	9.00	40.19
SAS Nagar	0.01	0.32	0.78	1.23	57.69
Panchkula	0.00	0.11	0.70	1.41	101.43
Total	2.55	4.94	7.90	11.64	-

Chandigarh and particularly nearby towns are planned to experience high growth in coming decades. Projected population for Chandigarh and other towns as per their development plans is given in Table 2. Thus population of these towns is expected to grow from 17.4 lakh in 2009 to 44 lakh in 2041. Because of the expanding economic activities, CMC shall offer increased employment opportunities (refer table 3).

Table 2 : Projected population of class-I urban settlements of CMC (2001–2041)

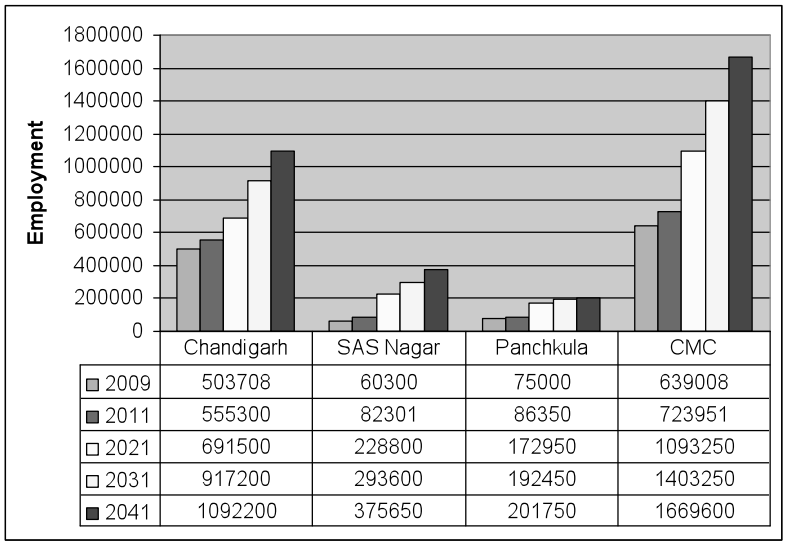
Source: Comprehensive Mobility Plan for CMC



	Chandigarh	SAS Nagar	Panchkula	CMC
2001	900635	123484	140925	1165044
2009	1326821	182456	228800	1738077
2011	1459274	241451	251054	1951779
2021	1795461	649472	495975	2940908
2031	2349824	815308	542253	3707385
2041	2801127	1029094	567284	4397505

Table 3 : Projected employment in CMC (2009–2041)

Source: Comprehensive Mobility Plan for CMC



	Chandigarh	SAS Nagar	Panchkula	CMC
2009	503708	60300	75000	639008
2011	555300	82301	86350	723951
2021	691500	228800	172950	1093250
2031	917200	293600	192450	1403250
2041	1092200	375650	201750	1669600

Landuse distribution pattern

A look at the landuse pattern of the three primary urban settlements (refer map 2 & table 4) reveals that the public/ semipublic landuse dominates (15.32 % as compared to UDPFI standards of 12–14 %) in the context of Chandigarh city. This is because being the capital of two states alongwith its own UT status, the city houses the various apex level administrative functions. Further, the high level of subsidies combined with its status has promoted ever increasing institutional activities.

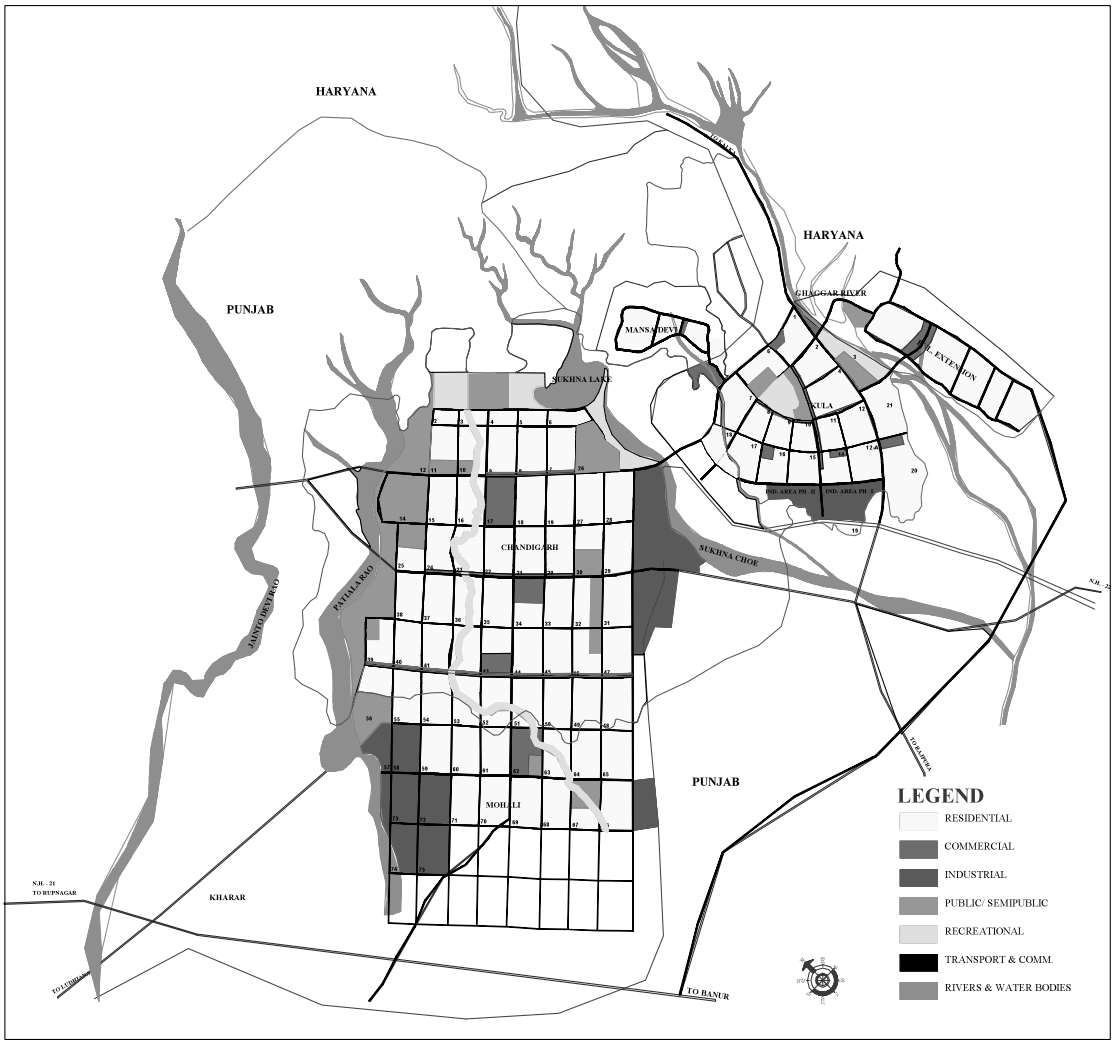
SAS Nagar has higher value for industrial landuse (25.43% as compared to UDPFI standards of 10–12 %). This is because of the presence of large industrial estate on the south-west of Chandigarh. This contributes largely to its economic status as an industrial town. Panchkula primarily attempts to cater to the residential needs of the workers employed in and around CMC. It strives to provide quality living to its residents while depending heavily on Chandigarh for its job requirements.

Table 4: Landuse distribution pattern in class – I urban settlements of CMC

Source: Computed values

Landuse	%age as per UDPFI	Chandigarh		SAS Nagar		Panchkula	
		Area in acres	%age	Area in acres	%age	Area in acres	%age
Residential	35 – 40	6721	37.96	2030	32.07	3665	38.60
Commercial	4 – 5	880	4.97	160	2.53	561.5	5.91
Industrial	10 – 12	1303	7.36	1610	25.43	487.5	5.13
Public/ Semi-Public	12 – 14	2712	15.32	700	11.06	552	5.81
Recreational	18 – 20	1292	7.30	185	2.92	883.5	9.30
Transport & Comm.	12 – 14	3484	19.68	746	11.79	1231.5	12.97
Agr. & Water Bodies	Balance	1312	7.41	899	14.20	2114	22.26
Total	**100**	**17705**	**100**	**6330**	**100**	**9495**	**100**

Map 2: Landuse distribution in class – I urban settlements of CMC



Social & Physical Infrastructure

Health & education facilities

An assessment of the status of health and educational facilities in the cities of CMC reveals an inequitable distribution. Chandigarh has concentration of such facilities that serves the city as also the region. SAS Nagar has 6 hospitals of which 5 are private ones and cater to the region at large. It has only one civil hospital which is 50 bedded. However for specialized and better health facilities, it still depends on Chandigarh. In Panchkula, health facility is catered mainly by the private sector in terms of nursing homes and clinics.

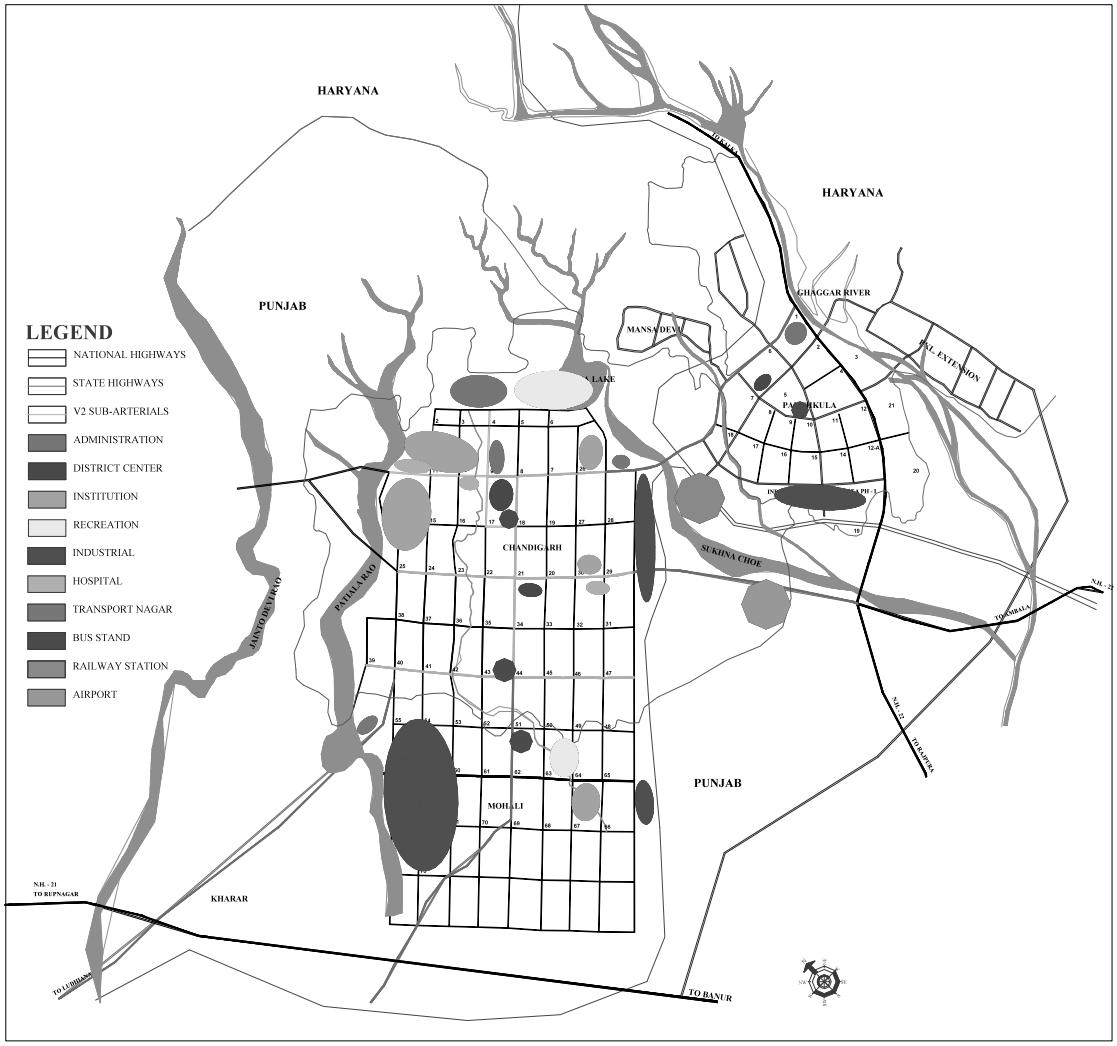
There is inadequacy of educational facilities at town level both in SAS Nagar and Panchkula. SAS Nagar has a number of private institutes, but for specialised and better education, it still depends on Chandigarh. The inadequacy of these facilities in relation to their demand at settlement level in Panchkula and SAS Nagar strains the existing transport network.

Transportation

Spatial distribution of activities and settlement areas has a direct bearing on the traffic pattern. The interface between transport and destination nodes for work, education, leisure and the distribution trade as now emerging at the metropolitan complex level, is increasingly laying stress upon traffic network along particular stretches. Some of the major activity nodes in Chandigarh Metropolitan Complex (refer map 3) are Capital complex, the north-western end of Chandigarh city, City centre and the Industrial area of SAS

Nagar. These will continue to attract a large number of people for their employment, shopping, trading, medical, education, tourism and other requirements. This shows implication in terms of heavy traffic. The consequent congestion comes on to Chandigarh roads.

Map 3: Transportation vs. major activity nodes



Chandigarh records very high number of vehicles on the city roads. Motor vehicles ownership in Chandigarh is one of the highest in India. While population of Chandigarh rose from 2.54 lakhs in 1971 to just over 9.0 lakhs in 2001, the number of vehicles during the period has grown more than 42 times from a mere 12,345 in 1971 to over about 6.0 lakhs now. According to the statistics of the transport department, at present there are over 2.0 lakhs four wheelers and more than 4.0 lakhs two wheelers. Over the past one decade, as many as 30,000 vehicles are being annually added to the city. This is an indirect indication of inadequate public transport services in the study area. The increased use of private vehicles directly contributes to the increase in total vehicle kilometres travelled, increased traffic congestion on roads and high emission levels of vehicular pollution.

In addition, there is the floating population of over 1.0 lakhs vehicles that come into the city from the adjoining towns of Panchkula, SAS Nagar and nearby areas annually. For every 1.8 persons there is a vehicle in the city, which is far more than the national Capital's ratio of one vehicle per four persons. As per the study done by Rail India Technical and Economic Services (RITES) for the Mobility Plan of Chandigarh, it is pointed out that merely 16% of Chandigarh's population travels by buses. Presently the intercity bus service from Panchkula to Chandigarh and SAS Nagar is quite unattractive as a public transport.

Besides nearby towns such as Zirakpur, Kharar and Dera Bassi in Punjab, Pinjore-Kalka and Alipur Kot Behla in Haryana and Baddi- Nalagarh and Parwanu in Himachal Pradesh are also growing fast and have large traffic interaction with the CMC. In the absence of adequate and quality mass transport system,

people are using the personalized modes which is not only leading to congestion on road network but also increasing environmental pollution. Such growing congestion is resulting in loss of productivity, reduced air quality, reduced quality of life, and increased costs for services and goods.

Water supply, sewerage and solid waste management

Chandigarh gets its water supply through 27 kms of conveyance from Bhakra system at the rate of 62 mg per day for which pumping is a major expense and evaporation losses en route are high. The UT also has 150 tubewells. Main source of drinking water in SAS Nagar is the canal water through Bhakra main line and the shallow tubewells. The Haryana portion of the CMC has its own water processing systems through ranney wells in the Ghaggar riverbed supplemented by tube wells. Overall the supply of water is good, but with growing demands and higher than normal consumption, the available per capita supply is dropping, as is the water table.

Chandigarh has a sewerage system but the discharge into the Ghaggar River is only through an inadequate primary treatment plant in Punjab, south of SAS Nagar. SAS Nagar does not have its independent sewage treatment plant. It shares the facility with Chandigarh. The waste collection and disposal system in Chandigarh leaves a percentage uncollected. New landfill sites are also difficult to find

Major policy issues

It is observed that each state in its ambitious zeal has its own policies with respect to physical expansion as also the expansion of the economic base. While SAS Nagar and Panchkula try to take mileage out of their close vicinity to the Chandigarh city, Chandigarh itself by virtue of its past glorious achievements is trying to further them by adding new dimensions to its economic base. The result is the new economic policies which reflect the respective government's vested interests with least regard to its impact on the CMC environment.

- The 'change of landuse' policy in Chandigarh has greatly facilitated the people to undertake landuse conversions. The result is conversion of prime locations into high intensity commercial activities. The introduction of single window system has made the process very quick. Many shopping malls are being planned in the Industrial area. Even the City centre is destined to undergo large scale conversions.
- Punjab and Haryana too have legalized the process of landuse conversions. Various charges (external development charges, license fee, conversion charges, etc.) are being introduced.
- With a view to attract investment, generate employment and leverage economy, state of Punjab has approved Industrial Policy, 2003. Under this policy, mega projects in housing, urban development, commercial, fashion technology, IT and ITES sectors involving investment over Rs 100 crores are being promoted. These mega projects are envisioned to be high intensity developments.
- Punjab New Capital (Periphery Control) Act, 1952, though adopted in principle by the two states viz. Punjab and Haryana, is being adapted to suit their purposes of bringing about large scale developments. Punjab while emphasizing the need to prepare a Comprehensive Landuse Plan for the entire Periphery Controlled Area, also permits change of landuse as an interim measure until such a Plan becomes final in statutory terms. Acknowledging the ground realities, it has also permitted regularization of certain unauthorized colonies which had come up within the periphery.

These policies shall have their bearing on the intensity of activities, population densities and consequently on the infrastructure of Chandigarh Metropolitan Complex. Further, several large scale projects are in the offing in Chandigarh Metropolitan Complex which are bound to redefine its structure, viz. Sarangpur Institutional Area, IT Parks in the three cities, high rise housing projects by private builders, Airport expansion project, etc. Tata Housing Development Corporation (THDC) proposes high rise apartments (more than 30 storeyed) in an area that is classified eco-fragile and seismic prone, and is also regulated by Punjab Capital Periphery Control Act.

Recommendations for sustainability of CMC

Strict controls in areas of environmental or ecological concern

Urban development needs to be integrated with the natural world so as to protect human beings from some of the worst abuses of urban environments. Restoration is the catchword of urban sustainability agenda, thereby implying efforts to restore the damaged ecosystems, to restore nature within urban areas, and to manage watersheds so as to enhance wildlife habitat and reduce flooding through preservation of natural floodplains. The need thus is to regard natural constraints at CMC level for environmental and ecological considerations.

- No intervention should be allowed into the areas marked as forest zones.
- Safe distances along rivers or water courses have to be ensured for taking up any development. No development zone needs to be specified.
- Good agricultural land in CMC should be protected and conserved. Till a statutory development plan for the entire CMC is prepared, any interventions into the agricultural land shall be strictly banned.

Comprehensive plan for water resources and waste minimization

The flow of natural resources into cities and wastes out of them represent one of the largest challenges to urban sustainability. Many argue that cities must ‘close the resource loop’ by recycling, reusing, remanufacturing, and otherwise diverting materials from their usual destination in landfills and incinerators.

- Integrated scheme for augmentation of water supply shall be promoted considering CMC as a single entity. This should also include artificial recharge of ground water, roof-top rain water harvesting, reuse & recycling of waste water, conservation of water & integrated land and water management in the CMC.
- In view of limited availability of land for use as landfill sites especially in Chandigarh, there is an urgent need to find other mechanical means of minimizing waste requiring disposal. Infact zero waste output may be aimed at. The waste management has to be done in more organized, scientific, cost effective and environment friendly manner.
- Unified Metropolitan Board for water supply and sewerage shall be instrumental in bringing down the cost of development while ensuring reduced detrimental effects to the environmental quality.

Integrated approach for transportation and landuse patterns

Rising traffic volume and congestion are the leading citizen concerns in most cities the world over, and of course produce other sustainability related problems such as air pollution, greenhouse gas emissions, depletion of non-renewable fossil fuels, destruction of open space by roads and suburban sprawl, and degradation of local neighbourhood quality of life.

- The issues relating to traffic and transportation in a large and growing city like CMC need to be viewed in the larger perspective of urban and regional planning and development.
- Policy decisions at least for the key areas of economic concern need to be taken and effectuated at a common platform. Strategies related to the spatial distribution of activity nodes as also the regional level facilities shall have to be spelled out at the level of entire CMC. This may reduce the number and length of trips by motorised transport.
- A strong public transit must be introduced to balance the private vehicle use. Pricing of transportation and other ‘transport demand management’ policies will play a role as well.
- The CMC will require a multi-modal transport system, and thereby the need to coordinate inter-modal transport issues.
- Unified Metropolitan Transport Authority (UMTA) may play a vital role for effective integrated development of landuse and transportation at CMC level.

Comprehensive development plan for CMC & need for strict enforcement

It is urgently required that a comprehensive development plan be prepared for the entire CMC area that shall suitably demarcate the areas to be considered for development or conservation. A clearcut regulation to that effect would check the tendencies of the respective governments to encash upon their proximities to Chandigarh at the cost of environmental and ecological concerns.

The gap on part of Chandigarh itself must also be filled. It should be able to check the large scale conversions as also the economic activities creeping into the system that are highly detrimental to its character.

Legislative base for integrated development

The Periphery Control Act, in the context of changed circumstances has lost its intent, and remains no more effective in controlling the developments in Chandigarh periphery. It becomes important to provide a suitable legislative base for an integrated planning approach. In this context, National Capital Region Planning Board Act, 1985 may serve a useful reference. An Act specifically for the Chandigarh Metropolitan Complex may be laid, which shall provide for the constitution of CMC Planning Board for preparation of Development Plan for the CMC; coordinating and monitoring of such a Plan; and evolving harmonized policies for control of landuses and development of infrastructure. The coordination will have to be through a High Powered Board in order to ensure coordinated and integrated approach in a metropolitan area which spreads over the jurisdictions of three governments.

Conclusion

Chandigarh is highly significant at both regional and national level. Because of its close proximity and easy connectivity to the national capital, it has become an important investment destination for Indian and multinational companies. Inspite of various difficulties faced, it is still one of the most liveable cities in the northern region. Therefore, considering its vast potential to serve its region, its constraints to physical expansion and the extreme dependence of its surrounding settlements, the development would have to be ensured through coordinated efforts of three administrative entities. This would mean an integrated framework relating to environmental factors, economic activities and infrastructural facilities. The development impulse of Chandigarh must spread to the entire Chandigarh Metropolitan Complex as one unit.

The need of the hour is to realize the resource constraints in terms of land and water availability to sustain the development and the other environmental issues; the aspirations of the respective governments to have the best bargain out of the existing situation and at the same time the quality and the character of the cities in question. The concept of sustainability must give due weightage to each of these aspects.

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the Learning Network on Sustainability

Sustainable design and Indian tradition

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India as a nation has always held a rich wealth of resources – be it natural, strategic, or political. Science and technology has directly or indirectly, under many occasions, acknowledged the leading edge and/or the inspiration that ancient Indian customs or traditions has had over innovations. Likewise, the concept of Sustainability and linking it with everyday living has been part of traditional Indian handcrafts and rituals. Meanings for practices have been associated with religion – their usage ensured that we returned what we took from the environment. My paper seeks to elaborate the concept of sustainability that has been (and is being) unconsciously practiced in the traditional "Indian" way of living, and attempts to link the same to sustainable design as understood today. It seeks to look at not only Indigenous Indian products but also traditional Indian everyday living processes that have followed the tenets of sustainability. The attempt is to revisit traditional Indian practices as an unconscious but effective means of Sustainable practice.

Introduction

> "Kale Varshatu Parjanyaha,
> Prithvi Sashya shalini"
>
> "Let the clouds bestow rain at the correct time; bearing the ability to give life; and let the earth remain green and bountiful..."

Sustainability and" green" thinking are today seen as manifestations of any society's coming of age. A natural progression of economic and industrial growth has led to a conscious assimilation of thinking *Sustainable* – be it in production or design; be it for products or processes. Concern for spaceship earth, and human endeavour to minimize unidirectional exploitation of resources, is hence viewed as a mandate across the globe today.

The hymn above, known as the *swastivachakam*, however, dates back to the Vedic era, years before the onset of the industrial revolution. It is till date practiced as a prayer succeeding offerings made during the traditional Indian *Pooja* or invocation. The reference to timely rains and green cover can be seen as a foresight to climate change -thus prodding the practitioner towards working on reducing ecological imbalance.

Sustainability has been a concept that seems to have been part of the Indian ethos since times immemorial. Returning what has been taken from the environment, is an ideal which has been ingrained as part of the traditional practices that have been set for generations to follow. The sacrosanct natures of these rules, termed as Sampradayas, were passed over generations, enlivening the continuance of sustainable forms of living. These practices consciously and unconsciously reinforce sustainable design thinking in the Indian traditional way of thinking.

1. Understanding sustainability

What do we today understand as Sustainable thinking? To deliberate on this, we may need to move backwards and understand what really constitutes *unsustainable* thinking. Industrial societies were for long dominated by the *take-make-waste* economic system, where raw materials were used to power our

economy and the often highly toxic by-products produced by the system dumped back into the very same resource base (The power of sustainable thinking, Bob Doppelt). Decisions, to a large extent, were constrained to covering the economic bottomline, ignoring "*the dramatic, undesirable social and environmental impacts that the modern world – far from solving – continues to create and exacerbate"*. (Ed Gillespie-Spaceship earth- Design for the challenge of sustainability in the 21st Century, Futerra,)

Today the thought process has evolved to accommodate the finite resources provided by nature. Decisions for thinking, practice and design are elaborated to cover a triple bottom line. Following the World Commission on Environment and Development and their 1987 Report – *Our Common Future*, sustainability can be recognized through three principles – Ecological, economic and social sustenance (Source: Jonathan M. Harris, Tufts University Medford MA 02155, USA , 2000, Basic Principles of Sustainable Development.

These can be elaborated as below -

- Economic: An economically sustainable system must be able to produce goods and services on a continuing basis.
- Environmental: An environmentally sustainable system must maintain a stable resource base, avoiding over-exploitation of renewable resource systems or environmental sink functions, and depleting non-renewable resources only to the extent that investment is made in adequate substitutes.
- Social: A socially sustainable system must achieve distributional equity, adequate provision of social services including health and education, gender equity, and political accountability and participation.

(Source: Jonathan M. Harris, Tufts University Medford MA 02155, USA , 2000, Basic Principles of Sustainable Development)

2. The components of sustainability

Though these perspectives seek to simplify the understanding of sustainable development, they provide scope for detailing the processes that can cover the triple bottom line.

2.1 The economic perspective can be realized through multiple practices, amongst which the most commonly followed are

- Practices of recyclability/ reusability
- Scale –To look at local solutions to problems
- Cascading- To Design products that have cycles of use
- Disassembly – To make products with minimum component parts, and which can be assembled and disassembled.
- Dematerialization: To design a service concept rather than an individually owned product.
- Sufficiency – To practice a feel of "enough" – and derive only what is needed.

2.2 The Environmental perspective can likewise be understood through-

- Energy efficiency – To Translate the least use of energy towards production/use
- Lifecycle thinking – To design products keeping in mind their lifecycle uptil their end-use and obsolescence

2.3 The Social perspective can be derived for human as well as nonhuman factors, through-

- Equity and fair trade – Equitable distribution and provision of basic needs
- Environmental justice – To conserve natural capital, and prevent its depletion or degradation.

With the principles of sustainability drawn as above, let us now look at the Indian tradition and its contribution towards realization of the above.

3. Sustainable thinking and the Indian ethos.

The oxford dictionary defines the word "ethos" as a characteristic spirit of a culture, era, or community as manifested in its beliefs and aspirations". It denotes "a state of being- the original essence that shapes and forms a person or animal" (*Source: Erhad 2007, www.Wikipedia.com*). Any practice, thus, is generated from the ethos that governs the community at the point of time.

The Indian ethos is built over scriptures that propound the reverence of almost all elements of nature. The earth is referred to as "Bhudevi" or "Bhumidevi"- the Mother earth. The Sun is seen as a manifestation of God; and is revered during harvest festivals across communities. "Varuna" is invoked as the "raingod" during prayers to receive rainfall, and"Vayu" has been worshipped over the ages to down the fury of hurricanes or tornadoes. All these references go higher than folklore – and the spirit of divinity associated with them draws the community towards maintaining responsible consumption of all associated natural capital.

The human form, in itself, is seen as nothing but an image of the Supreme Being –every entity being part of the whole.

> *In the Bhagavad Gita, Sri Krishna compares the world to a single banyan tree with unlimited branches under which all the species of animals, humans and demigods wander* (Shankar Ramasubramaniam, 2008, relevance of traditional Indian value system to ecocity -)

Every Indian household performs a daily invocation to their revered deity or form. The very concept of the everyday Pooja is seen as a procedure where we invoke the Supreme Being, and for being aware that all products we use are gifts by nature; to be duly returned back to source through "*naivedyam* "(Nivedayami- "I am making it known to you)

It thus presents no wonder that practices rising from this deep-rooted ethos seek to address the issues of equity, sufficiency and lifecycle thinking. These practices have transcended generations and are consciously and unconsciously practiced today by the Indian diaspora. Why cannot these traditions then serve as tenets to sustainable thinking?

4. Sustainability in practice

The norms issued by traditional thinking are often followed without questioning their relevance. Likewise, traditional products in everyday living are utilized for their promoted values in superior quality and output. Nevertheless, these have been conceptualized to follow sustainable practices in any form of the triple bottom-line.

4.1 Festivity

Common celebrations for bounties shared by nature – all festivities outlined in the Indian tradition are manifestations of this concept. Be it within family members, or be it with the whole community, these are practiced with fervour, keeping in mind the declaration for sustainable practice. Hence idols of Gods and Goddesses are mandated to be made in clay and colored with natural and soluble dyes. These idols are revered over the span of the festival- Ganesh chaturti for the elephant God Ganesha ; and Durga Pooja for the Divine mother – and immersed with full fanfare in water bodies at the end of the festival. The devotees pray for the return of their beloved God from the very elements of nature to which the idols have been transferred to. The use of natural material ensures that the immersion does not disarm the environment. Over centuries of practice, this tradition has been invoking the sense of *recyclability and environmental justice.*

4.2 Clothing

The Drape Versatility has always been the key strength associated with Indian apparel. Be it the vibrant hues of the Rajasthani or the subtle beiges of the Keralite, traditional Indian clothing has been providing fodder for international looks. However, most traditional Indian costumes retain their unstitched form- the saree for women or the dhoti for men. Variations in the draped versions form a multitude of different costumes representing individual style, demographics, age, attitude and position. Preserving the traditional attire- be it the elaborate nine yards draped saree or the simple shorter length Odhni- is practiced through mandating their wearing across specific rituals. Thus Hindu customs in the north ensure that women cover their head with an odhni; while the women from the south wear an elaborate *madisaar (ref.Fig1).* While the advantages of draping is substantiated by the comfort it provides to the wearer, it seeks place as a sustainable product through imbibing the economic aspect of *disassembly*- the use of minimum component parts in creating the outfit. A variation in the way the same dhoti is draped across various occasions (from its normal drape as a daily wear to the *panchakatcham* for rituals) provides illustration to *disassembly*.

Further, it gives room for *cascading*- the continuation in the use of the product through its life-cycle. To illustrate, the saree begins in most Indian households as an occassionwear in its new form, till its use for lounging or working at home at its end days.

Figure 1: The traditional south Indian drape photographed by Nithya Venkataraman

Thrift craft *Kantha* – the rural handwork from eastern India emphasizes recycling and repurposing. Traditional folklore maintained that *old cloth is believed to possess magic, repelling the evil eye, keeping its user safe (Source: Arlie Burr, www.mrxstitch.com).* Thus Kanthawork brings about new products from old clothing, with the use of quilting and simple running stitches to aid the transformation. Practioners of Kantha also ensure that the threads used for embroidery are derived from the base cloth. Kanthawork is a prime example of sustainable design following the economic tenet of *recyclability* and *reuse. (Ref Fig 2)*

Figure 2: Kantha Embroidery

This image is available at:
http://www.webindia123.com/craft/needle/kantha/images/kantha3a_small.jpg

4.3 Environmental planning

A sustainable environment involves well planned land use as well as transportation to arrive at a homogenous community lifestyle. The vision for a sustainable city or town is seen as one with "*compact, efficient land use; less automobile use, yet better access; efficient resource use; less pollution and waste; the restoration of natural systems; good housing and living environments; a healthy social ecology; a sustainable economy; community participation and involvement; and preservation of local culture and*

wisdom" (Wheeler Stephen. "Planning Sustainable and Livable Cities", 1998, ISBN 0-415-27173-8, Routledge, New York.)

Places of worship have always been central to a city's population in their traditional form. While complex rules were laid out for temple architecture, invariably all temples formed the focal points of a planned town, with streets leading from the temple across each direction. Moving from one side to the other involved walking through the temple premises; and these premises often acted as a point of community and social interaction. The indigenous concept is an ideal illustration for *energy efficiency*, lowering transportation and facilitating transit- a case for *environmental sustenance*. (Ref Fig 3)

Figure 3: A temple city

This image is available at:
http://en.wikipedia.org/wiki/File:Tiruvannamalai_Temple.jpg

Sacred trees Most of these temples have a *Sthalavriksha* –a tree which is earmarked for the given reigning deity of the place of worship. Devotees visiting the temple circumambulate the tree and offer prayers at its roots .The spread of this concept can be gauged by the fact that for 500 temples surveyed, "*Sthalavrikshas*" were found in 306 temples (M. Amirthalingam, 2008, Role of Sacred Plants in the Conservation of Plant Diversity-, ENVIS Newsletter Vol. VI, No. 2).

Similarly, **Banyan trees** often house idols of Lord Ganesha. It is thus no surprise to see Banyan trees revered within the precincts of the town/village as they become a prospective place of worship. Both these concepts make trees sacrosanct – aiding in the protection and development of keystone species that can aid in the smooth function of the ecosystem. (Refer Fig 4)

Figure 4: Sacred Tree photographed by Nithya Venkataraman

Temple tanks have been a part of traditional Indian worship places- be it temples or Gurudwaras. Folklore talks about the regenerative properties of the Amrit Sarovar at the Golden temple; and the medicinal value of the tank within the Bangla Sahib in Delhi. Tanks are a mandatory fixture in most temples of the south- and occupy a place of pride not only for a holy dip by pilgrims, but also for hosting festivities at night as part of temple activities.(Fig 5) An advanced level of the tank is found in villages in the South of India- these tanks known as *Oorunis* are double walled structures that act as rainwater catchment areas as well as reservoirs for Spring water collection from underground sources

The sacrosanct tanks offer a solution to retain disappearing water bodies- acting as a source of *environmental balance.*

Figure 5: Temple tank photographed by Nithya Venkataraman

4.4 Home Décor

Decorating the living space has been a practice globally across communities, across ages. Traditional methods of décor however, have provided scope for the community to practice sustainable thinking.

Floor décor The practice of Kolam /Rangoli is practiced across India as a morning ritual. Rice is ground to a fine flour and is used for tracing patterns outside the entry of the house. (Fig 6) The elaborate versions include colored flour with the use of traditional color agents- Turmeric, Vermillion etc. The Rangoli ensures that ants and insects get their daily fill of food at every house's doorstep. Of course, it also ensures that the very insects keep away from the interiors since their supply of food has been taken care of. This simple practice talks about a two-fold concept- an economic concept by *cascading* where the raw material (rice) is utilized well over its regular use; as well as the social concept of *equity* by ensuring that the lower life forms get their share of food.

Figure 6: *Kolam* photographed by Nithya Venkataraman

Lamps have been a source of light during times when electricity was an unheard-of entity. However, lighting of lamps assumes traditional significance as they are associated with auspiciousness and prosperity in the household. Hindu and Buddhist practices encourage the use of ghee or oil to light wick lamps around areas of worship at home. Ghee lamps are also extensively used for performing the daily ritual of "Aarti" – the use of cotton wicks with ghee is believed to purify the atmosphere and generate positive energy. (Fig 7)

Figure 7: A traditional lamp

This image is available at:
http://farm1.static.flickr.com/232/476643591_d622eb556e.jpg?v=0

4.5 Lifestyle

Sustainability is recognized as an ongoing process; and the success of sustainable thinking lies in the everyday practices followed by the person in particular, and the community as a whole.

Offerings are a part of every Indian ritual; be it an everyday practice or during special occasions. Every meal produced during festivity is for distribution in the community. It is often believed that prayers are to be substantiated with offerings- hence the practice of offering food to the almighty and then distributing it to the public as "Prasad" (Fig 8).This is a custom that is often practiced in reverence across temples of any community in India. Traditional households still believe that food is not partaken unless given in "Bhiksha" or offering to a needy Brahmin. A much ingrained practice- this ensures that an equitable distribution of resources is done in the society, emphasizing the concept of *equity* and distribution.

Figure 8: Offerings – photographed by Nithya Venkataraman

Feeding of crows Very often have we seen a crow being fed before the family gathers for lunch. The crow is seen as the vehicle of Sanishwar or the Saturn God. Yet again, here we see the universal understanding of planets and planetary systems as part of a cohesive and balanced ecosystem. The traditional practice of feeding the crow, before the family partakes its daily meal, ensures that the ecosystem is respected and the *Social concept* of *equity* is taken care of.

The Cow is revered as a sacred animal- It is often believed that the cow ensures that it provides nourishment in the form of milk, from the mere consumption of fodder (which would have otherwise been disposed of). Feeding the Cow is seen as a harbringer of prosperity and wealth, again ensuring *social equity* in the system. (Fig 9)

Figure 9: Cow worship

This image is available at:
http://www.ammandharsanam.com/newsImages/jan2009/01 Jagadguru performing Go Puja.jpg

The plantain leaf is seen as a symbol of an elaborate meal – the visual appeal of multicolored food items on a green plantain nevertheless adding to aesthetic value!(Fig 10) These leaves are disposable and bio degradable, ensuring that the used leaves convert to manure on disposal. Leaves from the banyan tree are also stitched together to form plates that have been traditionally used in the eastern part of the country. The disposability means that less energy is consumed on cleaning and washing them post-use, making them an *energy efficient* product. Plantain leaves are also converted to disposable cups – likewise ensuring energy efficiency while consuming liquid items.

Figure 10: Plantain Leaf – photographed by Nithya Venkataraman

Community bhajans and Satsangs at either places of worship or at residences is an established practice aimed at spiritual well being. The rich repository of philosophy provided by religion also provides *bhajans* or *akhand paths* as very commonly identified traditional form of worship. Their practice, however, requires the entire community to collectively perform with a common focus- bringing together people across socio-cultural variances under one roof. The collective forms of prayer could be seen as a form of maintaining *social-equity*.

4.6 Architecture

Living spaces today talk about lung space and low-cost air-conditioning for maintaining a sustainable environment. However, traditional Indian houses built with indigenous materials have often been prime examples of sustainable thinking- which are being emulated in architecture today

The use of **dried palm leaves** for roofing can still be seen across houses in Kerala. The cost advantage aside, it also provides natural cooling for the tropical heat; reducing the energy consumption for temperature control – an energy efficient product. The fact that fallen and dried palm and coconut leaves are used emphasizes *scale*- a local solution from available *recycled* material!

Courtyard houses have now been recognized as architectural solutions for creating green buildings. The Vastu Shastra, or the Indian architectural texts, maintain that a specific proportion of open space in relation the whole building site needs to be left open in the middle. This, according to these texts, is the abode of the creator and supreme God –

Figure 11: A courtyard house

This image is available at:
http://i907.photobucket.com/albums/ac275/rammanpandu12/1471020499_8936820804_b-1.jpg

Brahma. In concurrence, vernacular housing in India follows the courtyard design – with the central courtyard clearly earmarked for specific activities – ensuring ventilation and natural air conditioning. (Fig 11) The age-old practice propagates the concept of *energy efficiency*.

While we talk about the layout of a traditional house, reference to the **Tulsi plant** at the courtyard aids in understanding *environmental justice.* The Tulsi has been worshipped as a divine entity- the consort to Lord Vishnu and the symbol of auspiciousness and prosperity for every household. This belief has ensured that all traditional households invest in a sapling of the plant, and rears it in its courtyard. (Fig 12)This proves to be a highly effective way for community conformance to *environmental justice*.

Figure 12: *Tulsi* plant – photographed by Nithya Venkataraman

5. Lifecycle thinking in Indian tradition

All the above illustrations seek the concepts of sustainability in everyday living practices –requiring the practitioner to understand that the products he derives and uses need to go back to the system from where they originate. On a spiritual note, all actions by human beings are returned back to the originator-

> "Kayena vacha manasendriyair va, buddhyatmana va, prakriteh svabhavat
> Karomi yadyat, sakalam parasmai, narayanayeti samarpayami"
>
> "I dedicate to the Supreme person Narayana all that I do by means of the body, words, mind, the organs of action, and the organs of knowledge and by the impulsion of nature"
>
> *(Source: Swami Mukhyananda Shri Ramakrishna Math- Practice of Sandhya Worship – www.kuladevatha.gsb.in)*

At the same time, man is bestowed with the responsibility to owe the vagaries of nature to his *Karma* or actions- the Bhagavad-Gita throws light on actions setting the wheel of the universe moving-

> "Annad bhavanthi bhoothani parjanyad annasambhava Yajnad bhavathi parjanyO yajna: karmasamudbhava": 3.14
>
> From food come forth beings; from rain food is produced; from yajna rain proceeds; Yajna is born of karma.

Thus the accountability for environmental calamities and mismanagement of natural capital has long been held with the human community- which today forms the essence of understanding and practicing sustainable thinking.

6. The pedagogy of sustainable thinking

It is imperative that when we talk of environmental concerns, emphasis is given on reduction of damage to natural sources and to eliminate wastage. The traditional scriptures thus propound the concept of *Shruti* (listening) and *Smriti* (memory) as mediums of learning.
This entailed the passing on of the tenets through hymns and invocations that are heard and memorized over generations, maximizing the longetivity of the concepts.

At the same time, *Sampradayas* or *Parampara*, which can be translated as "living streams of tradition" ensured the passage of practices which were imbibed in daily lifestyles. These were often dictats that were followed as regular practices aiding an unconscious assimilation of sustainable thinking.
Modern society, however, has evolved with analytical reasoning and thought process behind assimilation of practices. A change in practice involves a conscious evolving of thinking. As illustrated by *Bob Dopplet* in *The power of sustainable thinking*- Change goes through a 5 step process- Disinterest, Deliberation, Design, Doing and defending. Indian traditional practices can clearly be said to emphasize the 4th stage-Doing, with the preceding steps having very much been covered by the unseen lawmakers of society. Today's scenario of mandatory sustainable thinking demands that we do deliberate on these practices- and evolve them through refinement in design to arrive at do-able tenets.

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the Learning Network on Sustainability

A new way of designing innovation

Considerations on the user's role in sustainable innovation

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Today the "technology push" answers more to the market needs than to people's ones. The idea that new technologies do not directly correspond to quality is already widespread, we need innovation to bring about strong and real values again. Our interest is in spreading a new thought line: if technology driven industry does not answer consumer's needs any more, why not looking for a new user-need push? A type of innovation that signifies a new way of designing, shifting the attention from the product to the user, as user-centered design has already done, but going even further. New crisis phases threaten the western market, and we need to face them with new tools: collaborative design could be the answer to redefine primary human beings' needs keeping in mind those of the environment.

Innovation and technology

If in 1985 defining technology push innovation as revolutionary didn't seem to be wrong, nowadays the debate on the technological character of innovation seems to be at issue again.[1]
Innovation remains the keyword for the western market to face the running competition of the eastern companies, but it has to find new ways to assert itself. Technology promise has lost its fire and as Ernest Braun suggests, it starts to be called empty promise.

The industrial production in the late post war period introduced and diffused on the market a new kind of products born from technological discoveries (television, dishwasher, washing machine, cars and later the personal computer); these products created and fulfilled new needs, entailing great social changes for western population. The innovative-technological factor of the new products was the driving force for industrial development, for the rise of productivity and it consequently influenced and changed the social standard of the involved population. The industrial deal was in a certain way simple: goods of high quality with the lowest possible cost were needed so as to be able to have a competitive product in the performance/price relationship. The solution of this equation assured success on the market; the customer was able to choose with his autonomous interpretative capability the most suitable product to his requirements and buy it (Manzini, 1990).

As decades went by these new needs were satisfied, the market, lacking demand, has to create new ones to be able to continue a productive cycle. We share the idea of those who claim that the actual market is based on the considerable presence of variation of the same products: the technical innovations proposed now seem to be significant only to differentiate from the competitors' production. The nature of the market seems to be linked to a perpetual generation of new technologies. An evident example is the one of television screen technological escalation, pointless innovation (Braun, 1995: 208).

Up to now major investments concentrate on the product communication with the objective of making the purchase itself necessary, no more connected to the response to any need. So the concepts of symbolic goods, fiction economy, capitalism third spirit, have been developed to describe the present situation. The problem shows its evidence when the consumer does not recognise any longer the product that matches his own need, confused by a high product complexity and a communicative redundancy that does not supply information anymore.

1 "The revolutionary mode of innovation is dominated by the *technology push*".
William J. Abernathy e Kim B. Clark, *Innovation: mapping the winds of creative destruction*, in "Research Policy", Volume 14, Issue 1, February 1985, p.p. 3 - 22.

"Choices are less and less justifiable by technical motivations: the more the technique develops, the more the available alternatives increase, the more choices have to find their legitimacy elsewhere. [...] Technical innovation, in the end, does not produce new qualities spontaneously." (Manzini, 1990: 67, personal translation) The situation described by Ezio Manzini in 1990 completely fits with the present one in most of the western country, twenty years later.

Redefining citizen and environment's needs

> *The question is not whether we become a little richer and have a few more 'toys', but whether civilization, or indeed life on earth, can survive*.
> Source: Ernest Braun, 2005

If technological progress goes beyond the users' wishes, it has inevitably configured their needs. In this perspective a thinking about consumption seems to be really incisive, surely more than technological research on the possibility of consumption decrease of the single product. Elisabeth Shove's point of view, in this context, is interesting: she theories the necessity of shifting the attention from theories relating consumption and production to a more accurate study of daily habit standards. It's a call to take into consideration the unexplored potential of humanistic disciplines as sociology, psychology, ethnography, related to the innovation process, to reveal non-recognised customer habits, and at the same time to help in configuring new customer's needs. Life standards our society is based on are far from existential ones; because of the consequences they have on the environment we can't venture to put this matter in the background.

An accurate study on consumption modalities, to be effective, should not concentrate only on individual consumption but consider also the collective rules above them witch are influenced by the socio-technical systems (STS) themselves. The designer should always have in mind the STS that will be his product context. Going even further we can say that the same field of intervention could shift from tangible object to the use of it. Designing usage practices implies a shift from a "design of" practice to a "design for".

Elizabeth B.-N. Sanders and Pieter J. Stappers's classification (see Box 1) highlights the ongoing strong change: while traditional disciplines as visual communication, interior design, industrial design or architecture focused on artefact production, emerging disciplines as experience design, interaction design, sustainability design have as their main goal the fulfilment of needs without putting limitations on what type of artefact or service they will produce.

Box 1: Traditional and emerging design practices

Source: E. B.-N. Sanders, P. J. Stappers, (2008)

Traditional design discipline Design of	Emerging design disciplines Design for
• visual communication design	• design for experiencing
• interior space design	• design for emotion
• product design	• design for interacting
• information design	• design for sustainability
• architecture	• design for serving
• planning	• design for transforming
	•

If technology driven industry does not respond to the user needs, these new methodologies could become the new revolutionary push of the production system. Passing from a "technology push" to a "user-need push" we have to believe in a new type of innovation which shifts the main attention from the product to the user.

Three are the actors playing in this scenario, who have the power to maintain or subvert the actual situation: society and its demand, designers and stakeholders. Actually we should also add governments, in the countries where they intervene in facilitating innovation management in general.

All these forces should look ahead together in the same direction to see a future change.

User as co-designer and his supporters

The easiest way to determine which are the user's needs is to involve them in the decision.

Up to the late 90s, the average manufacturer, when asked to consult the user about the products he would like to see developed, he would answers it was nonsense, since users were not aware of the technology developments. According to his point of view, users only knew what was available on the market (Grint, Woolgar, 1997). This attitude endorsed the concept by which it is the company that defines the users' future needs. If this has been working so far, elements are now present to force a change dictated by the users' behaviour. Thanks to purchasing groups, blogs, consumer associations and magazines a stronger conscience of the responsibility of every single purchase choice has, is emerging. This is the way in which users have already started a battle against misinformation and futile production.

At the same time stakeholders could rely on an already wide literature that theories a necessary change also in company business strategies. In *The Future of Competition: Co-Creating Unique Value with Customers* (Prahalad, Ramaswamy, 2004), the authors states that co-design potential is to transfer the concept of value from the product-centric idea to another one more linked to the user's personal experience. We can quote also *Outside Innovation: How Your Customers Will Co-Design Your Company's Future* (Seybold, 2006), and the most known von Hippel's *Democratizing innovation*.

In European Nordic countries user-driven innovation has been largely studied by institutions that encourage companies in applying this methodology.

Jørgen Rosted in a FORA report (see Box 2), suggests three different types of innovation that matched together could help companies to face a new rising competition from the eastern countries and underlines that the ability to find new ways of innovating will be the only path to success in the global market (Rosted, 2005). It is important to remember that also the European Commission throughout two different programs, PRO INNO Europe® and INNOVA, is enquiring and promoting a user-driven innovation.[2]

Box 2: Three types of innovation

Source: Rosted (2003); Rosted (2005)

> The importance Rosted gives to user-driven innovation is evident in FORA documents. In there user-driven innovation is presented as an expected step for the companies. A scientific and systematic approach is needed to achieve a full success of this new way of innovating.

Sources of innovation	Types of innovation	Time
Price competition	Price-driven innovation implies that companies are constantly striving to market a product that customers perceive as affordable, or at least as being cheaper than the competitors' products.	Price competition is as old as the market economy itself.
New research and technology	Research-driven innovation implies that companies are striving to gain a technological lead over the competition, allowing them to produce at a lower cost or to deliver a product that distinguishes itself from the competition.	Technology-driven competition made its biggest impact in the industrial age.
Non-recognised customer needs	User-driven innovation implies that companies are constantly striving to deliver a product that provides the consumer with a special value or experience unmatched by the competitors.	Waiting to be recognised

2 See *Fostering user-driven innovation through clusters*, Draft discussion paper prepared by DG ENTR-Unit D2 "Support for innovation", Brussels, September 2009.

The notion of user is changing: it is no longer considered as a passive user but as an active actor, a decisional subject. The whole innovation process seems to be put into question by this change; the same rethinking has occurred in the design discipline. The designer's task will no longer be to understand how to solve a design problem but how to know what the problem itself is. In understanding what needs to be designed, the user's contribution can't but help. The designer's new challenge will be to share designing responsibilities with the user.

This approach is not new, in the 60's and 70's there were strong trends in this direction but as we have seen, they were out off by an almost mystic trust in technology: the self feeding dynamic of the technical system made it seem magic, arising consumer curiosity about what it would have proposed next, as if it did not depend on man's will. It was exactly in those decades that the first participative approaches took root in environmental mediation, in collaborative urban planning and in contemporary artistic practices.
To conclude this short historical excursus, it seems interesting to quote the London congress of September 1971, called Design participation, organized by Nigel Cross; the term participative was rediscovered only in the 90s starting from Nicolas Bourriaud's publications.

The potentials of the participative approach are now posed again because the present situation seems more suitable to adopt them for different reasons, first of all this renewed thrust in creative potential or at least in the user's ability to define his own needs. This push is confirmed also in Web 2.0 whose paradigm is users' interaction: for the new generations of users, now used to internet participative features, it will not be a revolutionary approach; on the contrary applying a participative model to other field, as design, might be a due switchover. Secondly, the economy crisis of 2009 broke up the market that is now looking for new solution to re-establish a new balance.

Co-design, how to

Co-design introduces the participative aspect in the designing process, the audience is asked to cooperate with designers actively, it is not simply consulted on the matter: it's about designing in the social context.

Design (in its wider meaning) is only a society microcosm that has a voice in all media channels of culture transmission; if today the designer's role has managed to approach the direction of cultural production, his responsibility towards the community is even greater. Sharing this responsibility with the community itself would allow the whole discipline to go beyond meritocracy that characterizes the whole cultural process, by introducing a democratic character of participation.
Elizabeth Sanders, one of the magazine Co-design associated editors, to define the term 'co-design' starts from the description of co-creation. The author connects the term to any act of collective creativity, and just this, when applied to the specific field of design in all its stages, is called co-design.

A final important concept has to be defined before describing the innovative participative practices in use today, that of Living Lab. This term defines some work groups who by applying co-creation and co-design have as their main goal the achievement of innovation through the user's active contribution. Many work groups have already established all over Europe thanks to the common guide lines deriving from user-driven innovation, to the same literature (von Hippel, Norman, Shove etc.), and to the shared concept of innovation that permits a useful exchange of the information and technology acquired by every group in each work session. The single group keeps, at the same time, its own operative independence both on themes and on new application methods.

A wide range of examples can be found in *Towards a manifesto of Living Lab co-creation* (follow-up of INTERACT 2009 Workshop) a collection of papers of the homonym workshop held in Oslo in August 2009.

The tools used in these sessions can be the most conventional questionnaires, interviews, texts, assessments, together with the use of scenarios, of prototypes, diaries, workbooks, workshop experiences and brainstorming. In this way the classical sociological techniques and those of design process are put together. Every work group after finding the theme to solve or inquire into, tries to find a group of users that might be interested: their number, typology, heterogeneity or homogeneity as far as job, age, competence are concerned, are important values that will affect the applicability on wider groups.

The more heterogeneous a group is the more interesting the results might be. It might also be important the ability to involve more users in their real life setting where their behaviours won't be influenced by the study session; in these cases the feedback or the notes produced by the subjects will be written on paper or on a blog created for this purpose.

Every single user, questioned as expert on his own personal experience, will suggest the group his needs, his thoughts, intuitions and design solutions. Comparing the users' responses will lead to interesting results and in the final stage, when joined to the designer's or researcher's specific competence, it might turn into practical solutions, new concepts for products, services or simply new practices for the use of existing technologies, products or services.

Conclusions

We are glad to use this opportunity as an open call for users, designers, stakeholders and government administrator to make efforts in changing today's innovation. A lot of different arguments and point of views have been touched to demonstrate that a user-centered approach could be something more then theories, if all the agents want it to become a practice.

Consumers or better users are already aware of their purchasing power, stakeholders will be the first to realize this and to ask their designers to concentrate on users' needs again. For example, the technologies to reduce energy consumption are widely spread, while very little has been made to sensitize the public on a correct use of them. It is important for social consumption habits to become the subject of innovation research and to be dealt with the same scientific nature and efficiency we used with new technologies in the past. One does not intend to deny the innovative technological potential but we think it is important to underline it is not the only one and that it can't be the driving force of the whole productive system.

Living Lab's co-design strategy offers the users the opportunity and the tools to use their own knowledge and capability and the possibility to create new solutions or redefine the existing ones on the basis of the new needs they have highlighted.

The most effective method to induce a change in the users' behaviour is to introduce their innovative potential into designing practices. Through co-design experiences the users are actively involved by bringing the most urgent problems to their attention.

"The tragedy of the commons is what you get when everybody's individual best next move becomes the cumulative worst move for everybody." (Brian Eno, 2004: 62)

For this reason one has to redefine man's primary and secondary needs and to do it with the due respect for the surrounding environment.

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Design for sustainability

Ethic, aesthetic and new processes

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Stegall argues that "the role of designers in developing a sustainable society is not simply to create 'sustainable products', but rather to imagine products, processes and services that encourage a widespread sustainable attitude.

The innovation system can lead, through innovative interactions among actors, to the eco-efficiency system. It is important not to create new objects from old waste, but to project objects that could represent a culture of design, objects that are the expression of their own time and that therefore do not disappear from the market very quickly. We should reconsider the relationship between duration, maintenance and quality of an object, taking into consideration that, once produced, it acquires its autonomy and becomes part of the environment where he lives. The contemporary production fluctuates between performing objects and image objects, between instantaneous performances and communicative areas but with a significant loss of consistency and quality, objects intended to leave no trace in the collective memory. To avoid this, the work of designers should be supported by some experts working on a common platform of dialogue. For example, let's think to the new architecture, subject to economic dynamics opened for necessity of change and innovation, where it is required a strong review of traditional methods of design and product development, resulting in a highly flexible approach based on the intersection of phases and actors. This new architecture is adapting to changed perceptions landscape, and the attention is focused on the envelope seen as reactive skin, part of an energetic long-term concept.

Projects in which new technologies are used to generate solutions of artifacts, environments and services that disseminate sustainable behavior are now numerous. However, the simultaneous production often swings between performing objects and image objects, between instantaneous performances and communication areas (Manzini) with a significant loss of consistency and quality toward objects intended to leave no traces in collective memory. To avoid this, designers need to work alongside the experts who work on a common platform of dialogue. Not by chance, important inputs to the development of theories, methodologies and tools directed to sustainability, are recorded just where this exchange takes place, where the aesthetic needs live in symbiosis with the economic and environmental issues.

In the perspective called Sustainable Interaction Design[1], Eli Blevis, Associate Professor of Computer Science at the program of Human-Computer Interaction Design from Indiana University, defines design as the act of choosing among or influencing choices of future ways of being or as an approach that focuses on user's behavior rather than on the satisfaction of his needs. This way of perceiving the work of the designer proposes a pattern that points to the project of the context and of the modalities in which human activities take place, rather than on the design centered on the users of a specific artifact, environment or service. This model can only lead to a paradigmatic change in the design discipline as the fundamental notion of User Centered Design gets weak in the context of sustainable design geared to foster new behaviors rather than to meet current requirements. Adam Richardson[2] writes: "To quell the ecological damage being caused by our current industrial production system, we must contextualize fea-

[1] See: http://eli.informatics.indiana.edu/selectedpublications.html
[2] Adam Richardson, Director of Product Strategy, frog design San Francisco, in *Tragedy of the commons,* number 5 of Design Mind in 2007.

ture requests within this broader understanding. User desires are no longer justification enough for production. We must add an Environmental factor to the historical rubric of Business, Technology, and People. And just as we sideline products and services that fail to adequately meet standards of viability, feasibility, or desirability, so too must we reject initiatives that are not sustainable.

Ignoring this "E-factor" should be considered poor business practice and poor design – no matter how much consumers might seem to demand it."

To consider the ecological factor in the design means to formulate and monitor new types of approaches and concepts such as "design with the intent"[3] or "persuasive technology" in which the design is strategic and aims to influence or lead the user toward certain behaviors rather than others. This approach has been applied in many areas of design, producing results in the diffusion of sustainable behavior and success in the innovation market. The designer's task is to think about his role in changing human behavior in terms of environmental sustainability by working on the simplification of the complexity of the models (Mario Brunge) and ensuring the interests of the final user, with whom he can more easily identify himself in the dense and complex network of actors (Ropohl) called into question by environmental design.

In this respect, Massimo Botta writes in Interaction Design and Sustainability[4]: "The interaction designer could play on different levels. The first one is an intellectual level, where the designer could play his cultural, political and ethical role investigating and interpreting the human condition in order to propose products and services that stimulates different ways of being. The second one is a practical level, where the designer could play a pragmatic role working on the development of products and services based on environment friendly technologies, features and functions. The third one could be an opportunistic level, where the designer could play a "smart" role, taking advantages of user's behaviours".

The evolution of the technical system in terms of environmental quality offers endless opportunities (from new materials to the processes of recovery), the problem is to link these opportunities to mutations in the socio-cultural context; in this direction, there are finally some signs in countertrend, indicating a rejection of the disposable system of products designed to go without a trace in our memory, and therefore lacking of quality and undesirable. The designer, abandoned the idea of a single system builder (Hughes), stands as guarantor of quality, in the perspective of an 'ecology of senses "where the continuous dialogue between science and nature leads to choices that are not predetermined but to artifacts "environmentally preferable". The environment is a highly complex system (Durkheim), composed of many interdependent elements. Belonging to this system are both objective and measurable components, made of quantitative data, and components referring to values, to human needs and its aggregation systems.

The multiplicity of issues involved and their connections determine the need to address the environmental problem not only to the aspect of recycling, or any other parameter if examined in isolation.

The design necessarily activates universes of discourse: technological , socio-political or economical and productive problems. The designer has to facilitate comparison and to facilitate the foreshadowing of the solutions, identify the real environmental problem to evaluate and define the right priorities.

The design thus becomes a place where different disciplines meet and interact[5] to solve problems. Only the renunciation of the designer's own autonomy, may lead to a deep review of the ways of working and towards the definition of common languages between different disciplines in order to properly solve the environmental problem. The identification of the problem is a crucial preliminary act (Peirce Theory), since the definition of "environmentally preferable" makes sense only in relation to specific situations that can not be independent from the circumstances and surrounding conditions.

The choices are not predeterminable but relative, it is the responsibility of the designer to avoid automatic procedures and the resulting schematization of the parameters and relationships. Before the aim to reduce waste production at the source, with a design of easily recyclable and reusable products, the risk of trivializing reducing the solution to the use of only recyclable materials can lead to results opposite to the initial intentions. The technological recycling of the material is in fact a necessary condition, but alone, it's not enough to define appropriate choices. All the possible systemic relations cannot be neglected: a product is recyclable also because of the ease of disassembly of components, the number of components and materials used, the actual possibility of collecting and reusing them, or the regulatory conditions.

But changing scale, the problem is resolved only within the product itself; in fact it is necessary to consider the incidence of transportation costs, its fuel consumption and emissions. The issue is also not to induce distorted buying behaviors because the recyclability of recyclable materials does not mean reci-

[3] http://architectures.danlockton.co.uk/
[4] Published on MAIND – Plotting Interaction Design Knowledge
[5] H.A. Simon, *Technology is not a prblem*, in P. Baumgartner e S. Payr (1995, pp. 231-248).

clability of the whole product and thus it does not guarantee that the product does not become waste. Similarly, a product unable to propose a lasting system of meanings and values is intended, however, to become waste. Lack of quality generates waste of natural resources and produces waste finally, even if recyclable. Ezio Manzini notices how "the problem of insignificant objects started with the modern idea that every object was reducible to a functional system: a prosthesis whose quality was in performing a particular function in the simplest and quickest way, so the object is no longer perceived in the real sense but as a kind of momentary materialization of its role, a bag or a plastic bottle exist only when they carry out their function. Beyond this, they are waste"[6]. Very often, what is produced today is not made to last but is produced to replace[7].

These productions determine a substantial increase in both physical and semiotic pollution, and just when the technology has freed the culture of design from traditional technical limitations, massively expanding the possibilities of design and production, the awareness of other limits has begun to spread, that are the physical and semiotic limits of the environment. The incredible mass of objects produced paradoxically determines the absolute absence of signs able to leave traces, and it is not with the effort to produce objects with new materials, recycled or recyclable, that a real progress toward the resolution of the problem can be realized. Rather than create new objects from old waste, we should design objects that represent a culture of design, objects expression of their own time and that therefore do not disappear from the market very quickly. The point, as noted by De Fusco[8], is not so much to give the object a longer lasting but to qualify it for the time of its existence.

We should reconsider the relationship between duration, maintenance and quality of an object, taking into consideration that, once produced, it acquires its autonomy and becomes part of the enviroment where it lives. An object is an entity that is used to perform a function, but is also a component of the construction of the world identity. We must confront with this duality, with the multi-dimensionality of the products, defined by a complex network of relationships extremely difficult to unravel, today that the speed of changes weakens all forms of stability[9]**,** including the socio-cultural one.

We should consider the objects as creatures produced both by our sensibility and by our practical ability. Fortunately, there are examples of this type, just think of the searches that already since the early '90s were led by the Dutch group Droog Design or Brazilian Campana Brothers. The evident semiotic pollution Manzini spoke about in those years, led many young designers to the path of recycling, to an "aesthetics of ugliness" but smart, to the product exposed to any superstructure, pure and dry.

We're not talking about the simple use of waste materials but of a rebirth of a sense memory, of the affection to things, of the need of not necessarily producing new signs, but of recovering the link with all that already exists in our memory. If you already have pots or chairs perfectly able to play their functional role, then it is useless to force the world to incorporate another formal and aesthetic review, whereas it may be more interesting to find a new identity and new meaning to that which already exists.

With an openly Dadaist attitude, these designers made stronger their sense of time of use of a product and of the real reasons for deciding that an object should remain with us. Examples are the *Rag Chair* or the container *Chest of drawers* by Tejo Remy, the *Knotted chair* by Marcel Wanders, Hella Jongerius' vases, or the seat *Favela* by Campana's. They are objects that have their roots in the research of innovative applications for often poor materials, challenging the common sense. Objects of the second generation born from recovered products transferred out of context and of the original function and with a strong evocative component. Their inspiration draws often on objects of daily use, waste, industrial materials which are returned a new aesthetic dignity[10].

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[6] E. Manzini, *Oltre il mondo dell'oggetto*, in "Leggere", n. 40, 1992.
[7] G. Valle, *Un mondo usa e getta. La civiltà dei rifiuti della civiltà*, Feltrinelli, Milano 1995.
[8] Renato De Fusco, *Made in Italy. Storia del design italiano*, editori Laterza, Roma 2007.
[9] See: Modernità liquida by Zygmunt Bauman.
[10] Valter Luca De Bartolomeis, *Il design per un'ecologia dei sensi. Il recupero dei materiali, del senso e del tempo d'uso degli oggetti. In Area 110, Edited by* Federico Motta, Milano, *May-June 2010*. pp 1/6 design focus.

Figure 1: I “Big White Pot e Red/White Vase” di Hella Jongerius

Figure 2: “Chest of drawers”, Tejo Remy

Figure 3: “TransPlastic”, exhibition organized by the Campana brothers in 2007 at the Albion Gallery, which offers a range of furnishings that mix different materials such as natural fibers combined with colored plastics. Traditional products such as wicker chairs assume new configurations, almost as if they were “genetically modified”: mutant furnitures, multiplace armchairs, chairs with a traditional back and seat in colored plastic, mixtures of materials and colors that create pieces ironic but full of meaning.

Source: via Dezeen; http://www.dezeen.com/2007/05/18/transplastic-by-campana-brothers/

Figure 4: Nendo, "Cabbage Chair". The Japanese school of design Nendo created the *Cabbage Chair*, made with scraps of clothing industry, a chair made of sheets vertically rolled one on the other, that can be molded to your liking. The sustainable positive values of this chair are not negligible. It is created from a waste material but this is only one condition among others, it is important to underline that for the creation of the *Cabbage Chair* were not used elements stiffening the structure, and not even glue or screws. The structure of wavy sheets, in fact, returns a strong rigidity of form, strengthen by a treatment with resins to which the sheets are submitted, along with a "pillow" effect determined by the elasticity of the folded sheets. Then there is the possibility to send the chair into a cylindrical shape, so that it is not only easy to carry, because it minimizes the footprint of the chair, but it also ensures a high level of interaction with users, free to create their own chair, which will open gradually, like a flower, directly into their homes, making them the protagonists of an "unforgettable experience". The chair, in this way, allows significant integration between sustainability, experience design, physical and mechanical properties of a material, with the elegance and the design elements typical of Eastern cultures.

Source: via Dezeen; http://www.dezeen.com/2008/03/06/cabbage-chair-by-nendo/

As concerns the attitudes of businesses and consumers, we must observe a bit of confusion and some inconsistencies. The results of some recent research on environmental sustainability in small and medium enterprises in the home-furnishing system in Italy[11], an area with a high design content, shows how initiatives for environmental sustainability are not spread yet. In a sample of 100 companies representing the furniture industry, little more than one on two (53%) states they have taken steps in that direction. Most of these initiatives have focused on the production process and especially on the front of the recycling processes of waste (96%) and reduction of production inputs (71%). Much less common are interventions on the front of the product, which are limited, at best, to the use of recyclable materials (63%). Companies, in fact, have not adopted yet real green design methodologies, addressed to a sustainable product design from the beginning, anticipating the uses and possible ways of recycling. We operates mainly on existing products trying to mitigate its impacts on the environment. However, the theme of aesthetic quality, remains crucial. About this, companies agree that aesthetics is a parameter of sustainability. Creating a sustainable product from an environmental perspective but just not aesthetically pleasing, does not produce useful results. Naturally, the aesthetic is not just wrapping: the work of the designer is required to join experts in sustainability and in the production process to combine "taste" (De Fusco) and ecology. Companies investing in environmental sustainability have a precise profile. They are the same medium-sized enterprises that have dragged the competitiveness of the made in Italy in recent years, have a qualified commercial presence on international markets (73%), heavily invest in design (66%) and technological innovation (the 43.5% owns patents). The main reasons that push these companies to invest in the environment are attributable in part to ethical reasons (the entrepreneur takes care of the problem in person) in part to the need to respect environmental standards and certifications to operate in markets that are particularly relevant (United States, Australia). This is for instance the case of Arper who, just to conform to the regulations (EPD certifications) of the Australian market of the contract, begun to apply to his products the methodology of "*life cycle assessment*" to calculate the actual environmental impact and to understand the areas on which operate to soften it.

The path of improvement led to a process that involved the supply chain and customers, encouraging exchange and cooperation between the parties. The value of certifications in an environmental program is given by criteria and controls imposed by independent bodies that administer them, but also by the ability to communicate the achievements clearly and impartially. The environmental project undertaken by Arper began in 2006 with the acquisition of ISO 14001 certification (environmental management) and saw the first results on the product in March 2008 with the acquisition of environmental certifications for the product EPD for Catifa 46, Catifa and in April 2009 for the Babar.

Among the key factors that have pushed the company to undertake this path there is the will to achieve excellence in all aspects of the product, with attention to the details and to all the people he works with: suppliers, employees or customers. The objective is to minimize the environmental impact through policies involving every phase, from raw material processing to the behavior of all employees making products that last in time and that accompany the lives of people, making the spaces more welcoming.

Specifically, Arper's program comprises three main-elements:

- environmental management (ISO 14001)
- eco-design (LCA – Life Cycle Assessment)
- environmental communication (EPD – Environmental Product Declaration or the scheme of voluntary certification of product that provides data quantified on the environmental impact of life-cycle of the product itself)

The certificates obtained are a starting point that are allowing the company to address the development of new products in ecocompatible perspective, supporting a process of continuous improvement.

[11] The first results of the research on environmental sustainability in small and medium enterprises of the made in Italy were presented at the event organized in 2009 in New York by elogico. See: http://www.elogico.net.

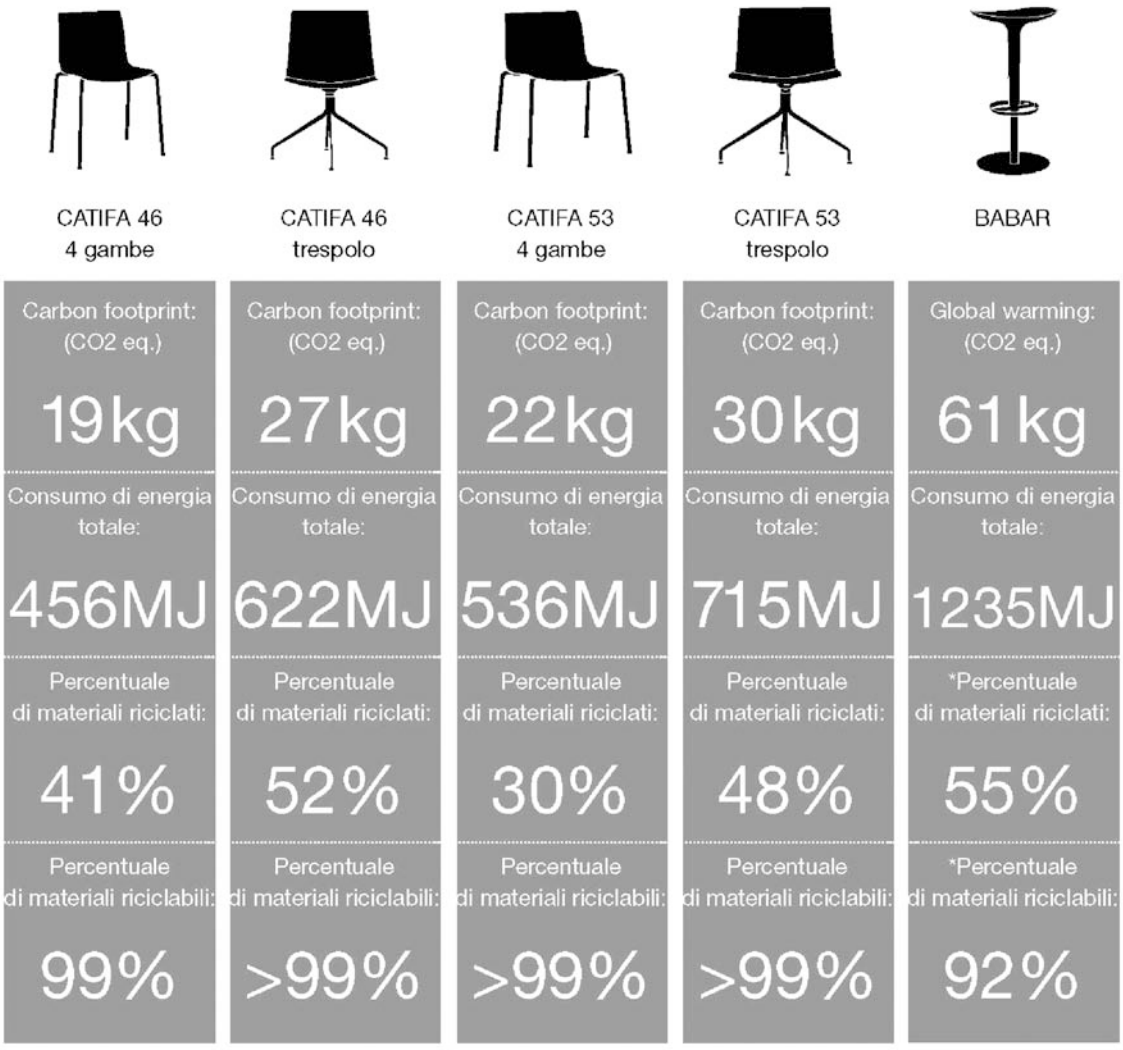

Figure 5: EPD Table showing some key results. For each product, the impact on the greenhouse effect (carbon footprint), energy consumption and the percentage of recycled and recyclable materials contained therein, are specified. The results are based on life expectancy of 15 years (period specified in the EPD requirements)

Source: www.arper.com

Returning to the outcomes of research, surprisingly, it hasn't been found a bigger importance of the consumers among the reasons that encourage firms to invest in sustainability.

According to the companies, the consumer is still confused and have difficulty in applying the general warnings with coherent actions in their daily lives. Analysis of data shows a generally cautious attitude of companies that tend to act with pragmatism and gradualism on the field of environmental sustainability. The most incisive action, not surprisingly, are taken where some results in terms of productive and economic efficiency are evident and measurable. The relation with the aesthetic, understood as "speakable quality" and cultural expression, particularly relevant in the field of home-furnishing, remains undisputed even beyond these types of production. I refer to the new architecture, subject to economic forces open to change and innovation, where there is the imposition of a strong review of traditional methods of design and product development, resulting in a highly flexible approach based on the intersection of phases and actors. This shows a more organic, natural, biological[12] approach that best matches the size of values and

[12] In *Out of Control*: *The New Biology of Machines, Social Systems and the Economic Worlds* Kevin Kelly argues that today we are witnessing the beginning of a techno-organic era in which the power of the technique is combined with that of nature. In practice, Kelly believes that the world we have created has become enormously complicated, so that now we must go into the world of nature to learn how to keep it running.

of human life. An architecture that reflects an increasing influence of the holistic paradigm, which means, first of all, a rejection of mechanistic and quantitative science in favor of the values of quality and of a temporal dimension of the artificial world. Over time everything changes and the design of a building can not prescind from these changes. Changes related to man and to his way of settling, to the ratio of the building and its context, which is characterized by cultural and social, and environmental parameters. Each building must be able to interact with the environment in which it is inserted and must constantly adapt to it. Unlike the technology from the 50's until the late 80's, the new technology tends to converse with nature, places more intelligent and complex products, thus increasing their value of reliability and ease of use. It also increases the content of information and complexity in production processes and in design, in products, so to achieve highly customized production. According to this new approach, what matters is not the product but the project that underlies the entire process by which there has been the development of a shape. The project doesn't pursues formal perfection, the correspondence to fixed rules, anymore, but involves the ability to adapt continuously shapes, structures, behaviors according to the conditions and circumstances and to their change over the time.

Julian F.V. Vincent, director of the Center for Biomimetics at Reading University in England, speaking of the relationship between nature and design, argues that biology and design are characterized by a common approach: cost[13]. A project always requires analysis, design, implementation, maintenance and disposal costs. What matters most for the designer is the cost understood in financial terms of structures and materials. The lower this cost is, the more competitive is the product. In nature, instead, the competition is based on a much more selective principle, the energy cost. In nature, only the more "energetically efficient" systems, ie, requiring less material and energy, survive. The species that survive are those that per unit of energy used, are able to reproduce more than any other one.

Similarly, men tend to design optimizing the costs of the various functions provided in relation to the requirements of feasibility and requirements of users. The project then must pay attention to properties, safety factors, materials must be the rightest ones according to specific properties, the necessary maintenance must be provided, then everything must be managed through integrated management system. In a complex world, as the one in which we live, where is perpetual the search for efficiency and higher performance to apply in architectures where high transparency and the relationship between surface and environment become generators of new languages and channels of search to give birth to a new project ethics, we can not recognize a fundamental role in energy control.

The energy control becomes a prerequisite of architecture, a necessary quality. The field of materials and building components has attempted to offer effective solutions in response to such requests, determining a quite consistent and dynamic innovative trend. This development now makes available to designers a technological keyboard that expands the potentialities of technical progress and performance in the project. There is also a positive progress of research in the field *of building science* in its specificity related to environmental physics, to science, to the durability of materials, to the development of modelling tools, to the simulation of behavior of systems and components .

So there are the prerequisites to make a best-learned and responsible construction project, taking it away from a functional facade, but unfortunately it must be noted that the potentialities of innovation and development seem to influence only marginally the current standards of building design and architecture. Very often the practice runs on resolutive iterations, on building systems that do not take into account the new goals, new requirements, and that instead show levels of reliability such to prefigure maintenance and management costs that are not so much coherent with the concept of energy efficiency and sustainability. An example is the substantial identity systems that are found in new housing construction within different climate zones that characterize the Italian territory. A residential building located in Palermo does not differ substantially, particularly for the housing, from a building in Bolzano, in spite of the different spatial and climatic conditions.

Instead, the new objectives require the adoption of systems capable of relating to the different needs and different environmental stimuli[14], introducing in the project and in the products more intelligence content, using, as Kelly would say, a "biotechnology", perhaps reducing loads traditionally assigned to the technical system through functional integrations between system and housing system.

[13] Vincent speaks about it in his article *Naturally New Materials*, published on MATERIALS Today.

[14] These stimuli, these tools of influence of the environment are obviously of different types of nature; in particular we can identify four decisive factors, the economic one (market demand, life cycle, value analysis, design and management progress), the functional one (objective functions, indoor environment quality, technical performance, durability), the environmental one (natural resources, natural tolerance, environmental loads) and the social one (social stability, built environment, transport, health, aesthetic, cultural aspects).

This mainly because of the deficiencies raised by the previous project experiences, such as those of the first high tech movement, where the search for efficiency and performances very often simply masked purely communicative and symbolic needs. The CIB (International Council for Research and Innovation in Building and Construction) has produced a document entitled "Agenda 21" in which are identified appropriate strategies for the attainment of a conscious and efficient design, especially in terms of sustainability.

The document suggests the following actions:

- development of integrated design processes
- improvement of environmental standards
- re-engineering of the construction process

These actions show that an innovative development can not be based solely on product innovation, but requires a reconceptualization of the whole process throughout its period of growth, starting from planning, to the design, to management and disposal. This requires the development of a *management framework* without which, every innovation can only be sterile and inoperable.

Agenda 21 thus focuses on what we previously noted, namely the need to develop integrated design process: this because the multiplicity and complexity of the objectives to be achieved requires that the quality of the design process is increasingly important and that the process itself is marked by greater complexity[15]. Within the building system we can identify promising lines of development, where the traditional approach based on expert analysis, developed in separate phases, has been replaced by integrated analysis and design developments, which can actually give rise to the so-called *function integrated systems*.

It is no coincidence, in fact, that most interesting innovations found in the architectural scene worldwide are related to partnerships that have seen a strong integration between traditional operators of the process and new operators with a more developed disciplinarity in building technology and environmental sciences. You try to overcome the idea of a hierarchical and geometrically defined vision, to go toward the inside-outside hierarchy, toward a conceptualized architecture, understood as an uninterrupted continuity between inside and outside.

The space itself loses meaning and becomes emotional space, a vision that creates a "time condition", "event condition" in which exists the possibility that the environment observes the subject. Maurice Blanchot speaks of a "look beyond": the architecture still standing to defy gravity, to have four walls, but these walls no longer symbolize the mechanical paradigm. They may have to do with the possibility of other meanings, emotional, of sound, of touch and light. In response to these theoretical assumptions architects move in different design approaches; communication is often entrusted with ornamental or graphics aspects, other times with organic forms unthinkable until recently.

[15] In one of his interviews, Tiezzi noted that the world of today is a complex world and argues that complexity can only be governed by complexity. E. Tiezzi, inteview by Mario Pisani, in Domus 818 September 1999, page 42.

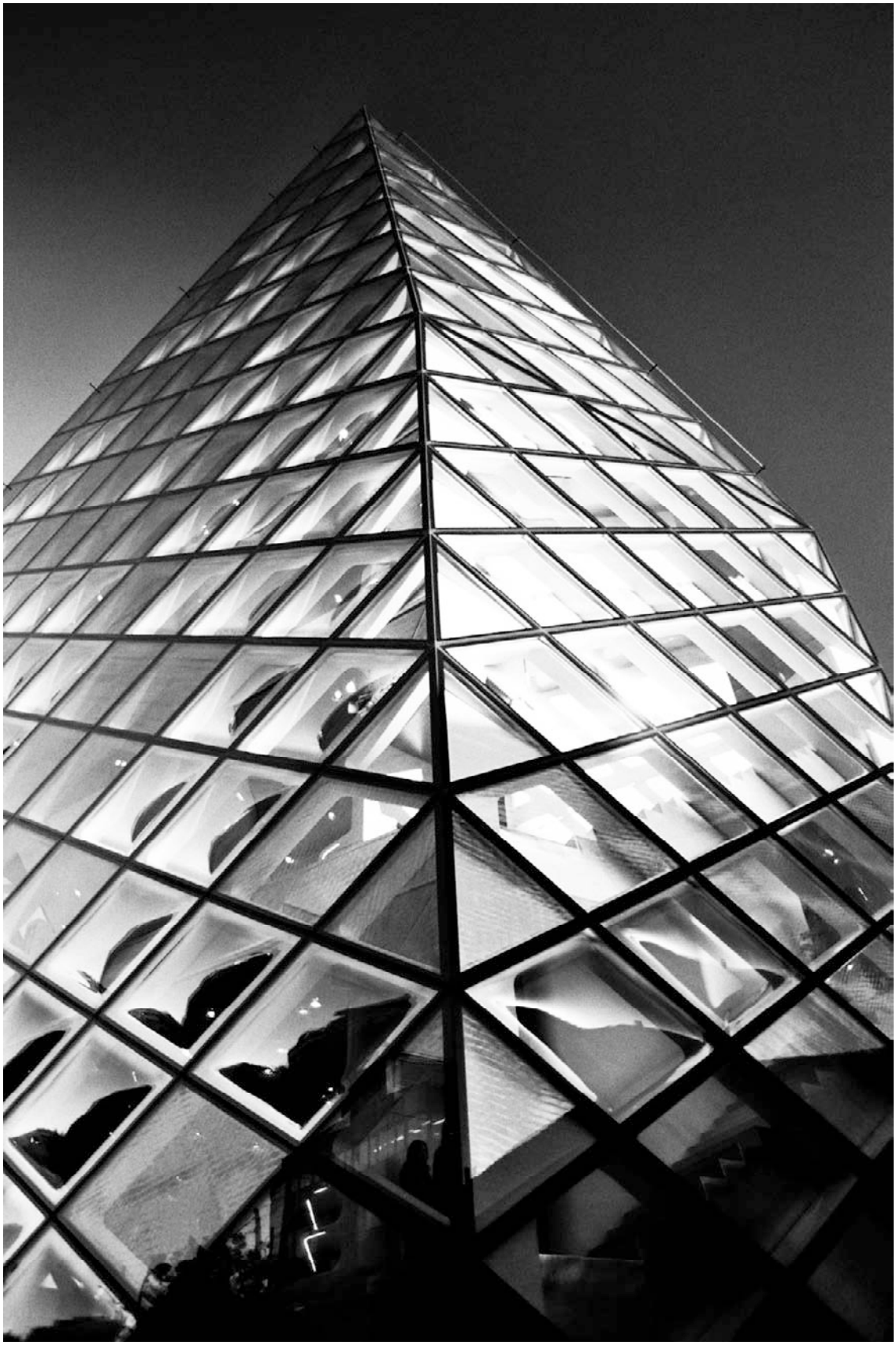

Figure 6: Prada Store by Herzog and De Meuron

The building, built and recently opened in Tokyo, is a tower of glass and steel, which from some angles looks like a honeycomb, with a tail, a wall that runs along the edge of the site, covered by a skin of musk, further highlighting the references to natural material and organic forms. It is a very tactile and spatially complex building, with steel rods that penetrate the volume, multiple stairs and a crystalline and irregular shape. The facades are characterized by four different types of glass. Sometimes smooth and transparent, sometimes they emerge like bubbles, others seem to be sucked into the building as if it is breathing.

The new Prada store defines and symbolizes a new building type, in part billboard, in part architectural shell. Other times the reflective surfaces are totally transparent, become beams of light or hint at the life it carries within. The evolution of housing systems, the introduction of new components and systems that have enabled some architectures, have both demanded greater attention to the problem of reducing energy consumption and the welfare of confining spaces. Customers demand high quality and demand a high level of comfort, now even more because of the considerable complications that certain areas, although certainly characterized by an evocative value, imply just about the control of comfort levels of living spaces. They ask this because a good interior comfort increases, as discussed in the next paragraph, worker productivity, optimizes the space and guarantees to cover the entire lifecycle of the building with low consumption and low maintenance costs.

Comfort, isolation and transparency are factors that require active control by users, the possibility to make the outer surface completely transparent or opaque, the isolation from outside noise, smog, wind, rain, heat and cold and especially solar radiation, to have natural ventilation or simply a natural contact with the external environment. Also important is the possibility to direct natural light within the environments to create a light intensity as uniform as possible, or to ensure appropriate shading to work with the monitors. From a performance perspective, the transition is the one that sees the replacement of highly technological passive walls with active or interactive walls (air chamber systems) using the glass and its performances in a selective way. These walls combine with cooling ceiling and primary air introduction systems, necessary to the control of internal increases over the desired conditions. The internal conditions are so homogenized, irrespective of climate and distance from the outer perimeter.

		K value W/sqm	**Acoustic isolation dB**	**Total transmission of energy TET (SF%)**	**Total transmission of light TLT %**
Conventional Wall (passive system)	Use of highly efficient glasses	1,5	33	35	63
Interactive wall	Variations depend on the speed of the air flow inside of the cavity	1 (0,6-1,2)	38 (36-40)	15 (10-20)	75 (0-80)
Final remarks	Result of the comparison (improvement)	50% on average	Twice better on average	100% on average	20% on average

Table 1: Table comparing the performances of passive and active wall

The extra costs of a dual wall system are offset by reduced costs for equipment and machinery and by a saving of approximately 50% of the total electricity required. The most important contribution is that all the energy produced and consumed within the building (by light, equipment and people) and about 50% of solar radiation is collected by a system through pipes and then directed to the central plant. The new system is successful because requires less material and energy at the same total costs.

It is estimated that over 30% of the requests now look to a better interior comfort, with lower energy consumption and lower maintenance costs. The surface of buildings is therefore moving from a passive to an active or interactive role. The research points to a real reduction in the total energy consumption in the world, hence the need, because buildings consume about 50% of all energy used on earth, reaching 70% in developed countries and warm-humid areas, to insert upstream of the project that wealth of knowledge and studies to identify the most appropriate to the context.

The use of active and interactive systems will reduce of 20% the consumptions compared to older buildings, and it is expected to reach 80 – 90% over the next 15 years.

The new architecture[16], constantly changing, result of a design for " variants" that the new industrial method implies, and that enables the continuous compliance of all requirements gradually emerging, involves the consideration, inside the same building, of elements of different durations. It is about having a "telescopic vision" facing the problem according to a logic much closer to the time, designing the separation and distinction of levels, so that the structure could last for a certain time, even long, but where, at the same time, it is allowed to change everything that happens in the spaces, during their use over time.

The architecture seen as an artistic assemblage of spaces must be able to change, to move; on the other hand, the mobile architecture exists and is therefore easy to imagine, even without thinking that everything should be temporary, but understanding what will be less lasting and most stable[17].

In the reported examples, all aspects make system with connotative and immaterial values of the product (Renato De Fusco) and it's just in these values that we could identify the greatest chance of success of a sustainable design. Released from this bond , solutions become façade solutions and for this reason too modest in terms of environmental sustainability. The complexity of the system calls into question some assessments on both anthropogenic (sociosphere and technosphere) and on non-anthropogenic components (biosphere and geosphere) and if it is unthinkable not to do anything on your system, so is the idea of relying on a blind and deterministic trust in technology, only working on materials at the expense of cultural, social and aesthetic values.

We should intervene on the planning of the system of products, on the link between needs, requirements and products made to meet their satisfaction. None of the methods available to a designer can resolve the current imbalance of this relation. As noted by Ropohl, if human needs are infinite, given the scarcity of resources, one wonders if it's right to satisfy everyone. Aesthetic research must therefore be functional to the reconquest of the ethical role of the designer (Vebleu criticism). The lack of such a premise undermines any other intervention. Stegall argues that "the role of designers in developing a sustainable society is not simply to create 'sustainable products', but rather to imagine products, processes and services that encourage a widespread sustainable attitude. With respect to a unique environment, no longer divided between artificial and natural, the innovation system can lead, through innovative interactions among actors, to the eco-efficiency of system.

About the author

Valter De Bartolomeis received his PhD in Technology of Architecture, investigating themes that bind the contemporary industrial production with contemporary achitecture, and his Master Specialization in Industrial Design at the Faculty of Architecture of the University "Federico II", Naples. Since 2004 adjunct Professor for the disciplines of "Industrial Design" at the Faculty of Architecture of the University "Federico II", and "Graphic Design" at the Faculty of Architecture Vallegiulia of the University "La Sapienza", Rome. He made many experimental researches carried out through workshops and cooperations with companies, both in the graphic design field and in the product and dressing one. All of his researches, as well as the activities conducted in direct contact with companies and production enterprises, follow a single path, made by research and project in the field, characterized by an interdisciplinary approach and themes linked to innovation in the design field, whether the product, components or visual communication.

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[16] From: Corrado Beguinot, "Architectur is intelligent if able to (inter)connect", in: *Telèma* 15, winter 1998/99.

[17] In Valter Luca De Bartolomeis, *Flessibilità, efficienza, spettacolarità. L'industrial design per la gestione del progetto e dei tempi dell'architettura*, Edited by Liguori, Napoli. ISBN assigned 978-88-207-4618-6. Volume recorded in the archive of the Publishing House, n. 0005608.

the Learning Network on Sustainability

Redesign in the context of green design

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Redesign is a kind of design method which in essential is an improvement and refinement of traditional design, aiming at shifting the vitality and value of traditional design. This paper will discuss the “redesign ” in the context of green design, which is different from pure and ideological conceptual design, more emphasis on the “redesign” of everyday products and environment around us which has a deep influence on our life. Nowadays the theme of “mankind in harmony with the environment and striving for sustainable development” prevails in the world, which reveals that “redesign” evolving from human-centered design to green design is in itself a process of constant development.

Introduction

What is redesign? Put simply, it means the improvement and optimization of design. Its core content lies in the pursuit of the nature of things; it means reexamining the design around us from the perspective of green and sustainable development; it also means to seek after the essence of design --- human-centered and in harmony with the environment--- in a most plain and friendly way. From nothing to something, it’s certainly a kind of creation ; making things already known strange, it is more of creation. Redesign embodies itself in the quest of the fairness of economy, resources and environment and of the mutual respect of ideas of one another. Sometimes a tiny originality and modification not only changes the appearance and form of a product, but more importantly changes the mind and consciousness of users as well. This is the charm of redesign.

The quadrilateral-shaped toilet paper, designed by Japanese architect Shigeru Ban, is plain and practicable and is a classical sample of redesign. (Figure 1)

The toilet paper, its core being a quadrilateral, is coiled up in a quadrilateral, whereas the toilet we commonly use is a cylinder and is easily drawn out with a soft pull.

The aim of the toilet paper designed in a quadrilateral is right at its inconvenience which causes some resistance while being pulled. The message conveyed and the function it achieved is the save of energy. The sound while pulling “Kah-tah”is a reminder and warning. Additionally, in the phase of transportation and storage, the quadrilateral-shaped toilet papers are more convenient in transportation. The small idea of green design may appear oblivious, but contains great and warm care for environment.

Figure 1：Quadrilateral toilet paper

Green design ought to run through the whole life cycle and each phase of redesign.

The World Environment and Development Committee under the 42nd GA of the UN in 1987 delivered a report entitled “Our Common Future”, in which sustainable development is defined as “development to fulfill the present-day needs without doing harm to the capability of satisfying the needs in our posterity.” The tenet is in agreement with the connotation of green design, which is the design of product on the principle of green development technology. The so-called Green Technology (GT) or Environment Safe Technology as called in the West, is a general name for technology, technique and products aimed to mitigate the environmental pollution or to reduce the consumption of raw materials and natural resources. The redesign under the proposition of green design aims to overcome the “deficiency” in traditional design, which is not related to function or model. Redesign is to fill up this deficiency in the disagreement with environmental protection or the green conception. In this respect redesign may simply be an optimization or improvement in the technology, appearance, material or manner of application. It may also advocate a fine mode of life, and design the product in ways to meet the requirements of green products, as is illustrated in Figure 2.

The famous Italian brand Moroso launched into market with 'paper cloud' sofa, designed by the Japanese design wizard Tokujin Yoshioka. He utilizes the unique attribute of lightness and fold of the most common A4 typing paper in the office which were vividly represented as clouds in the sky.

The snow-white sofa looks like a sculpture of cloud, and the feeling of a touch is also fascinating. Redesign in the context of green design involves the whole life cycle of a product throughout the conceptualization, manufacture, consumption, obsoleteness and recycling; it is a conceptual mode of “from cradle to grave”. In other words, to fundamentally prevent environmental pollution, and economize on resources and energy, design and manufacture are the key. It’s foolish to rescue after products have caused serious effect to the environment.

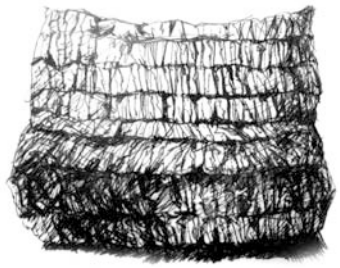

Figure 2: 'paper cloud' sofa

To sum up, redesign in the context of green design is a comprehensive design, which emphasizes the environmental attributes of a product—easy to disassemble, recycle, repaire, reuse and utilizable—throughout the whole life cycle of products, while guaranteeing the product’s basic functions , life span and quality and so on.

Few people are conscious of the fact that architecture is responsible for 1/2 of the energy consumption in the industrialized world. Students from Kansas University designed a one-household house in Rosedale. It is close to the medical center of Kansas University and is likely to become the first house to receive a platinum-level certificate from LEED and will thus turn out to be the first house to utilize renewable energy in Wyandotte County.

In the morning and afternoon, when there is lower demand for energy consumption, 600 square feet of solar energy arrays and household wind-powered turbines will send electricity back to the power grid, thus greatly reducing electricity costs. When the sun sets or the wind abates, the house will like other households be linked to the public power grid.

Moreover, the ground source heat pump contributes to maintaining the comfortable temperature indoors. The cellulose film on the outside walls functions an insulation effect of R-20. A 12-inch cellulose film is also applied in the ceiling. A durable and high-efficient seamed metal roof can prevent dampness and moisture. The outside walls of the architecture are built with vertical wooden rain curtains. As is shown is Figure 3, the illustrated 2,500-square-foot house consists of four bedrooms and two and a half

bathrooms. Its west wall lets in sunlight through its light screens, and a peep through the insulation coiling boards presents a view of the outdoor woods.

Figure 3: American architecture utilizes renewable energy

Muji and Redesign

Everywhere the present world witnesses “clash of civilizations”, the focus of which is the relationship between mankind and the environment. Therefore it wouldn’t coexist with the rest of the world if one single individual culture were maintained, whereas the spirit of concerning with the whole picture of the world and restricting the egocentrism is to become the mainstream. Redesign is also a transfer of culture from generation to generation, passing on advanced ideas and conceptions and leading the public consumption and habits.

The concept of green design has deeply rooted in the heart of people. Economical and pollution-free designs have become priority when redesigning. The conception behind the design of Muji products was developed by Mr. Tanaka Ikko from the aesthetic sense of everyday life. Supported by Tsutsumi Seiji, an entrepreneur, Muji was established in the autumn of 1980 as part of the Seiyu Co., Ltd.

The connotation of Muji is “Inexpensive high quality”. Influenced by minimalist sense of beauty, Muji streamlines its process of production as well as simplifying its models and have manufactured a few series of products which are simply modeled and modestly priced, covering fields of packaging, architecture, furniture and garments, etc. In the concrete process of designing, Muji lays stress on presenting the texture of the product, with simple, careful and considerate packaging. These designs reflect aesthetic sense of Japan and meanwhile have caused worldwide resonance for its green conception. Many commodities present the ideal of being green, environment-friendly, simple and natural. For the sake of environmental protection and consumers’ health, Muji gives up the use of many materials, such as PVC, Teflon, stevioside, and sorbic acid, etc. Taken as an example, most of its packaging is made in transparent and semitransparent, and as simply as possible, as is shown in Figure 4.

Muji has won the support of environmentalists, as it puts emphasis on environment-friendly recyclable materials and simplifies its packaging to the most basic state. Furthermore, Muji never does any commercial advertising, just as Kiuchi Masao says, “In product design we have absorbed the ideas of top designers and advanced conception, and this has served the function of good advertising. We have manufactured products that are accepted by various consumer groups, which makes advertising for our products, too.”

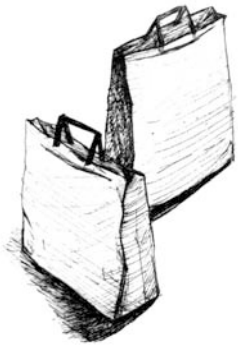

Figure 4: Muji’s packaging design

Redesign is a constantly developing process of creation

Creating out of nothing is no doubt a kind of creation, while instilling something familiar, stereotyped and traditional into the ideal of green design to beautify and integrate it and thus endowing totally new vitality and functions is more of creation and more of challenge. Just as Alvar Aalto says, “No design can be mature when it is done for the first try, which thus leaves room for improvement.” This provides a vast stage for redesign under the proposition of green design.

Paper has quite a long history in Japan. With the intensive research and development, paper has become an environment-friendly material which is super-enduring and super-applicable. TAMU is a company that has manufactured paper container for more than a hundred years. They seek to make paper into the latest daily commodities. The ice-cream-cone-shaped dustbin, made of two layers of paper, is their new product. Utilizing paper as its material is not intended for it to be cast off after being used, but rather, to promote the utility of paper as a new environment-friendly material. The paper dustbin is light, weighing only 233 grams, and yet can vertically contain things weighing 252 kilograms. As is shown in Figure 5, with its simple and elegant color series and inward constringent model, it always remains an option in life for environmental protection, other than a design of startlingly great coup.

Figure 5: Paper dustbins

This is a seemingly insignificant yet very touching case, as is shown in Figure 6. Manufacturers in Nara, Japan were good at making mosquito-nets. Yet with the change of life, fewer and fewer people were using mosquito-nets, which forced the manufacturers to look for other way out. They started to make dishcloth out of the same material. This cloth, after being sewn in two layers, is light and in large patches. It is highly absorbent of water and easy to dry. With elasticity and fine feeling of touch, it turns out to be a good helper for housewives in daily life. There are many such cases of reformation of local industry, which serve as an example that originality never fails to find stage again for those sunset industries.

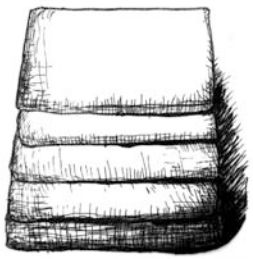

Figure 6: Mosquito-net dishcloth

Conclusion

Design has gradually expanded from the limited individual demands to limitless worldwide demands. Likewise, redesign today is endowed with more content and missions. Redesign under the proposition of green design requires that product designing must conform to the targets set for environmental protection, choosing appropriate raw materials, structures and techniques, reducing consumption in the process of manufacturing and using, without generating any poisonous or side effects. The products must be easy to detach and recycle and the recycled materials must be easy to put into reproduction. All this constitutes a desirable process of recycling. Therefore, the concept of sustainable development is based on the multiplicity of connotations in economic development, environmental protection and responsibility for society.

Redesign is a creative activity which performs a unique evolution of classical tastes and sense of beauty against the modern background and achieves the state of being true. Redesign whether brought about by modeling evolution, or by the appearance of new materials, or by functional improvement ought not to exist alone by repelling green and environmental protection. Inheritance and mobility are the basic law and development mode of design. Redesign under the proposition of green design is not only the self expression of the designer's emotions and feelings, but also the quality and responsibility that any designer with sense of social responsibility is supposed to have. It is also an important mission that is assigned by the age of green technology to design.

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the Learning Network on Sustainability

A 'bottom-up' enquiry into everyday things

Hussain Indorewala

Design practice as it exists in the real world is essentially a 'top-down' enterprise. The narrow and insular concerns and limited choices available to designers and other professionals in a system of production that is highly fragmented, dispersed, complex and compartmentalised in nature conceals its harsh and pernicious fallouts. Such effects are not surprising in a market economy that is essentially *driven by the needs of production as opposed to human needs,* which it fulfils only incidentally. Very few *comprehensive* studies have been undertaken to highlight the relationship between the *market product-system* and the *invisible millions* who encounter them as labourers, advertising actors, consumers, non-users, scavengers, recyclers, or often as displaced communities. What we require is a *'bottom-up' enquiry into everyday things*. The following will attempt to sketch out a broad framework for an enquiry into the socio-ethical, political, cultural and ecological effects of such a 'top-down' arrangement of the system of production. Such an effort could be useful to expose the unseen unpleasantness of our apparently innocent contrivances, and perform the invaluable function of creating a better understanding of the current state of affairs for a largely uninformed public. Designers, who are skilled in various disciplines are well equipped to undertake this role and provide insights to all those interested in achieving a sustainable and just society.

Since 2007, India and the European Union have had nine rounds of negotiations to complete a bi-lateral 'free-trade' agreement, which has been dogged by disagreements over certain "contentious issues" (The Hindu 2010). India has objected to the EU's insistence on the inclusion of "non-trade issues" such as "human rights, child labour and environment," which are not "economic criteria," and hoped that such a deal not be "contaminated by political riders," or issues that require "other forums" (Johnson 2007, Ganapathy 2007). The EU meanwhile is wary of opening up its borders to cheap and well qualified Indian professionals that would drive down the salaries of its own professional workforce. It is also "trying to force India to adopt higher standards of intellectual property," a demand that could "hurt millions [of people] in the developing world" from early and cheap access to generic drugs, especially HIV/AIDS drugs, most of which are manufactured in India (Aiyar 2010, Golikeri 2010).

What is glaringly obvious to anyone who cares to follow these assiduous deliberations is the callous disregard for populations in whose name these 'agreements' are being made. The highly misleading use of the term 'free trade' must be noted, as patent protection, agricultural subsidies and restrictive immigration policies are certainly not 'free trade.' Moreover, it is also no secret who the victims of lack of human rights, child labour and environmental regulations will be, especially in a country where 93% of the workforce belongs to the unorganised sector "bereft of bargaining power" (Breman 2010). A relaxed immigration policy for skilled workers would benefit consumers in developed countries as it would make services cheaper, and an elimination of patent protection in drugs would help save millions of lives around the world (Baker and Chatani 2002).

Almost a hundred years ago, the American sociologist Thorstien Veblen made the distinction between the "vested interests" or those "who own wealth invested in large holdings" giving them the right to "control the conditions of life for the rest," and the "common man," whose conditions of life are "controlled by these others" and are "helpless within the rules of the game."

> A vested interest *is a legitimate right* to get something for nothing, usually a *prescriptive right* to an income which is secured by *controlling the traffic at one point or another*...[c]ontrasted with these

> classes who make up the vested interests, and who derive an income from the established order of ownership and privilege, is the common man…the conditions of life for the variegated mass are determined by *what the traffic will bear*, according to the calculations of self-help [self-interest] which guide the vested interests, all the while that the farmers, workmen, consumers, the common lot, are still animated with the fancy that they have themselves something to say in these premises. (1919: 161-162, 175)

This variegated mass of people are today dispersed, divided, disoriented and dumbfounded by the world that surrounds them, where they are subject to forces they do not understand and circumstances that they cannot control. Large and highly centralised, hierarchical organisations of which they are, as individuals, a tiny component, affect almost every aspect of their lives, yet they are taught to believe that their actions are free from external influences and their hardships are a result of their own misfortunes or a reflection of their own incapacities. They are unable to understand many of their most intimate troubles as outcomes of certain kinds of social arrangements and institutional structures within which they live. Likewise, The institutional roles offered to the professional and technical elite –the engineers, architects, designers, technicians and others– leave them in a similar predicament, though to a much lesser degree, as they benefit from "the good will" that is afforded to them by the vested interests. These professional classes, when they assume to be working in complete freedom, are in fact unconsciously merely dispatching their carefully assigned and specialised organisational functions that are shaped by the realities of dominant institutions. The narrow and insular concerns and limited choices available to them in a system of production that is fragmented, dispersed, complex and compartmentalised in nature conceals from them and dissociates them from its harsh and pernicious fallouts. This is not surprising, rather quite predictable in an economic order that is driven by *pecuniary needs* —or of maximising private gain and wealth— as opposed to one driven by *human needs* —or to satisfy basic needs and creative capacities of every human being with the most efficient use of labour and natural resources— which it fulfils only incidentally and in a shockingly unjust manner.

Some definitions and assumptions

We must now return to our main question, which is: what does this centralised, bureaucratised, automated and dehumanised system of producing *things* do to the human personality? What does it do to the delicate fabric of our natural environment? How much unseen unpleasantness is concealed behind our apparently innocent contrivances?

Designers are professionals that provide technical and artistic skills, and are organised, like other professionals, primarily to serve the public good rather than themselves, or their employers and their owners. It is considered a breach of the ethical code if professionals show incompetence, indulge in corrupt and illegal practices, or purposefully compromise their abilities in order to enrich themselves or others at the cost of the public. But ethical practice also requires questioning the *ends* for which their skills are being used, by refusing to cooperate in any activity that would do harm rather than good to the public. Moreover, if the institutional framework, of which they are a part, does not allow them to act in the interests of the community, it becomes their responsibility to *question the institutional framework itself*, and work towards either reforming the existing order, or identify, enable and nurture alternative frameworks that can secure the interests of the community.

In this essay we use the term *design* broadly, as the mental or intellectual component in the bringing about of any good or service, which would include services that are usually rendered in the industrial enterprise system, by engineers, planners, stylists, consultants, production managers, etc. It is important to emphasise here that by *design* we do not mean the activities carried out by the intellectual elite; rather we mean the sum total of the 'brain-work,' a part of the somewhat vague distinction between mental and manual labour that goes into producing any object of utility, irrespective of who exercises it. The most important end of a system of production ought to be the *unfolding of a person's creative abilities and the enrichment of their social relationships* apart from the fulfilment of their basic needs. Its aim must be therefore, to not just provide material goods, not even a just and equitable distribution of material goods, but to be able to *create free, enriched and self-realised human beings*.

This essay will carry *two important implicit assumptions* that must be mentioned. The first one is that human beings care not only about *outcomes* of their economic transactions, but also the *process* by which these outcomes were attained. And second, that they care not only about what they *themselves* gain or

lose but also what *other actors* affected by the transaction gain or lose (Gintis et al. 2005: 6). This essay aims to sketch a broad 'framework of enquiry' to be able to explore the socio-ethical, cultural and ecological effects of the production, distribution and consumption of a given product-system within the present economic order. It is hoped that such a framework might provide insights not only into the different aspects of the product-system in question, but also into the nature of the order within which it is produced. It begins with the observation that many if not most of the undesired fallouts of the system of production are known to the public inadequately or partially, at least not in a vivid manner; and insofar as they are known, they are considered deviations from an otherwise healthy order, which if allowed to function in the best possible way would not entail such fallouts.

Resources, lands and livelihoods

> From all the bodies killed in the field, you had to cut off the hands. He wanted to see the number of hands cut off by each soldier, who had to bring them in baskets...A village which refused to provide rubber would be completely swept clean...Rubber caused these torments; that's why we no longer want to hear its name spoken. Soldiers made young men kill or rape their own mothers and sisters. (Hotschild 1999: 166)

Almost 67 in every 100 people on the planet today use cellular phones, about 4.7 billion subscribers (ITU 2010). The Democratic Republic of Congo (DRC) is home to about eighty percent of one of the key minerals used to manufacture these instruments, Colombite-Tantalite or Coltan, and one third of another important raw material, Cassiterite. It also has significant quantities of other useful minerals and some precious and semi-precious stones. The quotation mentioned above is from an eye witness of King Leopold's genocidal exploitation of the Congo, at that time for rubber, the demand for which had suddenly shot up when John Dunlop invented the inflatable tyre in 1888, making riding on wheels less bumpy and much more comfortable ever since. But identical words might be spoken by any of the faceless Congolese who today carry stones on their backs for miles at gun point; then we had smoother bicycles and cars, today we have smaller laptops and phones.

In the DRC from 1998, according to the *International Rescue Committee*, about 5.4 million people have died, making it the deadliest conflict since World War II. Children account for almost 47 percent of the deaths, and an estimated tens of thousands of women have been violently raped and tortured by combat forces (HHI 2010). The conflict is fuelled by trade in minerals mostly controlled by the Congolese national army (FARDC) and various war lords that have carried out horrendous atrocities in their "broader struggle for economic, political and military power." These minerals end up with multinational corporations based in countries like Belgium, US, UK, Canada, Thailand, China, India and others, who have continued to buy them "without adjusting their practices in the light of the conflict" and have failed to "ensure [that] their trade is not fuelling the violence" (Global Witness 2009). The findings in a series of reports by a UN panel in 2001 and 2003 "sat uncomfortably" with UN Security Council members who "were reluctant to punish or even seriously investigate corporations based in their own countries" that had "breached international business norms in their operations in Congo" (Woudenberg 2006).

Since independence, India has displaced or grievously affected about 60 million people in various 'development' projects such as dams, industries, mines, transport, etc., 40 percent of them being indigenous people, and a majority of the rest belong to the lower casts or the rural poor. Rehabilitation provided to the affected has been negligible; in fact, the Indian State does not even have reliable data about the displaced or the consequences of displacement on the affected people. Though the use of force and terror has been common, the main mechanism of displacement is a colonial era legal framework that gives the government the right to take over land for 'public purposes' or for private enterprises (Lobo and Kumar 2009: 4-21). Companies such as Tata Steel and Essar Steel in 2005 even financed a 'peoples militia' organised by a state government that burnt and emptied 640 villages displacing 350,000 indigenous people just in one district, to make way for resource extraction. A draft report from the government's own Rural Affairs Ministry called it "The Biggest Grab of Tribal Lands after Columbus" (MRD 2009: 160-161).

Volumes would be needed to document in detail all such horrors from around the world, but crude patterns can be discerned by these examples. Conflicts over resources have spawned considerable amounts of literature in recent years, and concepts such as "the resource curse" (Sachs and Warner 2001) and "paradox of plenty" (Karl 1999) have been invented by scholars to explain this perplexing phenomenon. But the ethical questions, which a concerned person might raise, are not so complicated: to whom

do the resources belong? Who got to decide how they were to be used? Who will benefit most from the exploitation of the said resources, and who will lose? Did the use of these resources *improve* the lives of the rightful owners (who may not be the 'legal' owners) or did it make them *worse*? Did they have the right to define what is considered an 'improvement' *themselves*?

Labour / work

> …the understandings of the greater part of men are necessarily formed by their ordinary employments. The man whose whole life is spent in performing a few simple operations…has no occasion to exert his understanding, or to exercise his invention, in finding out expedients for removing difficulties which never occur. He naturally loses, therefore, the habit of such exertion, and generally becomes as stupid and ignorant as it is possible for a human creature to become. (Smith 1776)

A report by the National Labour Committee (2009) documented the working conditions in the Meitai factory in Dongguan city, China, which manufactures computer equipment for companies such as Hewlett Packard, Dell, Lenovo, Microsoft and IBM. The workers, sitting on hard wooden benches without backrests, assemble keyboards that move across them on an assembly line, 500 per hour, or one every 7.2 seconds, everyday. Every key must be inserted into the board within 1.1 seconds, making it 35,750 *operations* a day (11 hour shift), and about a million *operations* a month. They are paid *one* cent for 50 *operations*, or 65 cents an hour. They are not allowed to listen to music, raise their heads or put their hands in their pockets. A visit to the bathroom has to wait until the break, as the assembly line cannot stop for one worker. They are fined two hours' wages for arriving one minute late or not trimming their fingernails, and three days' wages for leaving their workstations without permission. The management encourages the workers to "love the company like your home" and "continuously strive for perfection."

This method of production was outlined by Fredrick Taylor in his two treatises (1905, 1911) where he termed it "scientific management," or the breaking down of a workman's skill into routine and repetitive "motions" and operations that can then be handed out to them by the management in the form of instructions and tasks. It took quite a while before this method was perfected, with the arrival of advanced automatic machines with all the "intelligence" of production built in (Noble 1984: 36). The mix of mechanised, simplified tasks and self-adjusting, automatic machines required just button pushers as workers, stamping them for life, robbing all their autonomy and discretion, turning their lives into a "chronic illness" (Mumford 1964). A healthy human being on the other hand is the one, who is free to exercise her creative abilities and express her emotional and intellectual potentialities, which are an inherent part of her nature (Fromm 2004: 231). An object that is produced by an automaton under compulsion and command might prove useful to some, but it can never elevate itself to the level of a genuine *creation*. As John Dewey puts it,

> ...wherever conditions are such as to prevent the act of production from being an experience in which *the whole creature is alive and in which he posses his living through enjoyment*, the product will lack something of being esthetic. No matter how useful it is for special and limited ends, it will not be useful in the ultimate degree – *that of contributing directly and liberally to an expanding and enriched life*. (2005[1934]:27)

As long as oligarchic institutions overlook and organise production, the individual will remain a tool subject to the will of his masters, unless economic institutions are democratised in the meaningful sense of the term. The important questions regarding labour and work are: what are the conditions under which the object in question is produced? Do the producers control and manage their day to day affairs? Who owns their means of production? Does the work help unfold their creative capacities or does it stifle them? Do they have a fair understanding of all the various aspects of production? Do they enjoy what they produce themselves?

Technology

In 2003 at the World Economic Forum in Davos, Richard McCormick, president of the International Chamber of Commerce, accused 'anti-globalisation' activists of being "modern-day Luddites who want

to make the world safe for stagnation" (BBC 2003). The use of the word "Luddite" is instructive, referring to the early 19th century movement of English textile workers who rebelled against the social changes that new technology forced upon them, making their skills useless, suppressing their wages, and driving them out of employment. That neither the activists nor the real Luddites were 'anti-progress' or 'anti-technology' is a trivial factual detail, inconsequential to the loyal spokesmen of the vested interests. In the words of David Noble,

> Technological development has come to be viewed as an autonomous thing, *beyond politics and society*, with a destiny of its own which must become our destiny too… technological development has become simply the blind weight of the past on the one hand and the perpetual promise of the future on the other…The loss of the concrete, the inevitable consequence of the subordination of people at the point of production, has thus resulted also in the loss of the *present as a realm for assessments, decisions, and actions*. (1995: 5-6)

Lewis Mumford (1964) made the distinction between "authoritarian" and "democratic" technics, the first drawing on scientific discoveries and inventions to create "human machines composed of specialised, standardised, replaceable, interdependent parts—the work army, the military army, the bureaucracy" to create an "economy of controlled abundance" which expresses "a deep hostility to life." Democratic technics on the other hand has always been autonomous, creative, durable, "under the active direction of the craftsman" and made "discreet use of the gifts of nature." The emphasis here is not the technology itself, the important question is how technology is *organised*: Does it enslave or liberate? Who shapes it? Whom does it serve? For what ends and under what conditions?

Quite a few writers sympathetic to the human condition have expressed the hope that scaling down, decentralising and shifting to alternative technologies might alleviate our most urgent ills; but this view inspires a great deal of energy and effort into finding a technical fix to a firmly entrenched social problem. The problem we face isn't technology as such; it is the system of domination and control that converts every technological advancement into a tool to strengthen its power and influence.

Consumption

At no point in history has human society been as productive as it is today, yet a third of the species is food insecure while more than a sixth, about 1.02 billion, live in starvation (FAO 2009). The richest two percent of the world's population own about half the global household wealth whereas the bottom fifty percent own just one percent (Oziewicz 2006). About a third of the world's urban population lives in the slums, some in degraded but most in appalling conditions, and are projected to increase to about two billion people by 2030 (UNHSP 2003). A naive observer alert to the facts but ignorant about the niceties of economic theory might be horrified by such harsh realities, where so many are deprived of the bare necessities for survival while a few are awash in superfluities.

For most of human history, producers and consumers of goods had close relationships, even personal relationships, which ensured accountability and quality, strengthened mutualism and interdependence, and engendered honesty and fair dealing in their interactions. The nature of the system of production that is driven by calculated self-interest for an impersonal market creates an estrangement between consumers and producers that seems impossible to mitigate within the established institutional framework. Goods were produced in the old days because the community had a need for them; today goods are produced for private gain and since the existence of the system depends on uninterrupted production, the produce of human effort must either be wasted or consumed or wastefully consumed. To affect the latter, perverse methods are concocted to induce superfluous and wasteful consumption, well orchestrated campaigns are devised to create passive, acquisitive, mindless consumers, who, in their "struggle for pecuniary reputability" (Veblen 1899) strive to accumulate as many needless contraptions as they can afford.

This form of induced, passive consumption results in a state of affairs where the relationship that average consumers share with the objects that surround them is mixture of awe, incomprehension and possessiveness. They are in general unable to understand the forces that shape their environment, even though they are hopelessly dependent on it; the spicy commonplaces their televisions throw at them must be enjoyed, but they must remain ignorant of the principles that make it work. A curious child might be eager to strip it apart and peer inside, but such dangerous tendencies are quickly curbed and he is taught how to 'use' the device properly. The spirit of discovery and invention must be subdued, what must be cultivated instead is a habit of shallow gratification.

A rational, if not a more democratic system, would begin from consumers, determine their needs, and then set about trying to fulfil them; as consumers they will decide what must be produced, and as producers they will decide how much they wish to work. Hence, a few among the many questions we need to ask about consumption are: Are the basic necessities for a decent life secured for all? Who decides what is to be produced? Are the needs purportedly satisfied real or induced? Do the goods stimulate creative tendencies or possessive tendencies? Do they invigorate or do they stupefy?

Disposal

In a very famous leaked memo, the Chief Economist of the World Bank in 1991 wrote that "the economic logic behind dumping a load of toxic waste in the lowest wage country is impeccable" and worried that countries in Africa are "vastly" under-polluted (Vallette 1999). The human and economic costs of electronic-waste, one of the fastest growing waste products, are consciously shifted to the most invisible, vulnerable, inaudible and dispensable people around the world. Crude workshops and scavenging unprotected workers in Asian, African and Latin American countries process these wastes in horrid conditions to extract valuable metals, exposing themselves to toxic contaminants; un-recyclable and processed materials are then dangerously discarded in landfills, waterways and incinerators (Ladou and Lovegrove 2008). Separating the metals from plastic requires dipping in acid baths and burning in open fires. One report (Down to Earth 2010) observes a young girl "whose hair shines golden in the sun because of the copper extracts in it." The ideal of our present system of production, what some triumphantly call 'globalisation' is an eight year old in rural India separating toxic metallic components from circuit boards that she does not understand, belonging to computers that she cannot use, but she does it anyway, as it might keep her alive.

It is perfectly possible to design goods that can be easily dismantled, reassembled, recycled and safely disposed. But within the current rules of the game, since producers reasonably assume that toxic wastes, health hazards and landfills are someone else's problem, it's unfair to let someone else free-ride at their expense. Caring about fellow creatures and the environment in a way that doesn't profit is a "fundamentally subversive doctrine" as explained by Nobel Prize winning economist Milton Friedman (1970).

Accidents / fallouts

For the "most tragic example of industrial negligence in history," more disastrous in human impact than Chernobyl, an Indian court sentenced eight Indians for two years imprisonment, under a charge used mostly for traffic accidents (Nundy 2010). 25 years and 15,000 lives later, justice for the Bhopal gas disaster victims was finally done. The amount of compensation the survivors received was about $400 each.

For the Exxon Valdez disaster in 1989, ExxonMobil paid "record-breaking" legal fees, and after 19 years, it was fined $507m. This amount is what the company made every 10 days in 2009. The Deepwater Horizon oil Spill continues to spew the amount of the Exxon Valdez spill every 4 to 7 days. The devastating effects of these and many lesser known industrial accidents on lives, livelihoods and the environment are impossible to enumerate.

Conclusion

One of the most urgent challenges facing the professional classes today is to be able to break out of their narrow specialisations and assess the larger social and institutional structures within which they operate. They need to be able to challenge a system that reduces a great part of humanity to servitude and drudgery in the name of efficiency and progress. They need to look for alternative frameworks, or nurture new ones that are not only rational and ecological, but which also allow the fullest realisation of the potentialities of the individual, the community and the species.

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the Learning Network on Sustainability

The value of imperfection in sustainable design

The emotional tie with perfectible artefacts for longer lifespan

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Current Hyperconsumerism Society have been causing drastic environmental repercussions, most of which designers are responsible for and they should attempt to solve adopting such promising approaches as "designing new production–consumption systems". In the research here presented, alternative sustainable relationship between individuals and objects has been studied to prolong artefacts lifespan through the rediscovery of the affective tie for environmental gains. The study aims to give new value to what is addressed as "imperfect", as potential traces of the vitality of objects, reinforcing an emotional linking. To the purpose a wide survey has been carried out investigating cultural traditions first, and then an original analytical exercise has been carried out to identify potential "imperfect" features for sustainable design approach. On the basis of almost 100 significant (semi-)industrial objects, 4 main design approaches have been identified: Standard Unique, Time and use signs, Breakage followed by fixing, Breakage followed by a new function.

Introduction and objectives

Humankind is characterized by a strict relationship with artefacts, which interact with in order to carry out own activities or to enjoy their emotional aspects. The tendency towards accumulation have been terrifically increased in the last decades bringing to the Hyperconsumerism Society, that is an affluent society in a hypertrophy époque based on the creation of artificial needs for organized wasting (Lepovetsky, 2007). The aforementioned habits have been causing drastic environmental repercussions, mostly defined in the design phase (Thackara, 2005). To remediate to own responsibilities, designers have to make a radical ethical choice in order to become active agents in the transition towards sustainable ways of living (Manzini, 2006). Among the four potential approaches that designer can adopt for sustainability, "designing new production–consumption systems" appears to be one of the most promising (Vezzoli & Manzini, 2008). New sustainable patterns of consumption and production (SCP) have been increasingly studied and proposed even in international institutional level (OECD 2002), where durability and a revised relation with objects system is fostered.

In the research here presented, alternative sustainable relationship between individuals and objects has been studied to prolong artefacts lifespan in their whole life-cycle; a new relation sustained by the rediscovery of the affective tie for the goal of the achievement of environmental gains. Artefacts are intrinsically addressed to support users in their life, thus they can be considered as living mutant entities, tending to change their appearance or even their function during the lifespan, as wrinkles or scars for humans. The study aims to give new value to what is generally addressed as "imperfect", as uncompleted or endowing singular features, not allowed in standard industrial produce. Here imperfect features are studied as potential traces of the vitality of objects, reinforcing an emotional linking, in time and space. From a sustainability point of view, this aim is sustained by the consideration according to which:

> Design for sustainability does not necessarily imply any particular type of aesthetic or outer appearance for a product. […] And in further contrast to the current uniformity in product appearance that relies so heavily on 'newness', design for sustainability must also embrace the aging of products, the

> accumulation of meaning over time, and more profound notions of attachment and empathy. (Walker, 2009).

Imperfection in ancient cultures: wabi sabi

The potential value of imperfection in current society as been firstly evaluated through the investigation of cultural phenomena or even whole values system related to similar basis.

Japanese culture best valorised the appreciation of "imperfect" artefacts, according to a Weltanschauung called Wabi Sabi, emerged in 900 a.D. with a peak in the XVI century (Juniper, 2003). Wabi-sabi represents a comprehensive aesthetic centred worldview founded on the acceptance of transience. The Japanese term "wabi" means "to languish" and it indicates several mood conditions, as loneliness, humbleness, misadventure. Wabi refers to an emotional interior subjective condition. Sabi, instead, indicates the senses of desolation and of the impermanence of life, mainly referred to tangible contexts connected to exteriority and objective sphere. The two terms have been increasingly coupled, loosing any trace of distinction of the corresponding meanings in order to generate a unique sense. The pair endows a so highly elusive meaning and some authors tried to roughly define it:

> *Wabi sabi is the beauty of imperfect temporary uncompleted things. Wabi sabi is the beauty of humble modest things. Wabi sabi is the beauty of unusual things.* (Koren, 2002)

> *Wabi sabi is the beauty of faded, eroded, oxidized, scratched, intimate, rough, earthy, vanishing, elusive, ephemeral things. It is a kind of beauty beyond the dichotomy between beauty and ugliness, between ordinary and extraordinary.* (Sartwell, 2006)

Wabi sabi derives therefore from a new perception of time, assumed as intransient and ephemeral, noticeably proved by the signs that events impress on surfaces of both human skin and objects. From this point of view, such values as mutability and alteration can be intended as the basis for the design of daily objects.

Contemporary phenomena for imperfection

The fascinating sense of transient time and changeability is present in Western society too. If the oriental perception of wabi sabi was widely spread in all aspects of life, in western expressions of this mood have been mainly addressed towards artistic and industrial design applications, generally overlapping the issues of error, imperfection, wear or degradation. These expressions invite to the adoption of novel conditions, far from static, harmonic, symmetric situations but embracing different constants, as de-symmetry, de-harmony, de-rhythm (Dorfles, 2001).

"Eternally Yours, time in design" represents one of the best research about the aforementioned condition. Collected in a book (Van Hinte, 2004), the results of the experts roundtable proposed the elongation of artefacts' life-cycle based on the emotional attachment by user through the valorisation of imperfections, time- and use-signs, specifically designed. Eternally Yours suggests the creation of objects able to change in time and according to users' ways of interaction with the aim of avoiding "the fear and the discomfort of objects that always appears to us as unknown" (Sartwell, 2006). Several projects within Eternally Yours were intended to foster a novel design approach. Among them \/ Projects, an open source collection of 24 good-design-principles, affirmed among the others the Design about a future nostalgia, the creation of emotion tie between users and artefact as a sentimental ingenuity, the capability of products to grew and evolve. Proud Plastics project, by Marieke Sonneveld and Liesbeth Bonekamp, aimed at increasing the aesthetic value of specifically plastics, elongating their lifespan in artefacts. Finally, Long Now Foundation promotes a way of living, designing and thinking over a long term, even in millennia, to foster the necessity for a Weltanschauung conscious of the consequences of human actions, even through artefacts potentially supposed to last for eternity.

Eternally Yours was set in 1995 and very few cases followed this experience, especially relating to mass products. The research here reported aims at evaluating if the same attitude towards longevity may be fund in current (or recent) industrial produce, mainly highlighting the tangible designed solutions to go beyond the just theory or experimental dissertations.

Design approaches for imperfection

An original analytical exercise has been carried out to identify potential features in value of "imperfect" for sustainable design approach. The analysis collected almost 100 significant (semi-)industrial objects, characterized by an conventionally imperfect appearance or requiring new interactive approach with users during the whole life-cycle. Four potential approaches to sustainable design through the elongation of artefacts lifespan emerged:

- Standard Unique: industrial defects and differentiation as possible value;
- Time and use signs: the product as a dynamic element;
- Breakage followed by fixing: the sustainable emotional aspects of products' mending;
- Breakage followed by a new function: the breakage opening new functional scenarios.

Standard Unique

The intent of adding value to imperfections regards also industrial phenomena generating products characterized by aesthetic and morphological lack of homogeneity, currently bound to be rejected. The event of error is here assumed as an opportunity to develop novel hybrid entities able to stimulate an attitude to innovation: error is the means through which something can be possible and accepted when a new name is attributed.

The acceptance of discontinuity and inhomogeneity in industrial products field potentially carries consistent advantages. First of all, this kind of attitude allows to avoid heavy both environmental loads and economic costs connected to the implementation of materials, processes, machineries to obtain "perfect" features, typically mirror polished surfaces. Standard Unique approach suggests the vagueness of the final appearance as an addition of distinctive character to mass production artefacts. The deriving unique aspect stimulates the user to maintain the artefact for individual distinction, delaying the discard. Thus the object becames "eternally" his/her. Main features for differentiation are:

- Material;
- Process;
- Assembly.

Material

Material used in products potentially generate evident differentiation especially in the case it derives from:

- natural raw resources, i.e. variable for natural phenomena, as for wood (e.g. highlighting wood cracks in *Stitched Table* by Uhuru) or stone (e.g. leaving very rough surfaces in marble *Delaware bluestone project* by Lamb);
- recycled pool, i.e. non-homogeneous appearance with various colours or inclusions (e.g. recycled paper in *Parupu chair* by Claesson, Koivisto, Rune; plastics with inclusions in *EcoFish* chair by Cappellini; recycled Tetrapack in *Dot* table by Danese Milano);
- re-used objects, i.e. deriving from unpredictable applications, as processing scraps (e.g. leather scraps in *Free seams armchair* by Dimitrova and Bonvini) or discarded objects (e.g. various objectes in *Fossile Moderno* cabinet by Adami).

Among them, the *Pompon* armchair (see Figure 1) by Con3studio represents an admirable case. The armchair is upholstered with selvages, that are virgin systematic scraps in textiles processing. Meant to be discarded, the selvages constitute a ratio of 6% in the whole production, with an appreciable environmental gain. Furthermore, aesthetic qualities of the material are strictly connected to the production, varying according to the seasons and trends. Therefore, every Pompon armchair is a distinct item for the variability of both material and time, enhancing the sense of unique product for user.

Figure 1: Pompon chair, from textiles processing to final product.

Pictures by Con3studio

Analogously, the practice of industrial scraps recovery not only avoids the accelerated destination to grave prolonging the lifespan but also creates economic opportunities as for Regenesi (http://www.regenesi.com) or Remida (http://www.remidaanzola.it). Regenesi is a young firm realizing a collection of product in recycled post-consuming material. Similarly, Remida is a creative Italian recycling centre producing unique artefacts from the rejected materials provided by a network of 150 firms.

Process

Distinctive features in mass production may derive from processing step, through:

- parameters set to the purpose (e.g. human interference in *Saving/space* vase by Plust; *Roughly drawn* chair by Cohda);
- unpredictability of the evolving process (e.g. using algorithms in *Breeding table* by Weisshaar and Kram; through natural processes in *Second nature* by Yoshioka).

The second situation usually implies the discarding of the product although in conventional performance qualities and consistent with the rules of quality control. A novel attitude towards the analysis of defects deriving from industrial processing could lead to rethink some design issues connected to defects as added value features o aesthetic quality of the product. In this research, a mass production process has been analyzed to assess the potential influence of designers' choices to create distinctive artefacts saving energy and avoiding scraps. Interviewing industrial experts and referring to literature, the most prominent "defects" from polymeric injection moulding have been explored, assessing the potential aesthetic value compared to analogous relevant commercialized products on one side and on the other the potential loss in mechanical or morphological performances (see Figure 2).

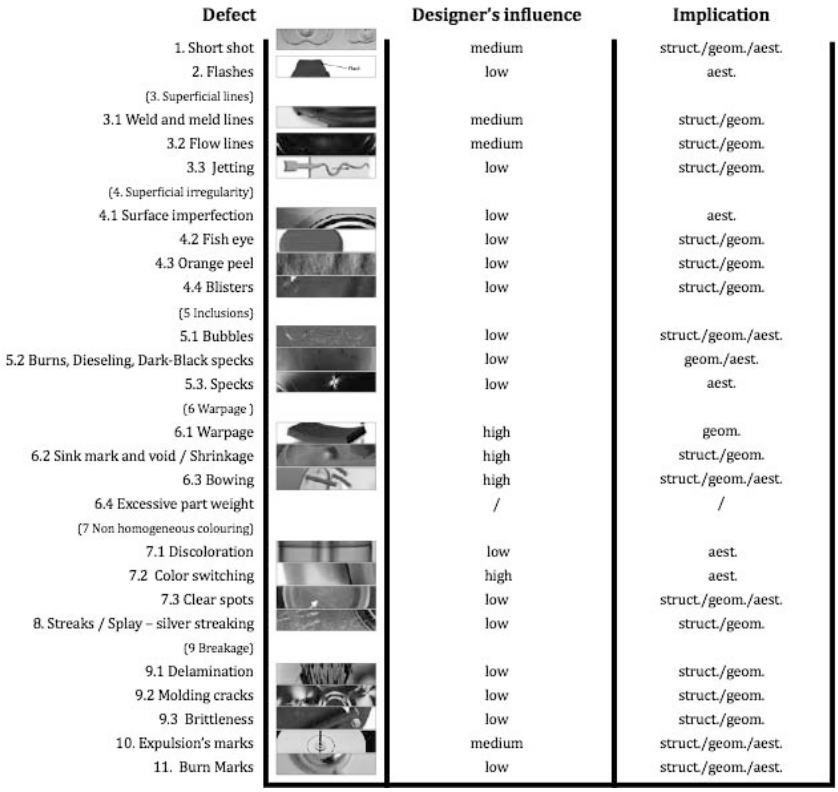
Among the most appreciable, the effects most potentially applicable are:

- Discoloration, typically proposed for denim treasures, almost constantly in last decades;
- Inclusion, associable to the value of insects captured in amber;
- Splay or Silver streaking, generating patterns similarly to *Emerso* vases by Paolo Ulian;
- Bowing, producing curious morphologies comparable to *Blow away* vase by Front for Moooi;
- Colour switching, showing pleasant nuances effects as similarly proposed by Patrick Norguet in *Rainbow* chair for Cappellini.

Assembling

Unique features can be achieved event in assembling step through a random association of modular items by operator or user, obtaining high variations while limiting costs. Modularity has always been a key feature for successful customization in industrial production, from kitchen systems to automotive, generally characterized by longer lifespan. Recently, an exponential rising of customized mass products has been observed, especially with very distinctive appearance, as for the *Standard/unique* chair by Maarten Baas for Established and Sons or *Clouds* modules by Bouroullec brothers for Kvadrat.

Figure 2: Explored effects from polymeric injection moulding processing, according to aesthetic value, designer's influence and implications (structural, geometrical or aesthetic)



Defect	Designer's influence	Implication
1. Short shot	medium	struct./geom./aest.
2. Flashes	low	aest.
{3. Superficial lines}		
3.1 Weld and meld lines	medium	struct./geom.
3.2 Flow lines	medium	struct./geom.
3.3 Jetting	low	struct./geom.
{4. Superficial irregularity}		
4.1 Surface imperfection	low	aest.
4.2 Fish eye	low	struct./geom.
4.3 Orange peel	low	struct./geom.
4.4 Blisters	low	struct./geom.
{5 Inclusions}		
5.1 Bubbles	low	struct./geom./aest.
5.2 Burns, Dieseling, Dark-Black specks	low	geom./aest.
5.3. Specks	low	aest.
{6 Warpage }		
6.1 Warpage	high	geom.
6.2 Sink mark and void / Shrinkage	high	struct./geom.
6.3 Bowing	high	struct./geom./aest.
6.4 Excessive part weight	/	/
{7 Non homogeneous colouring}		
7.1 Discoloration	low	aest.
7.2 Color switching	high	aest.
7.3 Clear spots	low	struct./geom./aest.
8. Streaks / Splay – silver streaking	low	struct./geom.
{9 Breakage}		
9.1 Delamination	low	struct./geom.
9.2 Molding cracks	low	struct./geom.
9.3 Brittleness	low	struct./geom.
10. Expulsion's marks	medium	struct./geom./aest.
11. Burn Marks	low	struct./geom./aest.

Picture elaborated by the authors with data and pictures taken from few sites as www.tanhowsay.com and www.plastictroubleshooter.com

Time and use signs

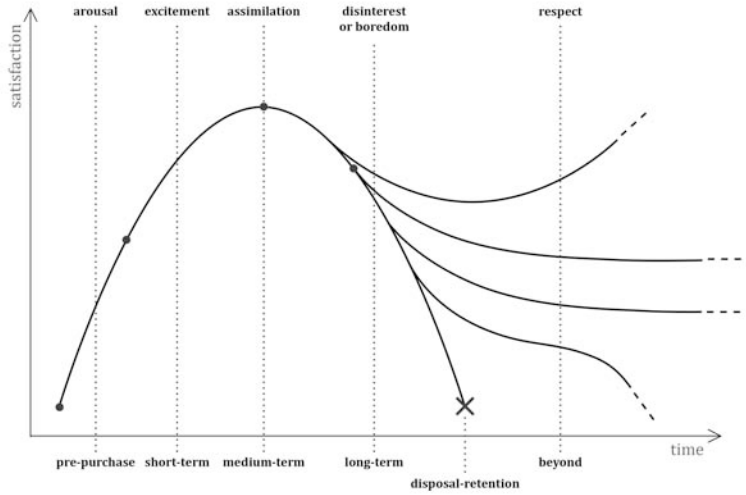
Time and use signs approach aims at considering artefacts as dynamic, changeable entities, evolving in the time instead of the conventional conception of static objects. Objects are supposed to react as living entities growing and evolving with users, sharing with him/her experiences and moods. In fact, "design-able future, so devoid of obsolescence, waste and serial dissatisfaction, is filled only with attachment, evolution and mutual growth." (Chapman, 2009). The sense of satisfaction during the lifespan of products therefore varies approximately as can be observed in the Figure 3. The final result could the enhancement of the emotional tie and the level of satisfaction connected to time passing till a sense of respect, as Martin Woolley (2003) theorized.

Evolving feature tends to weak the attitude to discarding, while to increasing lifespan and environmental gains. From a design point of view, the prediction of potential scenarios is fundamental to correctly apply all the devices necessary to giving value to time stream, i.e. anticipating the traces that necessarily mark an object over the time. Here, the "imperfect" characteristics assume the sense of "perfectible" features, tackling to the eventuality of never-ending changing process towards a diverse, likely better, state.

Main factors determining the variation and aging of products are:

- time
- use
    - daily
    - appropriative.

Figure 3: variation of satisfaction deriving from artefacts during the time (interpreting Woolley, 2003)



Graph by the authors, on the basis of Wolley (2003)

Time

Time category includes phenomena deriving from the alteration typically by corrosion and patina, indicative of time memory, as for such metal like iron, steel – especially Corten – , silver, brass or copper. The last one has been valorised by Odoardo Fioravanti in his product *Verderame* (see Figure 4), a copper floor tile tending to generate a covering protective patina in about two operative months. The general appearance changed in colour except for that area covered with a transparent film, showing a previously latent pattern. The pattern ironically represents the silhouette of objects that can be plausibly found over a floor: a pen, a shoelace, a beetle. Therefore the intriguing feature of Verderame – winning the contest "Il rame e la casa" (The copper and the House) in 2009 – is the ability to visualize both the passing of time through the generation of the green patina and the use of the objects. In fact, people repetitively walking over the floor polish the green patina, maintaining the original reddish colour. So, over a long period, paths of conventional walking emerge too.

Figure 4: Verderame by Odoardo Fioravanti

Composition from pictures by Tommaso Caldera, Paolo Giacomazzi, Odoardo Fioravanti

Use

Using things imply touching, handling, elevating, laying down or bring them. Repetitive actions carry signs, modifying the appearance of products, varying according to constituting material, user, gestures, caring…Traces deriving from all these activities are the tangible marks of them they are use signs. In a wide sense they represent the vitality of the objects and as for humans the unavoidable attitude to let the event characterizing own skin, with e.g. wrinkles, scars or tattoos. The perception of an inner vitality in artefacts stimulate user to take care of and keep artefacts for longer time before discarding them. *Memory chair* by Tokujin Yoshioka for Moroso (see Figure 5) is an example of dynamic objects varying and evolving according to user experience and willing. The "perfectible" chair, covered by a flexible aluminium composite sheet, lacks of a specific static shape in order to follow through user's body, increasing the comfort perception over the use.

Figure 5: Memory chair by Tokujin Yoshioka for Moroso

Some signs, instead, are generated actively by user to mark the ownership or in general the strict relationship with the objects; similarly, other products require the some processing by user tending achieve a final useful state: they are appropriative signs and uncompleted objects. These are intentional signs and gestures, necessary for enhanced product customization. The secret of sustainability in time is to be prepared to let the objects go, avoiding to define anything ahead of time (Van Hinte, 2004). To achieve this objective, from a design point of view, simplicity is generally a key factor, escaping from overloading.

In this sense uncompleted product is free change and evolve to follow through the necessities and taste of user. This mood is expressed by Martí Guixé in the lamp *Do scratch* for Droog Design (see Figure 6). The lamp consists of a black lacquered surface, leaving the light passing through it only along the path scratched by the users. Therefore, users etch a personalized drawing over it, enlightened by the lamp: the result is a unique personalized object, doomed to stay with user along his/her life. The gesture replicates the phenomenon generally practised by young people of scratching typically a tree trunk to mark and testify own presence and individuality.

Figure 6: Do scratch lamp by Martí Guixé for Droog Design

Picture by Droog Design

Breakage followed by fixing

Designer endows the competencies to predict and design potential devices and solutions to avoid, or almost delay, the discarding of products in the case of accidental breakage. Therefore huge attention should be addressed to the design approach for restoring the original function after breakage. In industrial field this kind of approach is generally associated to Design for Disassembly (DfD) strategies. In private affairs, instead, the attitude to repairing broken object by oneself is a dramatically spreading phenomenon, as showed by the settlement of movements for Do It Yourself (DIY) practises and by the numerous websites and blogs suggesting both conventional and creative procedures to restore broken artefacts, from home goods to bicycle. Among them, Platform 21 draw up a manifesto in 2009, called *Repair manifesto*, targeting to such mantra as "Stop recycling, start repairing" and "You can repair anything, even a plastic bag". Repairing activities are here assumed as a means to provide occasions for users. Through repairing, individuals became rather a guardian, emotionally involved with the artefacts' health, delaying the temptation of anticipated substitution and thus elongating the corresponding lifespan. Plausible solutions are situated typically post-consumption, through healing creations, generally conveying a new appearance to artefacts, highlighting scars to tackle to their own past, generating unique objects with a strong personal character.

Following the project *L'hôpital des objets*, 5.5 designers proposed the collection *Réanim*: they took care of furniture diseases, as wear or broken parts, recurring to designed prosthesis or small devices characterized by a patent aesthetic value, generally in fluo-colour. Réanim therefore is a tangible solutions suggesting how industrial products can afford to the elongation of lifespan for artefacts, while paying attention to the aesthetic and emotional appeal of products. Furthermore, users are involved in repairing processes, realizing the environmental value through intuitive easy gestures, potentially applicable to other artefacts and fields. The collection includes a chair leg, a seating plane, a tape and other small devices.

The intent of realizing solutions to repair almost everything maintaining an appreciable appearance, a novel material, called *Sugru*, as been patented among repairing creations. Made in silicon, when applied to any surface it dries at the air repairing, unifying, enhancing almost every artefact, and becoming part of it in harmonious way. Its own typical performances (self-adhesion, waterproof, flexibility…), together with aesthetic versatility (in shaping and colours) make Sugru a special solution to restore an empathic relation with artefacts for longer period (see Figure 7).

Figure 7: Sugru applications.

Picture by Jane ní Dhulchaointigh – sugru® HACK THINGS BETTER

Repairing intended as the enhancement of the performances is applicable even to software and virtual devices, through operations as updating or upgrading. Recently the phenomenon has been exponentially rising through operations as co-creation or co-repairing typically on open source systems, as Wikipedia, whose principle lays on the wabi sabi fundamentals. Open source are originally generated as imperfect systems with correlated bugs but over the time and through the collaboration of participants and users experiences supporting each other the product is bound to eternally improve.

This kind of solutions foster:

- the continuous improvement of the system;
- the collaboration and interaction between users;
- the creation of dynamically evolving systems.

Big shot camera represents a similar attitude in hardware field. It is based on the concept of clearly visualizing the inner components of a camera for both educating purposes and the possibility to access to every part for easy repairing and customizing.

Breakage followed by a new function

Objects life is generally assumed ended after the corresponding "breakage", strictly and widely intended. Especially in the current hyper-consumerist society, breakage is often deliberately projected to be anticipated and the phenomenon represents on of the main influent factor for discarding, for reiterating the buying and in general for a further consumption of resources, followed by environmental loads.

In the last phase of product lifecycle, designer are potentially allowed to procrastinate the grave limiting the negative effects of breakage, mainly through:

- the valorisation of the aesthetic value of breakage
- the emerging of residual tasks
- the product reuse**.**

Aesthetics of breakage

The easiest way to approach to breakage is the acceptance of the event, especially if sustained by final admirable aesthetic value or function, through the designing of:

- plausible post-consumption scenarios and tasks after unpredicted breakage (e.g. *Poor Jewellery* by Faldantrager);

pattern guiding the potential cracking to leave the main function unchanged even after (partial) breakage.

Shock Proof by Tjep explicitly shows the second approach. Following Do Break project by Droog Design, Tjep proves how a vase can afford (partial) breakage without a loss of the main task of containing flowers and even water. The goal is achieved enhancing the brittle behaviours of ceramics (the typical material for vases) coupling it with a tough polymeric matrix. Here Design contribution to "eternal" objects is – ironically – evident.

Residual tasks

Breakage contingency for sustainability may be also assumed as an opportunity for accessing to an alternative state of the artefact, predicting and designing the second life for it. An emblematic case of this opportunity is offered by Easter egg, where the chocolate egg itself is designed to allow the separation of the two part in order to reaching the usually polymeric container of a "surprising" toy, generally "broken", i.e. separated in his component to be comprised in a tight space while inside the egg, but to achieve the final state if composed, through the active role of user as a bricoleur.

Similarly, Paolo Ulian designed a specific geometric for a table centrepiece called *Seconda Vita* (Second Life in Italian, see Figure 8), where a pleasant pattern of holes on the constituting clay guides the craking in the eventual case breakage, in order to release small plates (typically for plants) as residual task. Therefore, most of the energy and resources embedded in this product are saved and prolonged in their use.

> "the accidental breakage can be lived non more as a negative event but as a generative event of novel stimuli and realities. I like to think that this artefact can be interpreted as a counsel to not easily discard objects, even in the case of only apparently crocks." (Paolo Ulian)

Figure 8: Seconda Vita by Paolo Ulian.

Pictures by Paolo Ulian

Novel tasks

The “breakage” of a product can finally be interpreted as the completion of the main task but the reuse of the product can be designed especially in three main occasions, which are:

- post-consumption, to attribute a second life to objects were not supposed to do (e.g *Fossile Moderno* by Adami)
- pre-production, designing a specific alternative function (e.g. *Nutella* jar by Ferrero spa as a glass)
- pre-production, realizing device to allowing users in attributing new tasks to common products otherwise discarded (e.g. *Rag chair* by Tejo Remy).

Watering can by Viceversa offer an explicit example of the way of which a designed product can elongate the lifespan of a common disposable artefact, as PET water bottle, attributing to it the novel task of a watering-can, and furthermore it also avoided the necessity for a bigger new product and the corresponding increased consumption of resources.

Finally, the attitude in reusing products after breaking or exhausting their own function is the focus of an interesting study by Uta Brandes and Michael Erlhoff (2007), called Non Intentional Design (NID), that is how common people reinterpret common designed objects for alternative purposes, as a mirror glass to leave messages with a lipstick or a cloth peg to close paper box.

Conclusions and outlook

In conclusion, the research demonstrates the presence of a deep desire, appealing both to designers and firms, of creating more sustainable products, durable and enhanced over the time. This study aims to set itself as both an experience and methodological tool of systematizing the current state of the art concerning this topic, being a valuable basis for the development of more sustainable products. The cases reported show the spreading tendency to a novel approach to objects, for both designer and users; “a revolutionary consumer reality is born, catalysed by new and provocative genres of emotionally durable objects and experiences that are designed for empathy” (Chapman, 2009).

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Innovation and ecodesign in ceramic industry

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The InEDIC project (2009-2011) is an EU Life Long Learning – Leonardo da Vinci funded project, which aims at developing training materials and ecodesign tools to support the integration of environmental considerations in the design of ceramic products, thus contributing to the innovation and competitiveness of this longstanding industry in Portugal, Spain and Greece.

Ecodesign is a concept that receives considerable attention from environmental specialists in all participating countries but specifically in the case of the ceramics sector partners report that there is a lack of know how and training materials to support the systematic integration of environmental considerations in the development and design of ceramic products during the whole life cycle. To support this presupposition by concrete evidence, the InEDIC project included a situational analysis to identify existing materials on the subject and the needs experienced by companies and by vocational education and training institutions. The results will be used to inform the development of the innovative InEDIC ICT-based training materials and tools, ensuring high quality, relevance and appropriateness. The identification of offers was based on data and information collection and analysis, including previous projects carried out by the partnership and other available sources and training courses from reference institutions. The analysis of needs was carried out by interviews with ceramic companies, business

associations and VET organizations as well as meetings with experts and other relevant organizations or initiatives in the ceramic area.

The paper presents the main results of the review and gap analysis in the three countries, as well as the main findings for the next steps of the project: the development of the InEDIC Ecodesign Manual and databases of materials and technologies which support ceramic product developers in the detailed design of innovative, more eco-efficient ceramic products.

Introduction

The Integrated Product Policy of the European Union makes products and services key elements in implementing actions for achieving Sustainable Development. In the design process and development of products and services, the prevention of environmental impacts throughout their life cycle is maximized while innovation and new business opportunities are encouraged and potential cost savings arise.

The main objective of the "Innovation and Ecodesign in the Ceramic Industry (InEDIC)" project is to develop high quality training materials and tools on ecodesign for the ceramic sector, in order to supply designers, trainers and other professionals with the skills to apply this sustainability strategy and practice in companies and to disseminate this know-how in the vocational education and training (VET) system. This project is a follow up of a previous Leonardo Project, "Transfer of Knowledge in the Field of Ecodesign" (contract CZ/04/B/F/PP-168002), upon which the InEDIC project will build by updating the training materials and, in particular, by adapting them to the ceramic sector.

The project started in October 2009 with a situational analysis aiming at analysing the present situation regarding ecodesign in the partner countries' ceramic industry in order to identify existing training materials for the ceramic process and the needs of know-how experienced by companies and of VET institutions (Celades et al., 2010). The situational analysis will be used as a tool for the development of InEDIC training materials, ensuring high quality, relevance and appropriateness, as well as providing a source of information on the state of the art in ecodesign in ceramics, which will be made available to a wide spectrum of stakeholders through dissemination activities.

Overview of the ceramic sector in Portugal, Spain and Greece

Portugal

According to the most recent, unpublished data from the Portuguese Association of Ceramic Industry, in February 2010 there were in Portugal 605 ceramic companies, 401 of which were active. These figures show a decline of the sector when compared to the official data as of 2007 presented in table 2.1.

Table 1: The Portuguese ceramic industry: facts and figures per subsector (2007)

Source: APICER, 2009

Subsector	No. of companies	Annual turnover (€)	No. of workers	Brief market and economic descripiton
Structural ceramics (bricks and roof tiles) NACE[1] 2332	147	205 Mio.	3500	Market: mostly Iberian, transportation costs are a barrier to exports. Competitors: Spanish companies and succedaneum products Domestic market tends to decrease
Ceramic wall and floor tiles	76	370 Mio.	4685	Turnover is concentrated in few companies Market: mostly external

[1] NACE Code is a pan-European classification system which groups organisations according to their business activities

Subsector	No. of companies	Annual turnover (€)	No. of workers	Brief market and economic descripiton
NACE 2331				Strong competition, mainly from Italy and Spain
Sanitary ware NACE 2342	22	278 Mio.	3186	58% of sales to exports (Europe, Angola. Cape Verde, United Arab Emirates)
Table and ornamental ware (porcelain, earthenware and fine stoneware) NACE 2341	405	318 Mio.	10955	58% of turnover to exports The subsector includes a small number of large companies and a very large number of workshops producing handicraft In 2006 Portugal was the main producer and exporter of earthenware
Special ceramics (electric isolators, refractory products and others to various industries such as military, automotive, Aerospatiale, biomedical and electronics) NACE 2343 and 232	50	44 Mio.	664	Most products are exported Low internal competition, due to the products' specialization
TOTAL (2007)	700	1215 Mio.	22990	-

Despite of the difficulties the ceramic industry is facing due to the economic crisis and the prices-based competition from producers outside Europe, the sector has been steadily showing an increase in the quality and capacity of the development of new products, supported by the adoption of the most recent production techniques and the accumulated know-how throughout the years.

Spain

The Spanish ceramic industry is characterized by the versatility of the forms and colours of its products; the industry has always implemented innovation strategies, since the sector stands out for its industrial investment and dynamism.

Table 2: The Spanish ceramic industry: facts and figures per subsector

Subsector	No. of companies	Annual turnover (€)	No. of workers	Brief market and economic description
Structural ceramics (bricks and roof tiles) NACE[2] 2332 Year: 2009	280	Not available	9300	Production: 10000 tonnes Typology: family companies scattered throughout the country. Production is intended for regional or national consumption, due to transport costs. In general, mining operations are located in the areas near the factories, since the low cost of the raw materials does not allow their transportation to be cost-effective.
Ceramic wall and floor tiles NACE 2331 Year: 2009	Ca. 185	2591 Mio.	17700	Production: 324.4 Mio. Spain is the leading European ceramic tile producer and has the highest global per capita tile consumption Last few years: gradual decline in the number of tile manufacturers due to mergers or acquisitions and some shut-downs.

[2] NACE Code is a pan-European classification system which groups organisations according to their business activities

Subsector	No. of companies	Annual turnover (€)	No. of workers	Brief market and economic description
Sanitary ware NACE 2342	Not available	Not available	Not available	Spain has traditionally been one of the main sanitary ware producers, but since 1999 production has declined. The industry is healthy due to the growing importance of the bathroom in the home has increased customer interest in new designs. New trends in the bathroom sector, focusing on greater wellness and care of the room, have led manufacturers to offer customers a comprehensive range of products for the bathroom.
Table and ornamental ware (porcelain, earthenware and fine stoneware) NACE 2341 Year: not specified	Not available (tableware) 190 (ornamental ware)	34 Mio. (tableware)	7600 (tableware)	Tableware: Spain ranks third in sales behind Germany and France. Recent years have witnessed a dramatic reduction in the number of companies. Ornamental ware: 190 small companies located in Valencia region and Andalusia. Fierce competition of production from Asia, particularly China, has led to a significant deterioration in the prospects of this industry
Special ceramics (refractory products) NACE 2320 Year: 2009	33	Not available	1402	-
Ceramic frits NACE 203021 Year: 2009	Ca. 20	794 Mio.	3278	Production: 0.9 Mio. tonnes (60% of European production) The performance of the frits sector closely follows the success of the ceramic sector as a whole, and if the latter declines, then the frits sector that supplies it, will also suffer. Export sales represent more than the 60% of the production. Main export countries are: Italy, Egypt, Portugal, Morocco, Germany, France, Poland and Russia.

Greece

In Greece the InEDIC project focuses on small workshops producing handicraft or art pieces, due to the fact that mass production of tiles and ceramics in Greece is not of special interest since, from the 70's and 80's, many industrial ceramics units have closed down and today almost 80% of total ceramics and clay production comes from small, family based workshops.

Handicraft has always been the tradition in Greece. The respect for ceramic art is inherited from generation to generation, preserving the values of tradition. In Greece there are numerous, mainly family based, workshops which maintain a high level of craftsmanship and participate in domestic and international exhibitions.

We may divide today's ceramists into three categories:

- Traditional ceramists who mainly manufacture houseware items.
- Modern ceramists, who mainly produce decorative items. The products are practical ones, as we might call them, pottery items (such as dishware, bowls, vases, jugs, ashtrays, candlesticks, mirrors with ceramic frames, tables with ceramic surfaces, wall decorations, hangers, lights, pottery items for social events – such as weddings, christenings -, souvenirs or gifts for events, meetings and congresses, table mats and coasters, piggybanks or toys, decorative items for hotels or restaurants, imitations inspired by primitive or Byzantine techniques, etc.)
- Art ceramists: There are many workshops which have more of an artistic character and which deal with products of free expression, creation and aesthetics touching topics of sculpture or a combination of other materials with ceramics – as it is the case of the various installations – or other ceramic items, such as dolls, masks or copies of various objects (tools, shoes (!), houses, tables etc.) These ceramists make unique works and they promote them in personal exhibitions

Ecodesign in the ceramic sector

The manufacture of ceramic products takes place in different types of kilns, with a wide range of raw materials and in numerous shapes, sizes and colours. The general process of manufacturing ceramic products, however, is rather uniform, besides the fact that for the manufacture of wall and floor tiles, household ceramics, sanitary ware and technical ceramics often a multiple stage firing process is used. The key environmental aspects of ceramics production are (European Commission, 2007):

- Air emissions: particulate matter, soot and gaseous emissions (carbon oxides, nitrogen oxides, sulphur oxides, inorganic fluorine and chlorine compounds, organic compounds and heavy metals);
- Process waste water, which mainly contains mineral components and other inorganic materials, small quantities of numerous organic materials as well as heavy metals;
- Process losses/waste, mainly consisting of different kinds of sludge, broken ware, used plaster moulds, used sorption agents, dust, ashes and packaging waste;
- Energy consumption/CO2 emissions: all sectors of the ceramic industry are energy intensive, as a key part of the process involves drying followed by firing (800-2000ºC). Today natural gas and fuel oil EL are mainly used for firing, while heavy fuel oil, liquefied natural gas, biogas/biomass, electricity and solid fuels (e.g. coal, petroleum coke) can also play a role as energy sources for burners.

The ceramic industry has, for many years, performed important technological and managerial improvements to tackle these environmental aspects of the manufacturing phase. In the other life cycle stages, the greatest environmental impacts usually occur during the withdrawal of the product after its useful life. This environmental impact is significant due to the large amount of solid waste accumulated in demolitions due to the large number of construction elements that are removed, with virtually no recycling or reuse because separation from other materials is very complicated.

It is possible to find many ceramic products with innovations that can be classified according to ecodesign strategies; below, some examples from Spain and Portugal are presented. One should keep in mind, however, that the environmental benefits of those innovations were not studied, as they didn't result from a systematic ecodesign method and therefore environmental trade-offs may occur. It is also observed that typically only one strategy or environmental component is observed: again the integrated approach of ecodesign, covering the whole life cycle of the product system was not studied or at least not communicated by the companies. Nevertheless these examples illustrate the potential of ecodesign in an industry which has traditionally focused its environmental efforts in the manufacturing processes. Whether or not this potential is recognised by companies and other players in the ceramic arena was a matter for research and will be presented in the next sections of this paper.

Table 3: Examples of ecodesign in the ceramic industry

Ecodesign strategy	Activity or solution	Examples
Selection of low impact materials	Incorporation of waste	Some tile manufacturing companies recycle pre-consumer waste, reaching up to 90% recycled material by weight while retaining the strength and versatility. There are also examples of house ware and tile producers that manufacture items using the sludge from the wastewater treatment plant.
Reduction of the material use	Reduction in products' thickness	Wall and floor tiles companies have researched into raw materials to achieve a reduction in tile thickness (in some cases from 12 mm to 4 mm).
Selection of environmentally sound production techniques	Reducing kiln firing operations	The ceramic industry has invested significantly in more eco-efficient production techniques. Designers can also influence the environmental performance of the manufacturing processes e.g. by designing products whose production requires less firing steps or lower temperatures.
Optimizing packaging and distribution	Reduction of packaging	Companies have been engaged in reducing the amount of cardboard, shrink plastic and glue, and eliminating strips in packaging.

Ecodesign strategy	Activity or solution	Examples
	Eliminating distribution activities	A recent trend is called picking, a new form of direct sales orders from the end consumer to the manufacturer, thus reducing the transport impacts.
Reduction of the environmental impact during the use phase	High efficiency construction elements	New bricks with high thermal, mechanical and acoustic performances have been developed. In this case it is not the product itself that is improved, but the energy performance of the building, a matter of high concern in the field of sustainability.
Optimizing the end- of-life systems	New method of installation and dismantling	Raised Technical Floor is a method of installation of floor tiles that reduces building waste and facilitates waste separation. This floor is a construction system installed on a metallic substructure at a certain height above the substrate allowing the incorporation of radiant heating systems under the flooring.
New concepts	Integration of functions	Ceramic wall and roof tiles that incorporate a thin photovoltaic film are intended to have a high aesthetic quality and technical performance contributing to a new building architecture type, based on eco-design concepts.

Methodology

In order to confront training needs and offers in the field of ecodesign in ceramics and thus inform the development of the InEDIC training materials, the research followed a combination of questionnaires, experts interviews and a review of information sources such as literature references, data bases of ceramic materials and technologies and others which are relevant for ecodesign in ceramics.

Three semi-structured questionnaires were developed targeting ceramic companies, VET institutions and business associations and included the following information:

- Companies: the company's profile, its environmental strategy, implemented management systems and other certifications, the design strategy, the experience with ecodesign and the needs of know-how in ecodesign the company identified.
- VET institutions: the institution's profile, how design and ecodesign are approached in its training and education offers and the needs in know-how on ecodesign related to the ceramic sector.
- Business associations: the association's profile, its experience with design and ecodesign approaches, including requests from associates, and the needs of know-how in ecodesign the business association considers important for its associates.

The questionnaires were replied by phone or during face-to-face interviews; the partners had therefore the opportunity to clarify any concept that the respondents would not be familiar with, thus reducing the potential bias due to misunderstandings related to the somewhat hermetic terminology used by ecodesign practitioners.

The results of the questionnaires were analyzed using current practices of simple statistics: descriptive analysis, frequencies, averages and simple cross-tabulations to identify trends and examine possible associations between one variable and another.

Confronting the information available and the training offers on ecodesign in ceramics and the needs identified in the survey allowed for a gap analysis and the establishment of a number of conclusions that inform the development of the InEDIC training materials and tools – the next stage of the project– , ensuring its high relevance and appropriateness.

Results and discussion

Review of information sources on ecodesign in ceramics

A thorough review of literature references in the field of ecodesign and, specifically, in the field of design in ceramics was undertaken. This encompassed books, manuals, papers and information included in specific websites. Over 50 references were identified and analysed and the main conclusion is that although a wealth amount of ecodesign materials are available, most of them are not specific for ceramics; and the

sector-specific references found often relate to environmental management of the production processes, to specific ceramic techniques or specific environmental topics such as energy management. No reference on the proposed subject of the InEDIC project was found, so there is clearly a gap to be filled in by the project.

Another issue of interest to the project was to identify existing ceramic materials databases displaying technical, environmental and economic information to support designers choices. The conclusion was that there countless databases and webpages containing lists of "sustainable" materials and products; in some cases they have been rigorously selected on the basis of criteria such as ecolabeling award or life cycle assessment or are publishing within environmental product declarations; however databases whose selection criteria is not clear have been found. Another finding was that it is much more common to find environmental information about finished products than about raw materials.

Similarly, eco-efficient technologies databases were surveyed. In this case the existence of the Reference Document on Best Available Techniques in the Ceramic Manufacturing Industry provides a very valuable and systemised information; however, those techniques that can be influenced by the design and development team are not particularly explored in this document. Other sources in the field of cleaner production have a similar approach: the description of the technologies and managerial measures do not entail a "design perspective".

Training needs and offers identified in Portugal, Spain and Greece

In Portugal the questionnaires were replied by 31 ceramic manufacturers from four subsectors (table and ornamental ware – 11; bricks and roof tiles – 10; wall and floor tiles – 8; sanitary ware – 2), three VET institutions (one Vocational Training Centre, one Polytechnic Institute and one University) and the national business association APICER.

In Spain, 21 ceramic companies from five subsectors (table and ornamental ware – 1; bricks and roof tiles – 1; wall and floor tiles producers – 10; sanitary ware – 4 and special ceramics – 7), 17 VET institutions (mostly Universities) and 6 business associations replied to the questionnaires.

In Greece the questionnaires were handed out to eight ceramic workshops and all were returned. Most of them are family based enterprises (SME's) and all are located in Central Greece, in the broader area of Magnesia Prefecture.

Spain and Portugal have a much more industrialized ceramic sector than Greece, where companies are very small and the production capacity is much lower. This conditioned the sample for the interviews and the focus of the study and therefore the findings regarding the ecodesign training needs of Spain and Portugal are very different from those of Greece. In the former, training offers are wider and most of them are encouraged by the government, through public education in Universities, VET or other institutions; however, in Greece there is a lack of state schools and diplomas, and total absence of pottery classes in school and professional training, since this knowledge is inherited from generation to generation.

The common points found in the gap analysis of Portugal and Spain are shown below, followed by the conclusions from the gap analysis of Greece, due to the different situation:

- All the surveyed entities and organizations seem to know the meaning of ecodesign and the majority defend its importance in the reduction of environment impacts of the product during its life cycle.
- Nevertheless, companies' environmental efforts focus on company manufacturing processes and not on life cycle; the 'ecodesign culture' has just started in the ceramic sector, in which companies have begun to declare their interest and will probably keep on presenting more specific needs and demands in the future.
- Although it is still in a very early stage, the ecodesign strategy is considered to be an important competitiveness factor for the ceramic sector. Enterprises are already asking their associations for more information about eco-efficient materials and techniques.
- It was observed that most companies have the freedom to change their products, have in-house design and development, and employ designers, so that designers and product developers (including free lancers that are subcontracted by ceramic companies) are an appropriate target group within the industry for the project results. This was confirmed by the business associa-

tions, which were consulted on ecodesign by designers and environmental experts. The latter, in the sense that they interact with designers, especially when environment is a design criterion, are to be considered as well.

- Although ecodesign is, at least to some degree, taught in the framework of design, ceramic technology or environmental management courses, all surveyed institutions detected training needs in subjects such as:
    - Tools for assessing the environmental impacts of ceramic products in the product life cycle
    - Ecodesign strategies for ceramic products
    - Communication tools for ecodesigned products
    - Creativity techniques
    - Environmental information on materials and technologies used in ceramic products
- Although criteria are defined for the EU Ecolabel for hard flooring, and there are product category rules for environmental product declarations of ceramic products (roofing tiles, clay construction products, building products, clay products, etc.), few ceramic companies use these communication tools, although the interest in increasing. ***Given their importance and direct relation to ecodesign, InEDIC should address ecolabels and environmental product declarations in the training materials.***
- The building-related subsectors are very important in view of the Ecodesign of Energy-related Products Directive of the European Union [REF]. ***In the environmental evaluation of products and as part of proposed ecodesign strategies, InEDIC should encompass the role of ceramic products in the sustainability profile of buildings.***
- A fair percentage of the companies have a certified quality and/or environmental management system in place; half of those that stated their motivations to perform ecodesign indicated "standard requirements". The conclusion is that the ***training materials should include the relationship between ecodesign and quality/environmental management systems.***

The main conclusions regarding Greece of the Greek gap analysis are as follows:

- Pottery and ceramics in Greece are based on small and medium-sized workshops. However, all of them are, on the one hand, ***forced to adjust to the global changes towards sustainability*** and, on the other, are ***interested in making products that incorporate the ideas of sustainability*** in general and ***protection of the environment***.
- Since production and supply costs are very important factors, ***a balance needs to be found between development*** (through ecodesign and sustainability) and ***production costs***. As long as this fine balance is attainable, almost ***all are willing to adjust and incorporate ecodesign/sustainability methods and rationales.***
- Vocational Training Centres are desperate to ***attract young people*** through incentives such as the INEDIC project or other new ideas.
- All modern Ceramists are interested in ***adjusting to the new reality of ecodesign,*** not only in order ***to promote their businesses,*** but also to ***protect the environment*** and to ***become competitive***.

Conclusions

The study clearly indicated that there is a lack of systemized, easy to use and state-of-the art based training materials and tools to be applied by companies and design practitioners that want to address environmental concerns in the design and development of ceramic products, while responding to the needs of more demanding markets and striving for innovation. The next stages of the InEDIC project are to develop and test such materials through pilot training and demonstration projects in the three partner countries, given that ceramic companies and workshops belong to the consortium as test partners.

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the Learning Network on Sustainability

The direction of packaging design in new era

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With global population growth, especially in developing countries, per-capita consumption also rapidly increases. The industrialization process in the past century brought material prosperity, but also raised the “energy crisis” and “environmental crisis”. Packaging, an appendage of commodity, inevitably becomes waste after use. China is a populous developing country; the growing number of packaging waste is even more alarming. The packaging design with environmental awareness needs not only rational thoughts from designers, but also the technical support. In the new period, packaging design should reduce space and material consumption through recycling or other technological methods while pursuing the economic benefits, uniting social and ecological benefits to achieve the aim of maintaining ecological balance. This will help direct the modern society towards a healthy and sustainable way of development.

With the global population growth, especially rapid growth in developing countries, per-capita consumption also increases. The industrialization process in the past century brought material prosperity, but also raised the “energy crisis” and “environmental crisis”. Along with the global population growth, people’s material life is also rising. This results in the amount of packaging litter – the “packaging waste” also growing.

According to statistics, accounting for over 35% garbage of urban litter are from the packaging industry in the United States. In Japan the number is 45%. The European Union countries, known for their strict environmental protection, accounts for 30%-50%. In this situation, it has become a global consensus to pursue the sustainable development of human civilization. *China’s Agenda 21* can be considered as a concentrated expression of the strategy of Chinese sustainable development.

Being a populous developing country, China’s amount of packaging waste is also at a alarming high status. In 1993, China began to implement green standards system, but the overall effects was not significant. According to related document, now the production of plastic packaging is at 200 million metric tons, which is difficult to recycle 30% of disposable plastic packaging. Many methods of green packaging design, such as materials reduction, waste recycling and recycled materials processing have not been given enough attention. In addition, China’s green packaging industry is uneven – in economically developed areas in the southeast, like Shanghai, Guangzhou, the green packaging technology develops rapidly; but the economically slower western regions, the development of green packaging has not advanced.

The expanding situation of packaging waste has become a serious problem that needs people to do something to save the environment that we live in. To meet the challenges of the future social and industrial development, the comprehensive consideration of technical, economic, environmental and social factors of packaging systems is a must. In packaging field, the key to achieving sustainable development is coordinating the advanced technology, economic growth, environmental and social benefites to the best.

Understanding how the society develops with insightful observation and changing the way that we produce packaging, may allow us to build a better place for both us and the later generations.

Green Design Vitalizes the Packaging Industry

As a branch of design category, the natural features and social function of packaging prominently expressed in terms of economic attributes. Natural Features mainly refers to offering assurance and various convenience for the capacity, protection, storage, sale etc. to bring material benefits to the society; Social Function refers to satisfying people's psychological needs, promoting merchandise sales, beautifying the environment, and bringing spiritual benefits for the communities. Such traits indicate that packaging are all linked with the principles of science, application, beauty, and economy.

The definition of "Sustainable Packaging" given by the international organization *Sustainable Packaging Alliance* is –

- In its entire life cycle, it's safe and healthy for both individuals and society.
- Meet the packaging performance and cost requirements of market.
- Use renewable energy in process of procurement, manufacturing, transportation and recycling.
- Maximumly use renewable and recyclable materials.
- In use of cleaner production technology and the best industry mode of production.
- The material are harmless in any case.
- Achieved the optimization of materials and energy
- Can be recycled and used in the biological cycle or other industries.

The packaging design in new times should be recycled through a series of scientific and technological means to reduce resource depletion. While in the pursuit of economic efficiency, social and ecological benefits, packaging will be the perfect combination to achieve the objective of maintaining ecological balance. Excellent packaging design not only conveys information or protect the products, but also brings consumers aesthetic enjoyment through variety of packaging forms with different materials, structure and texture that were given by nature.

Because of age, experience, occupation, income and other factors, different consumer groups have different aesthetical standards, taste preferences and consumption habits. Consumers' purchasing behaviors include both physical needs and psychological needs. Packaging designers should be aware of consumer group's favor, have a clear understanding of the fashion trends. At the same time, they should have some insight and analysis capabilities to ensure themselves able to satisfy consumers' material and psychological needs during the process of packaging design.

In addition to the business function of packaging design, there is a spiritual dimension of its aesthetic function. Packaging can be a cultural or spiritual interpretation carrier, which performs a guiding role at an emotional and aesthetic level for consumers. Therefore, introducing some concepts of environmental protection and awareness to packaging design, strengthening the aesthetic trend of green consciousness by offering consumers some hints and guidance, that has become a social responsibility of packaging designers who live in this new era.

With above traits, the orientation of packaging design is particularly important. No other than a clear design orientation can help designers to refrain from piling up visual symbols in order to avoid obstructing the communication function of packaging. The features of packaging design in the new era require designers to consider style, material, construction and other points of view. These can express design elements by some unique forms that are loved by consumers, and can establish a human bridge between consumers and merchandises.

The green product design is based on the idea of humane design. Since a large number of packaging waste is generated, packaging waste has become a problem that can not be ignored by society. How to reduce packaging waste for protecting the environment from human damage and erosion is an embodiment of people-oriented concerns on packaging design. People's life is inseparable from commodities. Packaging design, as an integral part of commodities, has become a link in the endless chain of society. Leading packaging design into a virtuous circle in order to ensure human society a healthy and sustainable track of development, which will be the only way that moves toward the future packaging design. To achieve this goal, below approaches can be considered -

1. A Clear Positioning of Green Design

Designers need to have a clear understanding about the advancement of green design and its system. The trends of packaging design is closely linked to the direction of development of the whole packaging in-

dustry. Globalization, environmental protection, technological innovation, materials science, new equipment, marketing and other factors, have a direct impact on the positioning of modern packaging design.

In general, western industrialized countries put more attention on the unique packaging, convenience and its benefits regarding environmental protection. The packaging cost, environmental and market issues is comprehensively considered. For example, under the premise of ensuring the basic functions of packaging, they oppose Excessive Packaging and Deceptive Packaging. Japan recommends the Rationalization of Packaging, that is, to select the suitable packaging materials and specifications size, besides meeting consumers' demands, also conduce to the disposal and utilization of packaging waste. Based on China's current situation in packaging design, such design concepts deserve attention from Chinese designers.

2. Coordinating and Harmonizing Packaging Design with the Strategy of Sustainable Development

The development of packaging design has an important aspect to promote the packaging through design innovation by combining the sustainability of development in social coordination and unity. Because environmental problems and sustainability principles of development has become a global issue closely related packaging design.

In the field of packaging design, application of the sustainability concept is becoming more important. Many materials use for packaging are considered to be sustainable. At present, many developed countries are improving the packaging industry by developing new materials, specifically in use of renewable resources, packaging, i.e. Sustain Pack, to create a variety of performance for packaging design.

Based on the Sustainability principle, the development of environmentally packaging design mainly focus on reducing thickness, repeated filling, using new materials and new approaches. This kind of practice has become very common, and commodity packaging in use of repeatable filling have also increased. In the premise of green packaging trends, China set up a national standard for *Green Packaging General Rule*, which gives Green Packaging some terms and definitions that refer to environmental protection, safety, rational use of resources for safety, economy, applicability, and waste treatment and re-use of available packaging.

3. Packaging should be designed in accordance with the *4R* Principle

The *4R* Principle shouldn't be ignored by concept of modern packaging design and its development trends. They are –

- **R**educe: reducing packaging materials waste by avoiding excessive packaging. Under the premise of packaging the first consideration is to minimize the amount of material used while ensuring the protection, transportation, storage and distribution functions is maintained.
- **R**euse: do not easily discard waste packaging materials that can be re-used.
- **R**ecycle: recovery process of the packaging waste for reuse.
- **R**ecover: obtain new energy and fuel by burning waste.

Packaging industry undertakes a due obligation to promote the resource conservation and comprehensive utilization. Designing with an environmental consciousness requires not only rational thoughts from packaging designers, but also supports from new science and new technology.

While ecological consciousness and environmental awareness increase, the scientific and economic concerns of consumers have evidently increased. With this prerequisite, highlighting the ecological and environmental protection awareness without affecting the normal function of the packaging, and pushing packaging design towards future direction of sustainable development, has become developmental trends in the new era. Designers should enhance the ecologic awareness, and take up the task to bring people high-quality healthy living by introducing eco-packaging technology, environmental protection to future packaging design, and carrying forward the future design's direction to sustainable development. Reduceing the space and material consumption through recycling or other technological methods while pursu-

ing the economic benefits, uniting social and ecological benefits to achieve the aim of maintaining ecological balance, such methods will help to direct the modern society towards a healthy and sustainable way of development.

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the Learning Network on Sustainability

Harmony of man with nature

Chinese traditional sustainable design ideology and contemporary practices on garden and park design

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Most landscape architects considered that it would be the sustainable design if only they focused on ecology. However, various landscape projects were carried out in form and modern art, but lost public distraction and faced the reconstruction. This is a result of blindness imitation, lack of traditional culture. Sustainable landscape design tends to treat traditional and local culture as the tendency of human civilization which is the same important as ecology. This chapter discusses the Chinese sustainable landscape design theory and examples.

Chinese traditional philosophy harmony of man with nature

The definition of harmony of man with nature

What is the harmony of man with nature? Chinese ancient philosophers explain that man means a common mortal, and nature implies the heaven as a wisdom and strong-minded nature which is opposite to the earth.

《Zhouyi Qiangua Wenyan》 which is the oldest masterpiece in China, considered that an outstanding person always:

- possess virtues to conform objective laws of heaven and earth
- holds intelligent to make clear the overall situation as sun and moon
- has the flexible quality adapt with the changing condition like four seasons
- supports the faith that one good return deserves another based on god and ghost
- follows the natural laws whom the heaven will not go against,
- and obeys the general laws that the surrounding will serve on.

The record senses the harmony of man with nature, the integration of heaven and man. Since 770-221BC, the judgment on heaven has changed from the God to the sky in nature. Till Song Dynasty, the neo-Confucius time, the definition mentioned by *Zhang Zai* confirmed the integration of man and nature. The former is composed of energy, and the heaven and the earth as his parents. People are brothers, living creatures are friends, and all of them in the same inherent quality. *Cheng Yi*, another author said heaven, land and man all make progress in only one way. At the same time, Taoism has the similar thoughts with Confucius. Laozi said 'Man follows the law of the Earth; the Earth follows Heaven; Heaven follows the Tao.' 《*Zhuangzi Qiwulun*》: Heaven, earth, and man should be together, and all things and man are one in fact.

Harmony of man with nature in a new view

The dictionary of Chinese thoughts advocates the integration of heaven and man, emphasis that it is the fundamental thought in Chinese ancient philosophy. It embodies the highest and most intact eastern mentality. In philosophy basic concept, it is an entirety of man and nature including human beings and other animals. 'No hunting the birds in spring months，Nestlings looking forward to mom's return ', written by one of the most famous poets, Bai Yuyi, in Tang Dynasty. The merciful feeling and compassion on birds are so impressing that human being should protect the animals. The saying of Mencius 'the feeling of commiseration belongs to all men' reflects the same emotion.

The harmony of man with nature in Chinese traditional gardens

Aesthetic arts

Chinese natural aesthetics set up on the philosophic basis of the harmony of man with nature. it is considered that everything should return to its root. It will have opportunity to achieve the harmony of all when the society keep stable originate state. Artists' personal emotion come from the nature and their works would feedback above the secular level in Chinese aesthetics thoughts.

With the influence of Chinese traditional landscape painting (see Fig.1), classic gardens take emphasis on the layout of mountain and water in natural, imitates the grant natural landscape in limited space. Mountains, stones, trees and springs became the basic elements of Chinese classic gardens. The most effect on the Chinese aesthetic is the philosophy principle of Taoist nature: Implicit, plainness and simple. The aesthetic advocates the natural beauty without any deliberation, and eliminate the wealthy good with dazzling decoration. 'But simple views, and courses plain and true, would selfish ends and many lusts eschew', Laozi told. 'Colour's five hues from the eyes their sight will take; Music's five notes the ears as deaf can make' indicates that simple is the beauty, and the artificial decorations would damage the simple condition and cause worse. Zhuangzi eulogized 'the notes of Heaven' 'whose placidity is unlimited, while all things to be valued attend them, in their plain simplicity, and no one in the world can strive with them for the palm of excellence.' However aesthetics opinion of zhuangzi has not refused the decoration absolutely or denied the artificial art uncomplicatedly. Until the spirit realm united with Taoist, at the condition of silent mind and forgetful stay, it is possible that Heaven, Earth, and man are together in eternity and the man-made art would be like natural creation that 'After all the carving and the chiselling, let the object be to return to simplicity.' 'Loud is its sound, but never word it said; A semblance great, the shadow of a shade,' the words of Taoism aesthetic thoughts, pursuit the grant aesthetics between heaven with earth and the beauty in unlimited universe. Nature and simplify are treated as the pretty without any duplication, in the controversy artificiality works are intentional unlovely. Such aesthetic ideology affects the development of Chinese art and cognition. In other words, nature and simplify had been the top aesthetic rules above the masculine and feminine.

Since Jin and Tang Dynasty, the Chinese traditional poets and paintings of scholars such as Tao Yuanming and Wang Wei, have taken nature as the first place. Return to the innocent has become the highest aesthetic realm in Chinese art. Chinese scholar appreciate the unearthly natural landscape far away the noises, find the free happiness from nature. Man-made alike natural is at the top of landscape architecture which is theory generalization of aesthetic ideal in practice.

Figure 1: The Chinese traditional landscape painting

Image available from: http://www.ypinn.com/wxinshan/UploadFiles_1507/200809/20080904100839927.jpg

Recluse themes

Recluse, a basic theme of Chinese traditional gardens, is the expression of profound humanism. The aesthetic of Chinese scholar recluses has been the main landscape cultural spirit behalf of traditional art and the humanism ideology origins. Most of Chinese scholars in history are idealists whose political ambition

were so fantastic under their times that they had to choose recluse. And they behave their thoughts through their private garden.

Since Mid-Tang Dynasty, Bai Juyi contacted his private garden with recluse thoughts firstly. Since then gardens became the proper expression of recluse. Scholars always give the name of private gardens with their feeling, embrace the nature, look forward to the relax lifestyle and enjoy themselves outside of cities. The most famous Chinese traditional garden the Humble Administrator's Garden (see Fig.2) is the typical one. The owner of the garden treated himself as ancient sage; voiced his emotion on the objects to express his intense social responsibility through the garden. The traditional gardens are not only the landscape design, but also contain strong social feeling.

Figure 2: The Humble Administrator's Garden

Further more, the Chinese classic gardens maintain close with Confucianism. The recluse symbolizes the vegetation as the spirit power of man in order to express their thoughts. In landscape architecture the plants such as Plum, orchid, bamboo, and chrysanthemum all manifest deep mind of humanism. Despite of embellishment environment, plants also reflect the noble and unsullied personality. Bamboo, always planted in gardens, means modest gentleman because Chinese people consider it uprightness and purity. The couplet in Ge Garden of Yang Zhou can be seen as the pursuit and admiration of gentleman characters. The humanist took more seriously the integration between nature and man in the symbolization of landscape plants than the natural beauty itself.

Coordination with nature

It is basement for landscape architecture to make use of natural climate condition and create a comfortable and pleasant microclimate. Take Jiang Nan as a case, the weather is uncomfortable in muggy summer and raw winter. Thus, most private gardens channel the air through the room and corridor to form the wind. It was also advantage for draining and growing plants if rockery was piled by using the soil in the lake and visitors also could enjoy the breeze on the peak. The purpose of rockwork in northwest and water management in southeast is to block off the chilly wind in winter from northwest, in summer the wind would also be more comfortable. In other aspects, these owners also confined their private garden in the view boundary including ridgeline, skyline and horizon as reference. expanding space and borrowing scenery both integrated the landscape with surrounding environment and construct the regional landscape pattern around. It is another great design method to perform the grant district landscape characters in limited space.

The private garden-- Liu Garden in Su Zhou

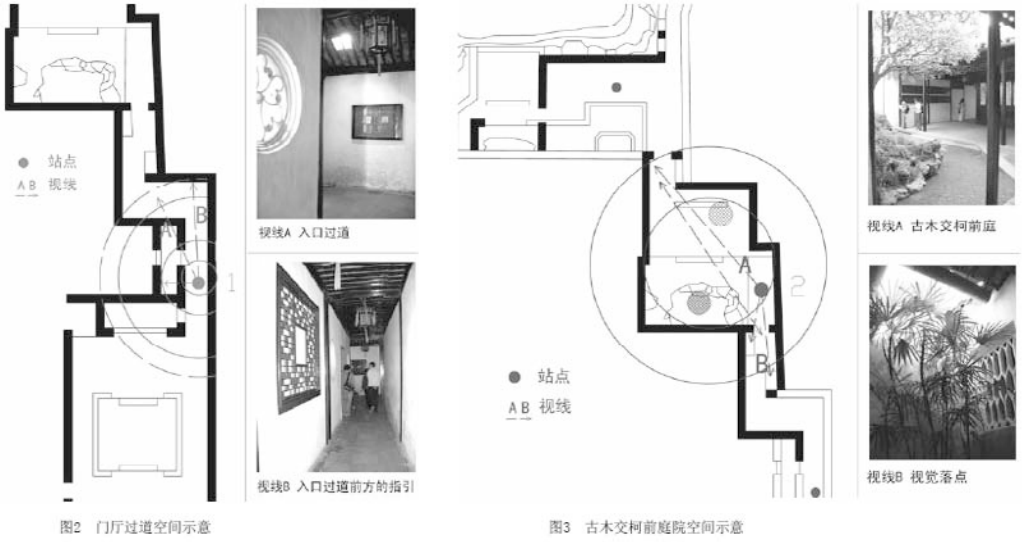
Su Zhou Liu Garden was constructed in artistic mood transforming man made to naturalize and permeating nature into man-made. There are two unique traits of the space in landscape design.

- Spaces dimensions contrast
- Space winding and guidance

It is one of the most significant characters to contrast spaces dimensions in the garden (see Fig.3). The entrance was originally a narrow and boring space. The designer managed the travel route by changeable corridors and patio, and then divided it into different space. Till the first amplified courtyard the visitors can see scenery such as a piece of the rockery and a corner of the pool in vague through glassless window. After a long zigzag veranda the main landscape was exposed framed by the green shadow pavilion built near the water. In the next processing the beautiful landscape popped into the two courtyards and was also framed through the window, door, railing and hanging fascia. when people view the centre of garden through the grid of the window from corridor, it seems more far reaching and more implicit artistic conception. It is also an important character to chase the artistic elegant with the deep conception in Chinese traditional garden. The gardener did their best to permeate landscape outside into the space and enrich the far-reaching feel with various levels to conform the deep and endless illusion.

Figure 3: The contrast between spaces in Liu Garden

Source: The Points in the Infinite Dimensional Space: The Analysis on the Space Meaning of Varying Sceneries with Changing view-points, Lingring Garden (Liu Yuan) as an Example



Another outstanding character of Liu Garden was the winding and guidance of space. Nature aesthetic in Chinese garden exists since ancient time so it is unapproved that the layout was straight. It would be interesting when the dimension come out one after another by each meandering. The Corridor, 300 meters long, is one of the most famous zigzags in Su Zhou. The formation of corridor is a passage with ceiling, but corridors in Liu Garden have two facades and one façade. Both of them lean on the wall to form a semi enclosed condition. The corridor connects each single building to form the buildings composition. Quxi building was 10 meters long, but only half room, 3 meters wide. But there is no tight feeling to walk along the aisle in the building because the scenery framed by the window and doorway were continuous paintings. It is really amazing that sceneries mobiles when people walk forward. However the staggered spaces were made by the direct joint of buildings. To deal with Hesuo Building section, it is more meandering to transit, pack, open and closed space, so that Liu Garden stretchs the tortuous space by interlocking the buildings. The guidance of space is another basic technique in space sequence design which lead the direction of movement and make people enter into the space unconsciously in the layout of space. Gardeners utilize the same or similar vision element as one of the most common way of guiding. The same element repeated can create rhythm. Take an example, the methods that the continuous glassless window, long corridor, plants and surface materials change can reinforce the guidance and draw visitor' attention .

Public park – Hang zhou West Lake

West Lake, situated in west of Hang zhou, the most important nature landscape, have the beauty of natural landscape with the boom of humanities landscape. The lake is divided from the Qiantang River because of sediment deposition. In Tang Dynasty the lake area covered 10.8 square kilometres, nearly 5.6 km2 larger than now. The western and southern lakes go deep into the hillside. In North Song Dynasty, Su Shi, the famous Chinese poet, as Hang zhou official, he dredged the lake and piled the embankment in use of the sentiment from the lake. Reorganizing the lake many times later, there were another embankment and three islands made of mud in the lake in Ming and Qing Dynasty and then the west lake make shaped. Two cases are studied in their own properties:

- The beauty naturalize in man-made -Su Causeway
- The humanism landscape-water garden and other gardens around the scenic spot

The Su Causeway is nearly 3 kilometres long from the foot of Nanping Mountain in south till the shadow of Xi Xialing Range, in the honour of Su Shi. The long beach crosses the whole lake and links the southern and northern mountains where becomes the elegant landscape. Six bridges emerged on the lake guide visitors wandering freely and enjoying various landscapes. Spring dawn in Su Causeway is located in the top of ten sceneries in West Lake. The willows along the bank flow gentle in the spring soft wind and the flower bloom dot in the green. The lake reflects the nature landscape tenderly and attracts visitors especially in the dawn and twilight. The Su Causeway divided the lake into different parts, the major lake in east but the minor in west which is the important method of water management in landscape architecture.

The island named Three Pools Mirroring the Moon with inner water covers 7 ha. In Ming Dynasty the officer constructed sandbar around the island forming a small lake to release the living creatures. Tortuous bridges attached each other from south to north, eastern embankment and western bridge intercross in the centre of island which plots the lake into four parts. View from the upper, the terrain appears that there was an island in West Lake and one inner lake in the island because the inner water was crowded by the ring shape dike. This is a water landscape interest in ten sceneries in West Lake which is the classic in Jiang Nan water garden (see Fig.4). Today the landscapes enrich, the space varies and the colourful plants are designed in cluster or single. Such flourishing scenery stretched from the island into the lake especially in spring and autumn. Three little unique tower-shaped vases in the lake become the landmark of this attraction where people have to take the traditional boat to approach.

Figure 4: Water garden: Three Pools Mirroring the Moon

Image available at: http://www.visitourchina.com/images/fileUpload/091224163745359.jpg

With the development and construction in different dynasties, West Lake surrounded by mountains has been an enormous public garden with open natural landscape. The sites of gardens can be selected through overall consideration, so as that the density of the whole fabric was abundance in order and have rhythm in process. The long bridge and Xi Ling Bridge have been the live link between the lake and the solitary mountain. Many gardens lay around the lake area belonging to imperial or private ones or temple equivalent viewpoints of the grant park. A lot of imperial, private and temple gardens borrow the scenery of mountains and lake but also embellish the aesthetic conception. The nature landscape of West Lake reflects the integration of man-made buildings and nature sceneries after the pavilion, bridges and other buildings freely hiding along the topography in the landscape. The Bao Shu Tower of Bao Shu Mountain in northern West Lake is the view centre of the whole landscape that plays an important role in the whole situation. The landscape of West Lake is composed by the various gardens.

The sustainable design practice of Chinese modern landscape

The importance of local culture landscape

It is a sustainable gardening method in Chinese traditional garden to emphasis on the local culture and condition. The mountain and hills cover 2/3 part of the whole country in china so Chinese people consider that there is not a garden without mountains and waters under the influence of Taoism. However the western always focus on the countryside landscape which is the big reason to make difference between China and western countries. The research goes further into the local landscape; create the proper landscape pattern which is the premise condition of modern landscape design and the main aspect of landscape trait.

The differences in the landscape patterns and elements make people more sensible and have distinctive interests. The research on the regional landscape related the environment, climate, local knowledge and physical space together. The designers pay more attention on the local physical space and conclude the special design characters according the building with settlement, land utilization, water resources usage and living pattern. Take the Jing Nan as the example, the boundary of the waterside is minor and regular similar to the form of cell. However the plain of Zhu Jiang Delta looks like regular which is pond as the element. The terrain in Wan Nan is in different levels so the dams and terrace cooperate in land utilization. In north of China, the land is like rectangular which is regular and big in unit. So the real local

culture landscape is a record of the relationship between men with land. The building and settlement are still the core of life landscape, which is based on the land and environment ecosystem landscape. The cognition of local environment and cultural values are the features of the local landscape. Thus the protection and inherit of the traditional landscape should be the whole systematic project of the local and region landscape. It is the basement of modern design to inherit the settlement form with living the environment, land shape with output space, country landscape with setting and various ecosystem designs.

The garden culture context

The culture content of Chinese classic garden is the expression of philosophy thoughts. Chinese express their culture with the special element application and aesthetic conception creation. Traditional buildings in China stress the formal and the feeling. the Chinese buildings in landscape mainly pursuit the interest, composition principle and attitude of environment. The gardeners try their best to achieve a picturesque art realm around the building. Then they emphasis principle with no fixed style mixed with uncertainty, obscurity and contradiction. It is best to wander through open space or semi-enclosed ones. Of course it is also a good attitude to the nature that the Chinese designer combined the buildings with stones, pool and flowers ingeniously and perfectly by use of the nature condition.. That is different with the content of western architecture which is the building itself.

Rockery piled and water management are the methods to reconstruct the nature in landscape. In Chinese traditional techniques the gardeners always create the notion of forestry, conclude various interests in a small area. Rock hill would not be high but with ridgeline, the water would be not deep but with curving line and the peak would be far-reaching, so the technique is not good at higher mountain or messy viewpoint. In the case of stone, Chinese gardeners break through the discipline of formal aesthetic to admire the skinny, freaky and leaky ones. It seems to break the harmony of the formal but actually it is perfect. Advocating mountains and water in nature, they imitate the existence relationship between them. Three mountains in the lake is the traditional landscape pattern in the water management of China. This represents the ideal and hope of the life and the context in further meaning.

The plantation of the landscape vegetation in China is influenced by the landscape poet and painting, philosophy and custom. Many landscape plants have unique inner culture itself so the gardeners focus the personality on the selection greatly. They analyze the symbol meaning of the plants in the aspects of shape, text, colour, size and seasonal changes. Then they figured plants as persons with idea, emotion and virtue. It is important to make colourful, perfume and charm in picturesque.

There are also other elements such as calligraphy, landscape ode, poetry couplet and sculpture to create culture which play an important role in the traditional gardens. The integration of void and real circumstance can tiger the mood and imagination of the visitors. In the modern times, various building materials poured out with the development of technology so that the culture can be transferred more easily and directly. Without the pavilion and corridor, other landscape sculptures or curving works can still express the context of the designer according to the different text, colour and shape which can enrich the humanism landscape.

Residential landscapes in case of Fragrant Hill No. 81

The first process of the design would be the concept of the whole site. The feeling of the entirety would be better than the effect of parts. It is the most effective way of reflection to the site directly and simply. In the project wall plays essential role in the no. 81 courtyard because it defines the residential space belonging to the people lived. So the designer chooses the rubble stone as the main material that is output in Beijing mountain areas (see Fig.5). The simple emotion bursts out as born with the mountain which can also infect the visitors. As far as mountains, the residential landscape should be in terrain.

The site of No. 81 covers 2 ha area. The core space was only 2000 square kilometres and the rest are irregular areas in corner. It needs nothing but only simple and direct way to construct the proper space to experience. The designer found out the valuable things in the original site and caught the feeling to express. The wisdom of design is to add or reduce the nature aesthetic in their feelings. The mountains is one part of the traditional culture in China, human beings came out of the forestry in the mountains firstly to the city. It is the instinct that ancient poets and modern people look forward to the nature. Although the design formation has changed a lot in the different lifestyles in modern society, the culture would be inherited. It is interesting to overlook the mountains far from the standpoint (see Fig.6). In No.81 project

the site is located in the view corridor between the Yu Quan Mountain and Fragrant Hill that can borrow the outside landscape. It is traditional in the project because the nature culture can be expressed by modern form simply

Figure 5: Rubble stone wall in Fragrant Hill No. 81

Image available from: http://bbs.chla.com.cn/upload/2009/12/08/82/103275993754678.jpg

Figure 6: Borrow the landscape of Fragrant Hill

Image available from: http://bbs.chla.com.cn/upload/2009/12/08/82/103275985933944.jpg

Public park – the westward expanding of Hang Zhou West Lake

The ecosystem stress of West Lake should be relied through the explanation western scenic spot. West Lake has been so sensible area that the projects around it would be caution. In fact the West Lake has conflicted with the problems such as water pollution, ecological environment destroy and landscape land commercialize with the development of industry and urbanization. It is a complicated project that westward expanding is not about western area but includes the social , ecological, water and urban aspects and it is the harmony between utilization and protection of landscape resources with the tourism space expanding .

The landscape of West Lake has some drawbacks such as the lake space is so open that everything can be taken in glance and the scenery is simple. In addition, the large area of land separated the lake from the mountain and blocked the link between the lake spot and hilly area which the nature pattern has been broken the mountain from waterscape in history.

Since the ancient time, the north and south mountains is the tourist scenic spot. Western scenic spot, the largest area in the landscape did not play useful role in the long time. The scenic spot of West Lake undertook so many pressures from the visitors that it can not meet the need of the tourism. However, the western water also exist the ecology problem. Although the drainage area in westward district covers 79.64%of West Lake, the flow speed of western water body is faster than current west lake. The result is that the sand would deposit during the flowing. The sediment has been one of the biggest problems in the westward waters expanding. It caused that the waters enrich the nutrition more seriously than the west lake which lead to the bad water quality. If the lake is expanded, the water will decrease because of the evaporation increases. The Yue Lake and Xi Li Lake face the trouble because of their weak self-purification capacity when the water input declines.

Wetland is one complicated ecosystem with different types and layers, providing a transition between dry land with water, and can support special species. It is one of the most important living environment types and the most various ecological landscapes in nature to solve the upper problem. So a lot of wetland would be explored in westward expanding process. It can result in supporting resources for production and living, or a good function and effect on the environment. Such classic ecological wetland system can purify the water body in the west and promise the cleanness of the water quality. It can not be taken placed by other systems on the advantages of storm repel, flow adjustment, control waster, regularity climate and beauty circumstance. It is the purpose of westward expanding project to connect the western area with other landscape spots closely for the whole nature landscape. In modern design, it can also be useful to the landscape construct of point, line and area. The close relationship of mountain and water can enhance the implicit and elegant of landscape and improve the shortage of landscape so that the West Lake develops new space. This area connects West Lake with mountains in west so it should keep natural and simple character. It is necessary to build one Rhododendron garden to coordinate with the Flower Harbour and complete southern landscape group in West Lake which is the subject flower. San Tai Ze Yun, a new landscape spot is another way to expand the nature landscape that exhibit the classic wetland ecosystem as West Lake in the history. It can attract some birds and has advantage for the fish living on the proper ecology where the water integrates swamp, wild water plants and wet trees together.

Local culture is the foundation of the modern landscape architecture design to keep the traditional characters with new ways. In history records, it was written that plum flower was planted closely in the valley of five ridge mountains and visitors appreciate flowers when went to the pilgrim. it is necessary to recover landscape of the plum flowers sea so that visitors in modern times can enjoy their experiences of touring the ruins of temple and old tree in the garden as back to tang dynasty. The most important thing is south peak; one of the top points in the landscape is on the trail of mountain, on the other side of the

mountain is the famous landscape --sweet Osmanthus Rain at Manjuelong Village. Ling Yin temple is so famous that visitors can arrive at the Mao Jia Bu (see Fig. 7) by boat and then walk to pilgrim. It is proper to develop the harbour to create the countryside landscape of Zhe Jiang. It is regional mystery on the free and calm walk along the stream, forestry and spring. There were some old buildings or squares in the old times but now there are only ruins left and trees blocked in sight. So it is necessary to rebuild the landscape of two peaks into the sky as the landmark to keep the continuous and complete sight. In furthermore, in the contrary of Qu Yuan Garden, the stream wander thought the country whose wine is local culture. To recovery the Zhao dam can strength the garden and the tower.

Figure 7: Mao Jia Bu – the countryside landscape around West Lake

Image available from:
http://image161.poco.cn/mypoco/myphoto/20100317/09/54672827201003170950151068621674624_000_640.jpg

Conclusion

The harmony of man with nature in fact is sustainable thought which can date back to ancient times and several eastern countries.

In the river of Chinese history, the Confucian and Taoism integrated together and influence the traditional garden design. The Confucian focus on that nature will be adapted to the human. However, as far as Taoism is concerned, the spirit of man should follow the nature circumstance and trust the nature as the first place in life. It seems that two thoughts are contrast but in fact supplement both. The natural personality and the human naturalize are the same attitude to the nature. The spirit origin of Confucian, the aesthetic view of Taoism thought and the complementary two thoughts set up the value, psychology and ideal to enrich the Chinese landscape.

It is hopeful for people to interpret the local landscape and historical tradition to recognize the regional landscape. Chinese modern landscape should be developed and go maturity only when the design can go with the character of local landscape and meet the custom and aesthetic of local inhabitant. Local natural landscape can appear when the nature resource has been used completely. Thus the climate condition, terrain feature, water resources, geological character, agriculture product and local vegetation pattern, which are the prime factors, can compose of the natural resources and district landscape. so the regional cultural landscape is the main element in landscape space layout.

In sum, it is sustainable to follow and adapt the ecology but also it inherits and innovate the culture in the harmony of man with nature. The spirit of Chinese classic garden pursuit the harmony and the nature is the element of landscape above the nature.

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the Learning Network on Sustainability

Radical Zero

The pertinence of mental design

Andrea Mendoza
Los Andes University
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Sustainability asks for memory. But, in the midst of contemporary speediness how to stop and bring back: ancient knowledge, good practices and experiences that could be pillars to reach more sustainable cities? How to keep updated without memory when as "post-modern" humankind we need to make a defragmentation of our mind everyday in order to absorb more information and be proficient with information exchanges?
Video-art may be an answer.

Based on the concept of "zero", the paper moves from the "void and uncertainty" that such zero may comprise, to the positive space where uncertainty stands as a metaphor for action. The topic will be unfolded by exposing the relevance of audiovisual works as enduring/continuing mementos born in the interstice art-architecture-design.

Three cases are exposed to attest that in a swiftness era, video and "new" platforms such as YouTube and public art have a great role to play on young consumers/producers/designers. Platforms leaving no trace in the environment but a real imprint in people's mind.

On a second level, the intention is to set up a discussion regarding material culture in a non "infinite" resources world whereas "zero" becomes an on-going starting point, an invitation to act HERE and NOW with the power of "memorable" technology.

"I think there is an important responsibility associated with making anything. There is always the choice not to make."
Tokujin Yoshioka

Introduction

"*How can nothing be something?"*. Ancient Greeks used to ask themselves that. But, how can mankind deliberate upon the void? It may have been important in the past, but does it make any sense nowadays?.

Given the invisible nature of information, all those waves that navigate from mobile phone to mobile phone, from satellite to cable TV, from an imac to an ipod, that invisible information is really getting "something", and thus, as designers it makes more than sense to deliberate upon the pertinence of our communication strategies, our product-service-system proposals, our contribution to the global knowledge, our role in a consumer's-producer's society and of course our role as educators.

Information hides, seeks, chases us in every corner of urban lives, from the billboards announcements on the streets to the private moments in front of the computers when unwelcomed ads and banners pop up.

Information seems to be an "alive" entity, a "living thing" that somehow inhabits our daily spaces and minds. Information pierces the invisible void that surrounds us all and that while being saturated at a material level enter our mental environments. Such information is out there circulating free in the semiosphere but also coded in every single new design we produce; that is why it seems more than pertinent to

deepen on the nature of our creations and see if there are other, lighter ways which going beyond the act of re-thinking the life cycle of a product or a system could be proposed.

Now, given that as designers we mainly occupy "the void" with artefacts, even if we talk about service design, we should start taking dematerialization more than as a strategy to download the impact of products in the environment, and thus, start thinking about designing Zero, this is: starting methodologies to accomplish a certain "mental design", transforming whims and cravings for "things" into reflection, not only in users/consumers but also in our scholars.

Zero Design

A good milestone to start with is the academia and our students, since it is them who, sometimes, arrive to the topic thinking that sustainability deals only with solar panels, hydrogen cars or organic supermarkets, but not only, along the years I have seen that the discussion regarding sustainability can also get stuck into topics such as Environmental product policy (EPP), ISO 14001, Integrated Product Policy (IPP), Life Cycle Assessment (LCA) etc., which are unfalteringly important but somehow, given its high level of refinement and technicality somehow leave aside "banal" quotidian gestures which are the real core of the daily life of our cities.

That is how if we, as designers aim at contributing to the tidiness of urban atmospheres and all the behaviours that those imply while eating, working, commuting, communicating, etc., we should, for the sake of more sustainable present, future and even past tenses (past, if we are to talk about memory), stop at most the manufacturing of artefacts that make people dependable, unaware of its surroundings and forgetful; that as practitioners but as trainers we ought to show new horizons to our students, horizons where our interventions get lighter focusing more in the capacity of people to remember and act according to those mementos, to those almost ephemeral experiences that people are able to recall and thus bring satisfaction back while passing by a piece or art, a public art intervention or a video. This is why we affirm that in order to reach more sustainable lifestyles what should be pierced firstly is people's minds.

So, acknowledging all the experience gained along the years in the realm of sustainability but definitively going beyond green artefacts or systems we may need to put a Zero design into practice. This is to develop a kind of design that deals with the void, the ephemeral, the transient and still lasting in personal and collective memories of citizens.

When we refer to zero design, we attempt to move against the stream and tendency to produce and use those artefacts that make people forget basic things such as a simple phone number; (how many of us knew the phone number of grandma's house or daddy's office in childhood?, whereas today we barely remember passwords, e-mails and log in accounts).

Mobile phones, iPods, iPads, all those artefacts claim to make our lives lighter but incongruously become burdens that deprive us from privacy, awareness and ultimately, peace. Just think about loosing your mobile phone right now… and its consequences.

But not only, and this text does not aim at criticizing those technological gadgets, on the contrary, the aim here is to examine until which point technology can be used the other way around, so that it what can "save us" from our overwhelmed selves. The discussion does not even go to those "light" technological designs, nor to the mere material culture, which saturates our daily lives, here we are talking about more complex and hopefully lighter: "mental works of art".

"The larger struggle we are witnessing today . . .
[is] an ecological drama where the outcome rests not only on our realization that the natural physical environment is one and the same as our bodies,
but that nature itself is a form of Mind". [1]
—Bill Viola

[1] http://mitpress.mit.edu/catalog/item/default.asp?tid=6469&ttype=2

"Art can save the world"

Quoted by Italian theoretician and designer Andrea Branzi (2007)[2], Dostoyevsky claims that it is art what really penetrates the social tissue and the collective imaginary. That is our starting point, along with the theoretical labour of designers and artists such as Paolo Rosa[3], Olafur Eliasson[4], Bill Viola[5] and Andy Goldsworthy[6], this last one who, for instance, sees his practice as in total connection with nature, not in a poetic sense but as a whole reality as he states[0]: "I find some of my new works disturbing, just as I find nature as a whole disturbing. The landscape is often perceived as pastoral, pretty, beautiful – something to be enjoyed as a backdrop to your weekend before going back to the nitty-gritty of urban life. But anybody who works the land knows it's not like that. Nature can be harsh – difficult and brutal, as well as beautiful. You couldn't walk five minutes from here without coming across something that is dead or decaying". Creators that have opted to use technology or simply nature, such as Goldsworthy in order to leave an imprint, a post-visual effect in their audience, but not just regarding a piece or art, but about life. Each and every one of them has worked with, from our view, the issue of sustainability if we understand it as a state of reflection, soberness and joy, a joy, which is almost ecstasy.

The work of the above mentioned artists, reach highest levels not as furniture, green devices or complicated systems, but under the format of videos.

Differently to what as designers we are used to, these artists use galleries and museums to convey their messages. We wanted to use that slightly difference to start a multidisciplinary conversation and see how pertinent would it be to appropriate some of the spaces and practices they use in order to bring about well-being and the so-called ecstasy or as Bill Viola calls it a spiritual sense, something untouchable but still real, significant and powerful, Viola[7]:

> *" […] all of the things which are in front of us now, came from someone's money and heart […] tables and recorders and cups, they all came out of this kind of inspiration of transforming the material world into our inner vision and what we see inside, so I think in some way museums are functioning as a religious sort of a spiritual place, maybe religion is not the right word, because I always think religion in a more political sense […] the individual in the religious sense that I think is in the core of the religious experiences, what happens within you […] so art museums are special places, especially in today's world where our lives are full of so many messages, floating all around us, infecting us, museums are a place where you can just be quiet and still and just focus on another persons dreams, you know? […] Artists always transform things, what we do is we detoxify and transform things, transmute them, transmuting, meaning letting to go, but I think that internet today is possibly one of the most accurate representations of the social nature of human beings…"*

Viola's views have "*deep roots in mysticism, poetry, philosophy, Eastern art, shamanism, Chinese Taoism, Sufism, and Zen Buddhism. Viola's chief concerns today are to draw attention to the upset ecological balance of nature by focusing on the connection between our inner and outer lives, on the conception of the self as part of the whole"*[8].

Rethinking the systems

As said, even if the discussion regarding Design for Sustainability could be centred on the necessary implementation of systems that help users to fulfil their needs, basic or not with the help of technology, or to develop strategies that help leaving lighter footprints to both consumers and producers, the idea here is to rather rethink the way in which we, as designers, could dare to edify people's way of thinking for the sake of more sustainable societies, at least from the designers viewpoint.

And there, the first in being edified is the designer him/herself. That is how, the first exercise that will be presented below is related to an "intimate" design experience, meaning a task born from the didactic arena but put into practice in the privacy of our students daily lives. That first exercise is called Radical.

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[2] Mendoza, A. (2006) Interview with Andrea Branzi. Milan Polytechnic for SOLOS Self Organized Livelihood Subjects. Ph.D. Thesis. Milan Polytechnic.
[3] http://www.studioazzurro.com/
[4] http://www.olafureliasson.net/
[5] http://www.billviola.com/
[6] http://www.telegraph.co.uk/culture/art/3663966/Hes-got-the-whole-world-in-his-hands.html

[7] http://www.tokyoartbeat.com/tablog/entries.en/2006/10/bill_viola_interview.html
[8] http://mitpress.mit.edu/catalog/item/default.asp?tid=6469&ttype=2

The second one to be exposed is the way in which students solved the task of fulfilling a need in users/citizens/consumers by means of a video. There is to say that the primal aim there was to make people think about the need rather than actually fulfilling such need, there, somehow, we were designing a placebo. Third example is the outcome of a design workshop that gave account of the pertinence of using video to not only convey a message but to build up community in the framework of the Desis-international network.[9]

1. Radical

This exercise has been running for already two years in the framework of two different classes at the design department from Los Andes University in Bogotá, Colombia: Studio 7-Sustainability and Design Atmospheres.

Studio 7- Sustainability is a semester-long workshop in which students dig into the idea that sustainability is "*whatever makes people -happy- without jeopardizing the surrounding atmosphere*" (concept brought from a definition of UK based think-tank Attainable Utopias[10]). The class works pretty much towards the exploration of the interstice art-architecture-design as a scheme to find out pertinent interventions that prompt well-being in the city.

The basic idea of the exercise is having the students facing a personal challenge during one semester. Such challenge regards their daily lives, their quotidian not much as "designers" but as human beings. Main issue is to make students reflect upon the limits of the planet (at all levels: economic, social, political, cultural, environmental and even religious) and from there, having felt at "first hand" the limits of the planet and what is like to live "without" x or y comfort or habit, watch how their mind-settings as designers start changing so that afterwards such intimate experience mark their projectual paths.

A series of choices are given to the students so that they can choose one challenge. Such challenge should be done and documented on audiovisual records during the whole semester. Fig. 1.
Some of the challenges that have been posed during this period include issues such as food, water, transportation, etc., few of those are:

- taking showers with cold water
- reduce the time in the shower
- recycle the used water in the shower "somehow"
- reduce the amount of water used to do the dishes, laundry, etc.
- using the stairs instead of the lift
- stop using the car on individual basis (promoting car sharing/pooling)
- _increase in a great deal the use of public transportation or bikes
- eat healthy (highlighting that the aim here is not to go on a diet)
- bring food from home to avoid buying junk food
- do not accept/buy food that comes into plastic bags, plastic plates or plastic cups
- stop using watch, ipod, headphones etc.
- stop using mobile phone
- stop watching TV
- avoid a certain bad habit (smoke, drink alcohol, etc.)
- avoid to be late or in a hurry
- watch out the language
- control one owns personal manners and behaviours in stressing situations

Besides these personal challenges, students have contributed with their own defies, for instance one girl decided to stop using perfume since she felt that she was depending too much on it while another opted for closing her facebook account.

As a result, more than keeping track of the exercise in their logbooks, preparing infographies about it, make an essay and project an artefact, the final given task was to make a 30-60 seconds video to not only

[9] www.desis-network.org
[10] http://attainable-utopias.org/tiki/tiki-index.php

give account of their experience, but to attempt at motivating possible watchers of those videos. The resulting material has been uploaded on the internet under: Youtube **susRADICAL** and **atmenO21** channels.

Figure 1: still images from the Radical exercise uploaded to YouTube

Andrés Casanova, Eliana Zuluaga, Laura Cerón (videos uploaded to YouTube as part of the outcomes from Sustainability class under tutorage of Professor Andrea Mendoza)
http://www.youtube.com/user/susRADICAL#p/u/0/oI-OG_Jm3JY
http://www.youtube.com/user/atmenO21

Andrés Casanova.
Challenge: stop using cellphone

Eliana Zuluaga
Challenges: reduce water consumption, use public transport, eat healthier

Laura Cerón
Challenge: stop consuming junk food

2. Design Atmospheres

Design Atmospheres was a class aiming at "fulfilling" basic needs of a given target by means of a video. This based on: a. the premise that most of the "needs" are mental-consumerist creations and can be fulfilled with placebos and b. the assumption that memorable experiences, thanks to the fact that can be recalled, could work as placebos bringing even more "satisfaction" to users/consumers than the actual objects.

Now, the core intention beyond fulfilling, or not, basic physical needs was to make users/consumers reflect upon what they really need. So the work was pretty much focused on the appropriate means to penetrate people's imaginary.

The objectives of the class can be summed up as follows:

- to understand the nature of "satisfaction" and the role of the object there
- to hypothesize whether the development or representation of the atmosphere that surrounds a particular object is able to fulfil the necessities in user/consumer.
- generate atmospheres that promote consciousness facing the proliferation and few pertinence of material culture (given the actual limits of the planet) in users, clients, consumers.
- to provide students with theoretical tools from which they can articulate a posture in front of our contemporary material culture and use this basic but fundamental knowledge in designing atmospheres that can contribute to the improvement of life quality in contemporary cities.

Such atmospheres are designed thanks to: a. video installations placed: b. inside a box (this trying to create the silence and ambience to which Viola refers when talking about the appropriate spatial conditions in galleries and museums).

Vis-à-vis the characteristics of the results expected, here we were talking directly about public design, art and interaction.

The questions posted at class were:

- which are the needs that objects really satisfy nowadays?

- which is the atmosphere that emerges from the interaction of the subject with her/his material culture?
- is it possible to satisfy a need throughout, not the object, but the atmosphere that it is created by this interaction?

In order to answer or hypothesize on those questions, the course took a multidisciplinary approach by looking at studies on human behaviour, ethology, ethnography and areas that can contribute to the enlargement of the discourse and envision its possible outcomes.

2.1 From hubs to habitats

The course was attended by students from 4th to 7th semester and thus, at this stage what we did was understanding what is an object, which are the footprints that those left in its owners (emotional basically), which is the spectrum that can be traced upon its existence, what are those objects good at fulifilling a giving need, etc., and from there, having established a concept and roadmap we started developing a project aimed at fulfilling human necessities without producing the object.

We started by identifying how such object becomes a hub around which an atmosphere is re-created.

Here it is good to go back a little bit to explain which is the kind of hub we are talking about. This by an assertion brought from an interview to Paolo Rosa (2007)[11] when he describes:

> *"… an African artist makes a sculpture of a pregnant woman and a member of the tribe, while passing by, leaves a feather on it, another passes by and leaves a leaf, another a piece of intestine etc., each one goes adding something to the mud of the sculpture and thus it becomes not only an object but a gravity centre for the community".*

Thus, the atmospheres we are talking about, regard the interactions, the invisible symbolism and meanings that objects have in our daily lives.

Nevertheless to jump from artefacts to atmospheres hubs are an intermediate stage between the mere object and the atmosphere, so students tried to work upon the example given by Rosa.

The tool, video was and continues to be our main goal in terms of Communication Design for this sort of "conceptual artefact", hence this is a light way to convey messages both from the material view point and also in terms of uploading it in platforms such as internet so that the result can be immediately grasped.

For this task, a couple of students wanted to work with the issue of migration (illegal and not) from Latin American countries to the USA. They[12] found that immigrants are usually very bonded to faith and religious believes, (a very characteristic aspect of Latin America), it is their faith and connexion to God what keeps them alive and strong. Therefore, students came out with the idea of setting a hub, which is a sort of "indigenous totem pole", in one street of New York city (a city without public shrines on the sidewalks) to allow the particular target finding on the streets of a foreign city a space of relief. In their words the hub is "*like a sponge which goes absorbing meaning as time passes by; a place in which they can find their roots and at the same time a space that they can enrich*".

The video, outcome of this and alike proposals have been uploaded on Youtube. Fig. 2.

[11] Mendoza, A. (2008) in interview with Paolo Rosa for SOLOS Self Organized Livelihood Subjects. Ph.D. Thesis. Milan Polytechnic.

[12] Gustavo Cubillos and Felipe Herrera. Los Andes University, Colombia.

Figure 2: Hubs & Habitats design exercise. Sample taken from the work done by Gustavo Cubillos and Felipe Herrera. Uniandes. 2009-2

Video uploaded to YouTube by students Gustavo Cubillos and Felipe Herrera as part of the Design Atmospheres Class under tutorage of Professor Andrea Mendoza:
http://www.youtube.com/watch?v=AwkDMnAjnAs

Hubs and Habitats. Design Atmospheres, "The American Dream". Cubillos & Herrera. Uniandes. 2009-2

2.2 Wall-e, the approach

At this point, it is good to repeat that material culture keeps on piling. We don't know if it will reach the level shown at Pixar's movie: Wall-E, in which the use of technology allow human beings to remain in a steady state of comfort while it is others who try to solve the accumulation of material culture in the planet (robots, the only one of which is surviving is wall-e).

Now, the point is that in reality, right here, right now, despite tools and methodologies of eco-design (dematerialization, leasing, updating of LCA, lessening of parts per product, reduce, reuse, recycle…), the actual situation of life in the planet (having into account extinction of species, pollution, social-economic-politic differences, the issue of water, human rights, etc.) seem not to really help. Top down solutions is what people (as in the case of wall-e) continue to expect.

In parallel to an essay based on the movie and the practice of the Radical exercise that this particular class pursued, the methodology used here in order to work with the hubs-habitats issue, started, again at a personal level, with an exploration of the material culture of the students themselves. They were called to write down their will/testament and illustrate it with pictures or graphics, having to choose 10 elements, which were essential for they as individuals, objects that they would like to pass to others after their decease. From that testament they should pick up one object and start describing the Rites, Roles, Rules and Regulations that such object establish with its owner/user, this in the framework of Social, Environmental, Cognitive and Emotional factors (aspects that were to be worked along the analysis, testing a final proposal). Fig. 3

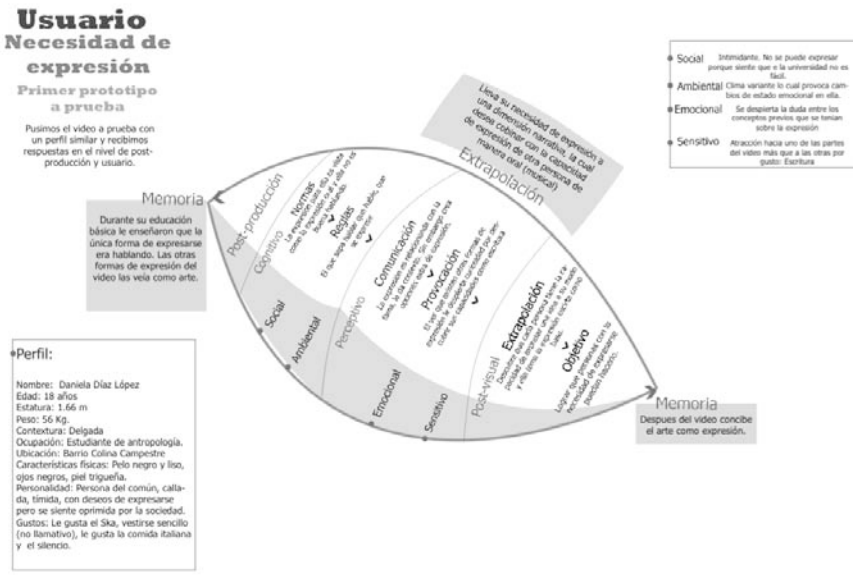
Once the object and the sensations, memories, feelings that it produces were traced, one of these factors was highlighted and taken in order to work with, by inferring which could be the real, hidden necessity that it fulfils.

Once the nature of the objects was grasped in depth, students started working on designing the atmosphere, this is: an ambience recreating the "aura" of the object and by means of communication design, draw the way to transmit it by means of a video.

For the conceptualization stage they took a PROSECCO pattern, this is: PROvoke the viewer in terms of grasp her/his attention, shock and keep him/her watching; SEduce him/her, this is to make the viewer focus attentively leading him/her to the images but trying to make them "travel" into themselves and consequently reflect upon what they have seen. Such reflections, hopefully (and according to the testimonials of the tested targets) regard changes towards better ways of behaving, being and doing in the city and among citizens. The last part is COmmunication meaning the part in which the message is conveyed. A final stage that could not be tested hence it comprises the private lives of the spectator in the mid-long term run is the "Post-visual stage or effect" and regards a future time in which people will see or feel into a similar situation to the one that was presented in the video and will evoke the sensations and reflections around it.

Figure 3: Model used to assess the video-installation proposal

Design Atmospheres class under tutorage of Professor Andrea Mendoza. Authors: María Fernanda Rodríguez and Catalina Delgado, 2010-1



Wall-E as a Film, but also as a concept and methodology was a really good example of designing a message that is provoking, seducing and, besides its high pre and post production quality, is a great communicator of the material culture "issue" and its consequences.

Interesting in this first stage is that students started understanding and discovering that what makes the object relevant is not its value as artefact but what it means, what it will recall in the memory of the one who will inherit it.

One of the working groups in class[13], decided to deal with the "expression needs"; hence according to their observation and interview phases, students have difficulties to express themselves in the campus. A Series of testing were done to assess if such necessity could lead people to re-think their behaviours.

Initially, viewers were a group of particular students from the campus or student's friends, they were the first target on whom the analysis was done; but later on viewers were all passers by, all people that commutes in the university campus.

Their final outcome, a video (set on a black box in the middle of a very transited area of the university campus), was posting questions regarding the "challenge" that students should face in order to say out loud their minds and opinions, this by exemplifying the way in which great thinkers and speakers have done it, featuring music and discourses of: Manu Chau, Gabriel García Márquez, the Che Guevara and Jean Michel Basquiat. Fig. 4.

Another group[14] developed a project called: La Curva del Olvido (the elapsed edge) in which they by means of just sound and a heartbeat line wanted to set a trip from childhood to the future, a journey in which the sounds evoke the music that our youngsters used to listen in Colombia vis-à-vis the urban sounds that we listen today (mobile phones, traffic, etc.) ending up with a flat beat, like the one that sounds when someone dies.

A third resulting example was a video in which lifestyles based in overconsumption are shown by means of a table game.

These videos have been uploaded to Youtube and can be seen under:
http://www.youtube.com/watch?v=k-w2yiW-75I
and
http://www.youtube.com/watch?v=k0WA4_k-Ktw

[13] Delgado Catalina, Rodríguez María Fernanda. Uniandes Design Dpt. 2010-1
[14] Botina María Fernanda, Mendez Luisa. Uniandes Design Dpt. 2010-1

Figure 4: Still image from one of the outcoming videos of the exercise

Uploaded to YouTube for the class Design Atmospheres under tutorage of Professor Andrea Mendoza. Authors: María Fernanda Rodríguez, Catalina Delgado, Hugo Perilla, Angelica Portilla, María Fernanda Bottina, Luisa Méndez

Expression Needs.
Rodríguez & Delgado.
Design Atmospheres
Uniandes
2010-1

Remembrance Need.
Botina & Méndez
Design Atmospheres
Uniandes
2010-1

As said, with this semester exercise, our intention was, somehow, to prompt a certain "religious" experience in the viewer of the final videos. Religious not in a political sense (Viola 2006) but as Bill Viola[15] well notes when explaining how his it that his operas reach an evident level of intimacy with the viewer thanks to the silent atmospheres in which those are experienced, he considers as religious: "*that what touches the inner being in a deep way, and then anything that emerges out of ourselves from a genuine, from an unguarded place is ultimately a sacred act*"

For us, that inner being, that inner state is again: a void. It is invisible and intangible, it is… zero. And for this we believe that the internet has then a great role to play as a new gallery, a new wunderkammer.

The exercise could seem banal, but reviewing the state of the art there is a concern regarding the issue of objectualness in our contemporary, example of this is Youtube project LIFEINADAY (produced by Ridley Scott). Kevin McDonald, its director, states that he was inspired by the UK based Mass Observation Project, a project started in the 1930's and that kind of continues today.

In the project ordinary people were asked to keep diaries, written diaries of things that happened in their lives. According to McDonald[16]: "*what is so fantastic about this archive is that what seemed banal maybe 60, 70 years ago, is kind of fascinating to us now […] they have files of drinking habits in 1939, sexual habits from 1939 to 1950, people views on capital punishment, eating habits, cafes, others collected the drawings that people did when they were on the telephone, etc. etc. The Mass Observers wanted to know what ordinary experience it was like for people, not the experience in the newspaper, not what politicians said it was, but what ordinary people said life was like […] the project collected and learn about ordinary people's experiences. I hope that in Life in a Day, we can get something a little bit similar to that. Life in a Day is a film and there what I like to do is to make a film unlike any film has been made before, which is: ask thousands of people, everywhere in the world, on a single day, which is the 24th of July 2010 to film some aspect of their day and then post that material onto Youtube so that we can use it to make a film that is a record of what is like to be alive on that one day. It will be a kind of time capsule, which people in the future, maybe in twenty, thirty, forty, fifty, a hundred, two hundred years could look at that and say: oh my God, that is what life was like. A portrait of life in a day.*"

2.3. DESIS

DESIS is a network of Design Institutions interested in design for social innovation and sustainability. For this, the network's slant has moved towards initiatives which starting from the bottom up of the soci-

[15] http://www.tokyoartbeat.com/tablog/entries.en/2006/10/bill_viola_interview.html
[16] http://www.youtube.com/watch?v=CEQhy0oFE1w

ety aim at improving the social tissue of their environs bringing about well-being. People who start up these initiatives are called creative communities or like our DESIS-USA partners call it: urban activists. As in the above-mentioned exercises and classes working around the issue of design for sustainability, the labour within DESIS gave as a result a video, this time, targeting a study case from a semestral workshop linked to DESIS-Colombia a branch to DESIS International Network.

The particular clusters around which DESIS Colombia works are: Urban Dynamization and Traditional Knowledge. Urban dynamization is concerned with the ways in which well-being can be reached by means of a multidisciplinary work, bonding art, architecture and design. The Traditional Knowledge cluster (TK) deals with the living heritage which is inside our Colombian indigenous communities, the scope there is to learn about their communication "manners", translate, assess, and bring some of this knowledge to the urban arena, the city of Bogotá.

The specific case we will refer to here is the work done with Ojo Al Sancocho.

Ojo al Sancocho is a film festival created by Sueños Films, a group of Filmmakers based in the community of Ciudad Bolívar in Bogotá, a territory where thousands of people arrive every day due dislodgment caused by internal armed conflict. The aim of the festival is to allow the community to be recognized by their achievements rather than by its negative image. This festival has already been replicated in other parts of the country. It has been recognized as an effective communication strategy, which utilizes cinema as an urban dynamic tool to build up a sense of community (Rodríguez)[17].

Interesting is that them, themselves, say that their initiative should help people to leapfrog from the basis of Maslow's pyramid (hierarchy of needs 1943), to the top, because they are conveying: joy (Bejarano 2010)[18].

The work taking Ojo al Sancocho as study case for the Studio-7 Sustainability class at Los Andes University, dept. of Design 2010-1 was done following the methodology of case collection and intervention called: DESIS Toolkit which is an instrument based on quasi-ethnographic research (Meroni 2007) and that deals largely with mood boards, pictures and posters.

Because the above-mentioned reasons, we wanted to use the video as both, a resource and an outcome.

After having pursued the on field labour, observations, interviews, picture collection and preliminary analyses, students found out that there was an interesting space for a design intervention, which at a certain level was not easy, given that the film festival runs pretty well.

Still, it was found that a design intervention could be pertinent[19] in terms of communication towards the outside of Ciudad Bolivar, this is working in the not so good-will that this huge and amorphous neighbourhood has for the rest of the Bogotanians.

The city was too large to think about a strategy so again, the students took the University Campus as a laboratory to spread out the voice and give visibility to the initiative. For this they focused on a branch of Sueños Films that airs some material at the Ojo Al Sancocho festival, which is: EKO, an audiovisual school where children learn about filmmaking, and not only, since they have the opportunity to express realities that sometimes are hidden behind their particular private lives and that are invisible to the rest of the community. They work as neighbourhood's reporters and go mapping all kinds of situations helping to build up memory and enhancing dialogue.

Their works can be seen on their webpage: http://ecoaudiovisual.blogspot.com/ with links to their videos in Youtube.

Our students at the university came out with the idea of replicating a piece of the festival at the campus, so that students who have never heard about the festival but that are pretty interested in the audiovisual discourse and the filmmaking arena (specially students from arts, design, anthropology and architecture) could give: a. a closer look to the material which is exposed at the festival, b. get to know the labour done by EKO.

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[17] Rodríguez, G. (2010) In interview with the Ojo al Sancocho film festival as part of a collecting labour for the SEE/SEEK Project. UNEP (DTIE). http://www.sustainable-everyday.net/see/

[18] Daniel Bejarano is the head of Sueños Films and the Ojo al Sancocho Festival. The Maslow assertion was done during a talk given to our students in class and repeated at various speeches including the *Dinamización Urbana* symposium seminar at La Tadeo University (also part of DESIS Colombia) in Bogotá. Seminar organized by Prof. Mauricio Hoyos and co-chaired by M.A. Cesar Sierra and Nicolás Rojas.

[19] It is important to note that we always assess the pertinence of a design intervention since it is not said that the communities "need" our help. That is how for instance another case we visited called "nights without fear" an initiative to fight violence in another sector of the city by re-appropriating the squares of neighborhoods bringing music and food one night every 3 or 4 months, stated that they were not interested in being connected to other areas of the city, did not need any new device to help with their infrastructure, did not find the pertinence of "design", etc., because theirs is a very local rooted initiative. What they found interesting was maybe being visible at an international level, and at some point that is what DESIS also does with the international network.

In the particular case of EKO the DESIS lab students decided to work on a very rhetoric way using the name of the festival Ojo Al Sanchocho. This title is a popular expression, which means: "watch out", although ojo is Spanish for eye and Sancocho is the name of a popular Colombian soup which has all sorts of potatoes, legumes and vegetables (besides meat, chicken or fish, varying according to the geographical region). The final work then, was to, given the roots of the name: "to prepare the Sancocho", that was the name of their particular project.

A whole series of visits, field work, pre and post-production gave as a result a 1 minute video in which children from Ciudad Bolivar meet in different parts of the city with a legume at hand (dummies made out of fabric) and progressively, by taking different transportation means (this to show how easy is it to arrive to Ciudad Bolivar from any zone of the city), they reach destination (a big pot) in order to prepare the Sanchocho.

Video and behind the scenes can be seen in Youtube under **MrSostenibilidad**, Ojo Al sancocho 2010.mov. Fig. 5.

Figure 5: close caption of the outcomes

Photographs as part of the on-field-labour/behind the scenes of students: Juan Manuel Gallego, Jaime Vargas, Andrés Casanova, Santigao Ramírez and Adriana Chaves, for the Sustainability Class. Project: Ojo Al Sancocho/preparando el sancocho. Under tutorage of Prof. Andrea Mendoza.
Sources:
http://www.youtube.com/watch?v=tQnn2YNAg00
http://www.youtube.com/watch?v=cmxMHSnWOXc&feature=related

OJO AL SANCOCHO
Studio 7-Sustainability
Uniandes
2010-1

Conclusions

1. In the book Pride of India, Chamu Krishna Shastry states that: "*the world is compelled to question the appropriateness of the methodologies and technologies that have came into being in the last 100 years. The society needs an alternate world-view in every area of human life, from the model for the family to system of education to science and technology […] We need an alternate mindset to find innovative solutions. The world is looking to the East, inclusive India, for such solutions. But, does India have the knowledge base to fill this role*?"

   Even if this text intends to be both, a record to think about the appropriateness of video as a light tool and outcome in topics related to design for sustainability and, secondly, a repository of the audiovisual labour done in at the Colombian academia when working with design for sustainability, it is important to remark how Krishna Shastry's statement points in a right direction. On a wider discussion and not to focus just in India and all their rich knowledge behind sciences (arithmetic, mathematics, astronomy, etc.), all ancient cultures do have a code that has needed to be translated into urban modern language so that memory can be kept. That is how, the production of knowledge these days, everywhere in the world, needs to be shared and kept for the sake of past, present and future generations in the lighter possible ways and there is where our brain comes to play.

   The role of design then, if intending to leave a light footprint in the environment but also a strong imprint in the collective memory, should make best use of communications means that go beyond the mere artefact, even if it is a "green" one or even beyond product service systems to collect in the lightest possible ways "solutions" for the everyday life acknowledging that what

has to be firstly changed in our contemporary societies, is the chip in people's minds; it is there when we talk about mental design.

2. New technologies more than mandatory are a congruent step of human evolution and should be used to bring about awareness making those enter in all our systems, including the emotional one, which is pierced as stated by Branzi (2007) by means of art and related practices.

   Such congruence can be better understood by looking at Viola's when saying: "*for the first time in human life we have the artificial technological system that can embody and represent that invisible aura, what digital technology is giving us is the ability to represent invisible things not visible things, I mean the essence of digital is a code, a code is not a thing as a cup or a stone or a table, a code is some conceptual metaphysical element that has no physical existence and yet is the more powerful tool we have today to understand our world, both in ways to model things with the computer, the ability to communicate with digital web systems like the internet and it is all based in this underlined fundamentally immaterial element that is fast becoming the whole way in which human beings work and even on ourselves the way in which we re-visualize today unlike the mechanics of anatomy as we used to understand it in terms of force and reaction and the hydraulics today's model of human being is a code a DNA and it is not coincidental that we have remapped the human being as a coded system in terms of biological elements and that is the most accurate model of a human being we have that is not coincidental that occurs in this age the code of a computer that also works on a code, although we do not understand yet where it is going but is very powerful*".

3. The above exposed cases, authors and results give us floor to attest that design for sustainability can and should go beyond green objects and systems. A mental design is possible if we acknowledge the importance of human memory and its codification under audiovisual platforms profiting the existence of the internet an "intangible" space that comprises a very meaningful "void".

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the Learning Network on Sustainability

Design for sustainability based on the culture ground

Sustainable thinking in Chinese traditional culture

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Globalization in promoting economic development leads to some consequences. The main negative effects lie in disappearing cultural diversity and the design drove by the consumerism. After the feedback of these consequences we should rethink our current design status. This paper studies and collates the sustainable ideas being presented in Chinese classical works, Taoism, Confucianism and Book of Changes. Through the analysis of the examples of ancient Chinese architectural design, script systems and artistic creation, we will make a summary that ancient Chinese artefact design how to make use of modular or adaptable system to respond to changeable environmental and social needs. Starting from Chinese traditional sustainable thinking and methods, we will reflect upon the status of modern design, and explore the approach to the design for sustainability as the cultural fundamental.

Globalization in promoting economic development leads to some consequences. The feedback of these consequences let us rethink the current design research. There are two major negative impacts. First, the improvement of mutual dependence makes a strong culture of Western countries covered, leading to disappearing cultural and design's diversity. Second, the global ecological damage and resource grab lead to environmental pollution and ecological damage. Capital-driven design is the marketing tool. Consumerism design culture is one of the direct causes of rise of sustainable design. The paper tries to analyze the relationship among tradition, design and sustainable development. Starting from the sustainable though and methods in ancient traditional culture, reflecting on the status of modern design, we try to explore design for sustainability based on the cultural ground.

Sustainable concept in Chinese culture

View of nature: Unity of nature and human, obey nature and rule (Tian Ren He Yi, Shun Tian Shou Zheng)

Chinese cultural regards the unity the law of heaven and human as important, which means the human and nature in harmony. '*Chuang Tzu • Equality of Things'* said, 'tian di yu wo bing sheng, wan wu yu wo wei yi', that means heaven and the earth exist simultaneously, we are the same with the others in the nature, we and the things on earth are all one part of 'Tao'. It expressed clearly that the value between man and nature is their harmonious relationship. Lao Tzu regards the relation between nature and human as an orderly process: ren fa di, di fa tian, tian fa dao, dao fa zi ran, which means human follow earth, earth follow heaven, heaven follow Tao, Tao follow the nature. Such objects and subjects for each others, nature and human gathering together compose the overall shape of tradition in China. '*Chuang Tzu • know the North Tour'* said, 'Shan lin yu! Gao rang yu! Shi wo xin xin ran er le yu!', which means making exposure to the mountains, forest, open country would bring us fantastic feeling. It reflects directly the close relationship between human beings and nature. Conforming the law of nature is the highest law of peo-

ple's everyday lives. 'Shun Shou Tian Zheng'(obey the nature and rule) is the main concept about compliance of law of nature in *'The Book of Changes'*. *'Kun • Tuan speech'* said, zhi zhai kun yuan, wan wu zi sheng, nai shun cheng tian, kun hou zai wu, de he wu jiang, han hong guang da, pin wu xian ning, which means only following the nature can all the things achieve better situation. It considered in *'The Book of Changes'* that all the things in the nature on their right place are the law of that. All we need to do is conforming, or you would not go well.

There are two main ancient thought in China, Confucianism and Taoism. They all praised highly about the thought of 'unity of nature and human'. The main concept in Confucianism is 'Ren', and the one in Taoism is 'Tao'. The meaning of 'Ren' and 'Tao' are all include the thought of the unity of nature and human.

Appearing in Confucian, 'Ren' means the moral character of harmonious co-existence. *'Analects • Yong'* said, 'ren zhe, ji yu li er li ren, ji yu da er da ren. Neng jin qu pi, ke wei ren zhi fang ye'. This harmony exists among the people firstly. But for the Confucian, the logic of 'Ren' can be enlarged to the objects in the nature. DONG Zhong Shu, one of the famous Confucian in ancient Chinese considered that, as the three fundamental elements for the growth and development for the all things, heaven, earth and human, they three, must be coordinated for each others. *'Chun Qiu Fan Lu • Legislative God'* also said, heaven, earth and human are the base of all the things in the world; heaven give birth to them; earth cultivate them, people make them; without the base of heaven, everything won't happen yet; without the earth, survival is of no support of resources; without human, it is only a world of things. Different from putting more emphasis on the human relations of Confucianism, 'Tao' is the highest category of Taoist ideology. As the universality of 'Tao', the Taoism considers that everything is equally. *'Chuang Tzu • Autumn Floods'* said, from the level of law of universe, everything is the same, without higher or lower class. But from angle of the objects themselves, they considered their position as the most expensive, most respected. Other species are inferior and negligible. As Taoism's opinion, all things in nature are in equal existence and they are all irreplaceable and have their own independent value.

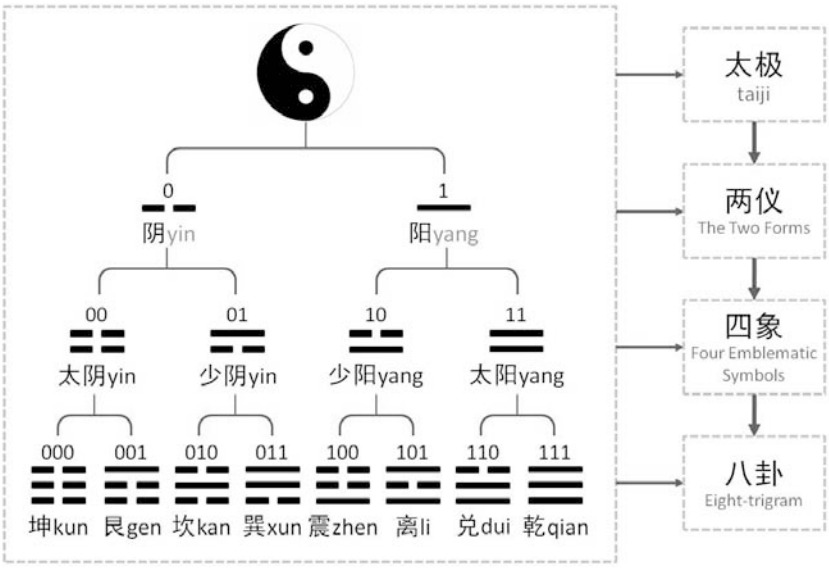
The ancient people in China were in pursuit of 'Tao' instead of freedom and personality. The interdependence between human and nature is the core of 'Tao'. This equality between man and nature, harmonious view of nature of co-existence is the characteristics of Chinese culture in the presence of the basis of sustainability.

Systematic thinking: all things as a whole (wan wu yi ti, chao yi xiang wai)

For the mode of thinking, China's "all things as one" systematic values generate macro, chaos, fuzzy thinking. Every concept has multi-meaning. As the highest realm of Tao, we also can't talk about it in detail. These situation lead to the uncertainty of concept, diversity of explanation, blur of form. This macro-oriented thinking is lack of rigorous logic. Chinese consider that everything is in the changing situation. Before we start to know something well, we will explore some elements and their interactions relating it firstly. So we put more emphasis on the relationship of things, and consider that understand the thing starting from the whole, not the part.

Chinese culture tends to look overall of things, and put the changes in the external environment and internal structure as priority. *'Lao Tzu'* said, 'dao sheng yi, yi sheng er, er sheng san, san sheng wan wu', which means Tao becomes one, one becomes two, two become three, three becomes all the things, ⋯. Tao, the law of nature made all of these happened and endless. The most ancient classic *'The Book of Changes'* established epistemological basis of a systematic thought in Chinese culture. It used Yang Yao '—' and Yin Yao '— —' to construct the Eight Diagrams representing the basic things in the world. Derived from the Eight Diagrams, it form such multi-level structured system of world, as taiji (t'ai-ki)——the two forms（Yin and Yang）——four images——trigram（Eight Diagrams）——sixty four trigrams. (See fig.1)

Figure 1: Multi-level structure in 'The Book of Changes' (Drawn by HE Song Fei).



Thought of endless cycle

The view of simple cycle is another concept in Chinese culture with the idea of sustainable features. The law of nature 'Tao' has the meaning of infinity and immutability. Tao is a kind of being with infinite and movement for ever. At first, Tao is infinite being. *'Quasi-original Road South sub Training'* said, 'fu dao zhe, fu tian zai di, kuo si fang, qi ba ji, gao bu ke ji, shen bu ke ce, bao guo tian di, bing shou wu xing⋯⋯', which means in time, Tao is no beginning and no ending. In space, Tao is no bound. It can generate the universe and the things in it. Secondly, Tao is in perpetual motion. Tao evolves to produce everything in the universe during the movement. *'Lao Tzu'* said, 'du li er bu gai, zhou er bu shi, ke yi wei tian xia mu', which means the root of all movement and changes in the world is the law of Tao. *'Han• Yue Zhi'* said, 'jing jian ri yue, xing chen du li, yin yang wu xing, zhou er fu shi', which means Thing is the cycle of changes promoted by yin and yang. *'Lao Tzu'* also said, 'tian zhi Tao, zhong er fu shi', which means that everything's running characteristics of birth and dead is infinite loop. This is a very primitive, simple and sustainable concept in ancient China. Professor Benny Leong considered this concept of cycle is also the culture. Whether cultural tradition is continuous is very important. Cycle concept is a unique set of ancient Chinese philosophy. It has a profound impact on Chinese economy of creation and production activities.

The sustainable creation method in Chinese culture system

Transformation methodology

Chinese history is the history of turmoil, so 'change' is the main features of Chinese history and culture. China had experienced numerous empires and dynasties lasting thousands of years. Among these dynasties, there are only six lasting more than 300 years. The time of peace and stability in these six empires is also short. Most of the time is in the war. The upheaval led to the changeable environment. It made Chinese people good at cope with the changes. Never changeable thing is the change. As the origin of Chinese culture, the classic *'The Book of Changes'*, its core is the theme of 'change' and launched in response to changes. *'The Book of Changes'* considered, 'changes' have three levels of meaning. First, the world is changing. Second, the change of the world is permanent. Third, the changes of world have the law, and the law is clear and simple. *'The Book of Changes'* explores the rule of change, aiming to let people know how to deal with the continuous changeable environment. In the ongoing internal war and

alien invasion, regardless of physical form and external appearance of how social change, culture and core values have been retained. We can say that Chinese culture is very strong and stable inertia.

Chinese traditional culture has its adaptive system to adapt to changes for stable succession. That is 'chi jing da bian', which means maintain the adaptive core value and try to transform at the time when encountering with environmental changes.

From normal external environment change to dramatic one, culture and internal systems are accustomed to generate a large variable range of the system to solve the problem, especially in a country with large population.

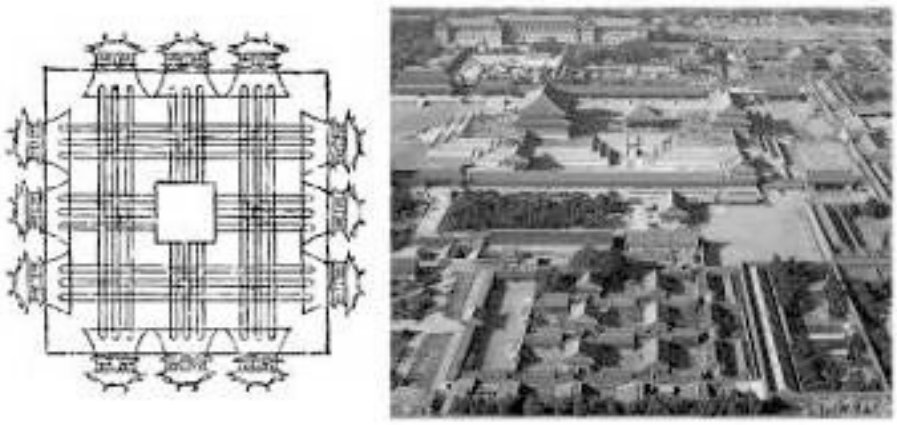
In a word, 'chi jing da bian' is epistemology of traditional Chinese culture and also the methodology.

Creation method of the multi-level modular adaptive systems

Based on the thought of 'chi jing da bian', Traditional social organizations developed a method or mechanism to produce efficiently. Permutation and combination with basic unit, we can constitute diversity to adapt to changeable environment, and the consumption of resources is also reduced to minimum.

This system is making use of clear organizational structure to compose the basic, standard cell to form a hierarchical system of the modulus. For any complex things, the first is to identify the basic elements. To meet the simple needs, the basic elements can be permutated and combined into basic units. When facing the greater environmental changes and complex needs, combination of these basic units and the cells can become more complex to response to. And so on, finally it can form the large set of system. These are familiar to the Eight Diagrams in *'The Book of Changes'*, from simple to complex, but the clear structure still. (See fig. 2)

Figure 2: Forbidden City and planning of ancient royal city is the different levels of modulus of system



Source: Left, picture original from ancient Chinese book *'Kao Gong Ji'*, right, picture original from http://www.oldbeijing.org/dispbbs.asp?BoardID=16&replyID=216230&ID=5992&skin=1

German scholar Lothar Ledderose has done research work in-depth. When he mentioned this system, he put more emphasis on how it play roles in production and art creation. After the study for Chinese architecture, text, bronze, paintings and other fields, he concluded that Chinese invent the assembly standardized parts of production system items. A large number of prefabricated parts can be assembled together in different combinations quickly, thus limited kinds of components can to create unlimited units.

The manner has played a significant role in the Chinese society, and even shape the structure of the society. It becomes the important driving force for the economic and social development in ancient China. Making use of such multi-module system, ancient Chinese not only created abundant products, but also utilized different modulus to correspond the level of social hierarchy, maintaining a system of ancient Chinese Confucianism. Many ancient books had recorded clearly about this strict social hierarchy corresponding to module. For example, *'Book of Rites'* said, 'tian zi zhi tang jiu chi, zhu hou qi chi, dafu wu chi, shi san chi', which means the building of emperor is nine, vassal's is 7, senior official's is 5, junior official's is 3. *'Kung-yang'* said, 'li ji tian zi jiu ding, zhu hou qi, da fu wu, yuan shi san ye', which

means the the sacrifice Ding Tripod used by the emperor is 9, vassal's permitted number is 7, senior official's is 5, junior official's is 3. (See fig. 3)

Figure 3: The number of bells reflect the status the nobility, the Chime-Bells, his owner is Marquis Yi of the Zeng State in Warring States Period

Image available at: http://blog.whjy.net/UploadFiles/2008-5/111427257980.jpg

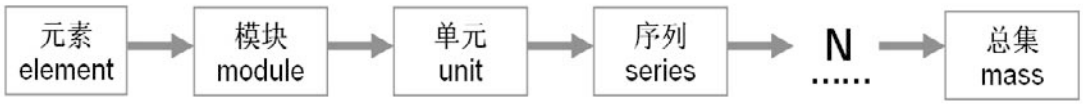
With a unique cultural identity, this system that can be adaptive to the needs of different possibilities in the future is the sustainable creation method summed in the long history by Chinese people.

Application of sustainable method of artefact design

Professor Lothar Ledderose summed up modular creation system of China's cultural tradition with structural features. It is the composition in the form of system-level, which consists of a number of differences from the simple to the complex. (See fig.4)

Figure 4: The indication of adaptive modulus of multi-level system

Drawn by HE Song Fei)



Different areas of application for this system, the construction is flexible. The number of units and levels of required modules are totally depending on the demands responding to the changes in the environment. For example, the script system, architecture, and apparel and accessories are more complex, the furniture and tableware have fewer levels. Here we take the case of traditional wooden architecture.

Wood structure building system in China is unique design geographically. From multi-functional building units to huge palace community such as Forbidden City, they are all composed with the basic elements like beam, pillar, bracket, and casement. The difference lies in the demands for social hierarchy and environment. (See fig. 5-10)

Figure 5: The elements such as beam, pillar, bracket, and casement are the basic components for all the building forms

Images available at http://bbsdown2.zhulong.com/forum/OldAttach/2005/8/24/1813078.jpg and http://bbsdown2.zhulong.com/forum/OldAttach/2005/8/24/1813083.jpg

Figure 6: Specific brackets of Chinese architecture, the basic components together as different types of function module.

The picture photographed by HE Song Fei

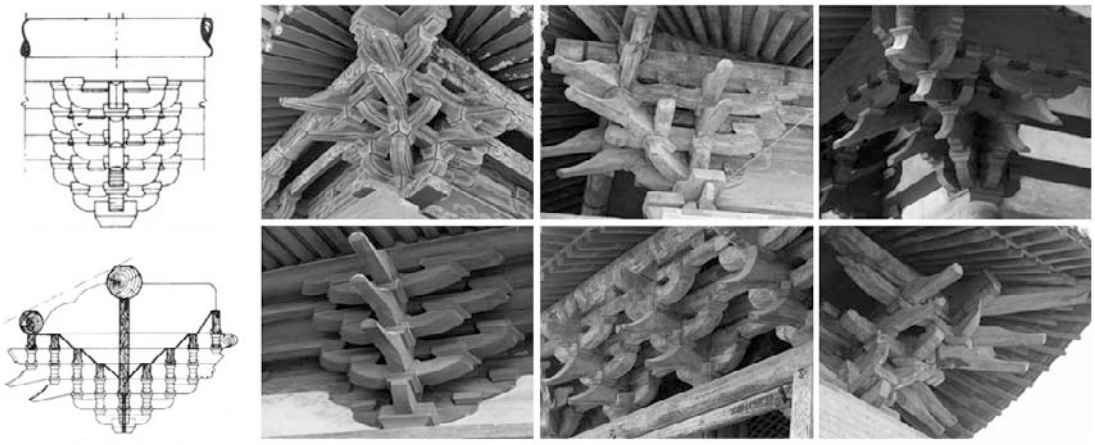


Figure 7: From the structure in the diagram, we can see clearly the different modules combing into a single building. The arrangement of columns and brackets are also in accordance with the basic spatial scale module—bay spacing. A "bay spacing" is roughly equivalent to about 3.3 m2.

The picture original from http://www.cdid.com.cn/dzbbs/thread-1690-1-1.html

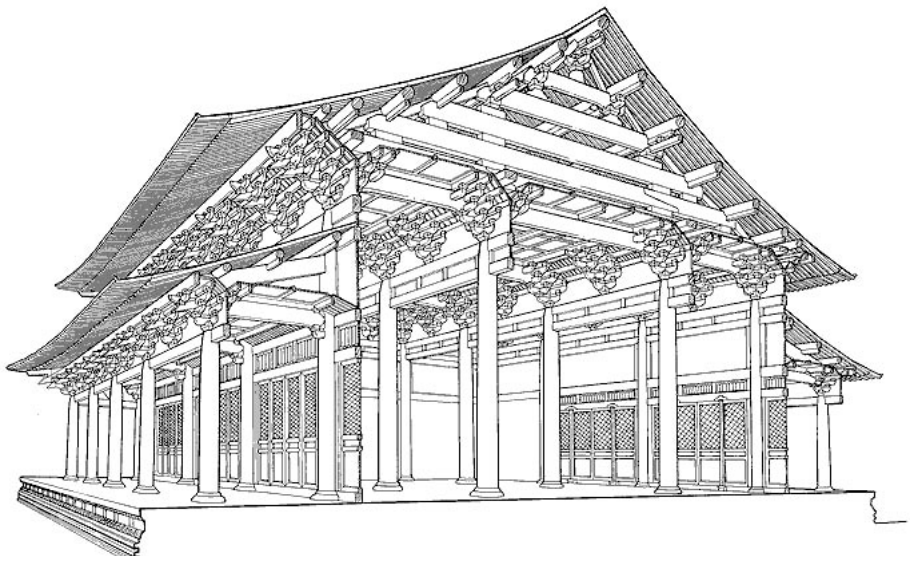


Figure 8: The main palaces of Temple of Heaven in Beijing. Importance of the palace led to that of the form. Single building is the higher level of system in the form of architectural design. It is the most important unit.

The picture photographed by HE Song Fei

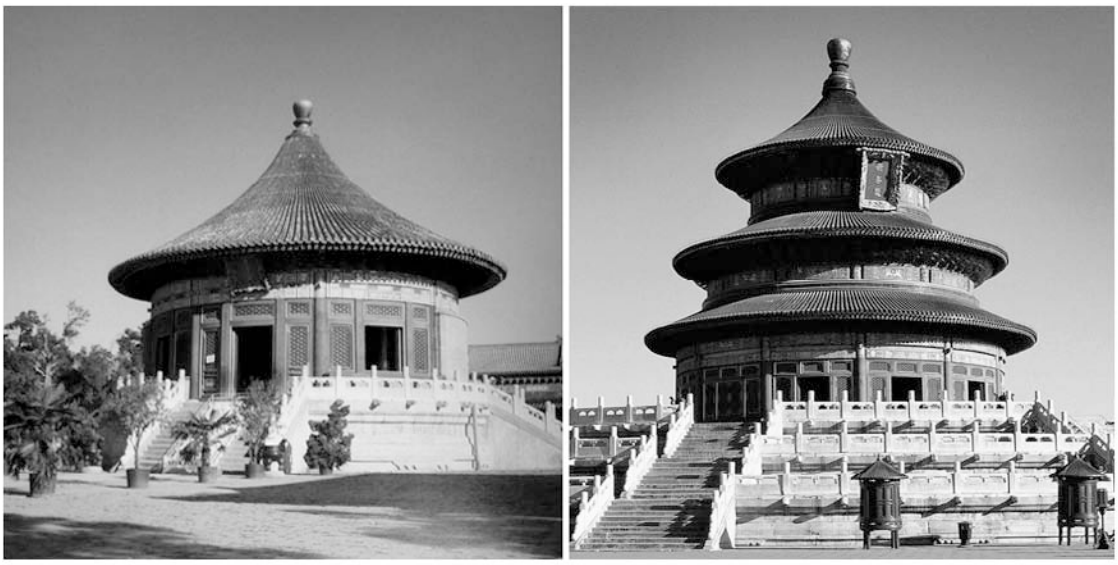


Figure 9: According to the functional needs of space, architectural unit combined into the compound, temples, gardens and other buildings of different series.

The picture photographed by HE Song Fei

Figure 10: From aerial view, the Forbidden City in Beijing is composed of plenty of compounds (architectural series). Under greater demand of use, many units come together to bigger building mass. Such mass can be change based on the terrain or functional requirements, such as size of family, function of government agency, social hierarchy and so on.

Source: picture original http://www.oldbeijing.org/dispbbs.asp?BoardID=16&replyID=216230&ID=5992&skin=1

Conclusions

Sustainable design is not only to consider resource conservation, environmental protection, social harmony and other social and economic factors, even more important to maintain the sustainability of fine cultural traditions. Cultural-based sustainable design has two meanings. On one side, based on the study of connotation and extension of Local culture, we can make use of local characteristics design, methods and philosophy of the system for re-creation. On the other side, utilizing the popular local culture, we can promote sustainable livelihoods concept and design. Social, economic and environmental sustainability is integrated into cultural sustainability. Because tradition continues, social, economic, and environmental will develop sustainably.

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Design Education for Sustainability (DEfS)

the Learning Network on Sustainability

Service design education and sustainability

A proposal based on service models

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Research activities on Design for Social Innovation and Sustainability have found out service practices that could enlarge our vision about what a "service" is, and consequently how *Service Design* could be defined. This has also relevant implications in how the discipline could be taught, particularly regarding the consideration and promotion of a sustainable approach.

Design discipline has widened its field over the years: from the design of industrial products to the design of services or product service systems (PSS). *Product Service Systems* research community was born considering the issue of sustainability, based on the dematerialization of the economy, "reducing the material flows in production and consumption; creating products and services that provide consumers with the same level of performance, but with an inherently lower environmental burden" (Mont, 2001). The growing research community that is being building around *Service Design* (Morello, 1991, Manzini, 1993; Mager, 1994, 2004, Pacenti, 1998), although it has inherited the researches on *Design for Sustainability* (Manzini, Vezzoli, 2002, Manzini, Jegou, 2003, Manzini, 2004) – particularly those on *Design for Social Innovation and Sustainability* – was developed based also on other influences, for instance in Italy: *Strategic Design* (Zurlo, 1999), *Interaction Design* (Anceschi et.al, 1993, Montefusco, 1993; Susani, 1997), *Experience Design*, which can be described as an integration (Ceppi, 2004) of what has been called *Primary Design* (Petrillo, Trini Castelli, 1987) – as a "sensorial" approach to design practices – and the *Experience Economy* (Pine, Gilmore, 1999).

As a convergence of all these studies and practices, *Service Design* discipline was set up and is continuously expand itself through research groups, consultancies and graduate/undergraduate courses established all over the world. Besides this, and reinforced by these emerging practices, service design is considered as a "rapidly growing field that has since been given a thorough theoretical and methodological basis" but also as a "young discipline that contains many exciting, undiscovered lines of research and continues to invite us to explore the unknown and pursue exciting experiments" (Mager, 2007)

However, the theoretical and methodological basis of *Service Design* could be considered for some as a still opened question, i.e., a work in progress. Considering that "Service Design" places together two terms "design" and "services", i.e., the definition of what a "service" is have a huge influence in the definition of this discipline.

Let's take as an example, the following definition, extensively divulged on the Service Design Network, the larger international research community in the field:

> "What exactly is service design? Service design addresses the functionality and form of services from the perspective of clients. It aims to ensure that service interfaces are useful, usable, and desirable from the client's point of view and effective, efficient, and distinctive from the supplier's point of view." (Mager, 2007)

As we will see in the next lines, the definition above, presuppose and define "service" considering a specific service model that we have called "standard", on which there is a "client" and a "supplier", or provider. But other service models are possible and the researches on *Design for Sustainability*, and particularly those about *Design for Social Innovation and Sustainability* are showing this up. This possibility could indicate to the *Service Design* research community that its still necessary to go further in defining its methodological and theoretical basis.

We do not intend to set up in the few lines of this paper a definition for *Service Design*. Its main objective is to illustrate how, in many aspects, there are emerging service practices that could enlarge our

vision about what a "service" is, and consequently how *Service Design* could be defined. As we will see next, this has also relevant implications in how the discipline could be taught, particularly regarding the consideration and promotion of a sustainable approach.

Sustainability and service models

Relational services

"Service is a term by which we refer to a social relationship in its pragmatic dimension" (De Michelis, 1996). If is true that social relationships are part of every service, in the next paragraphs we will present an example of an emerging service model, which require intensive interpersonal relationships between participants to operate: the *relational services* (Cipolla, 2005, Cipolla, Manzini, 2009)

This service model emerged when some research projects[1] looked for people creating solutions outside the mainstream unsustainable patterns of production and consumption. Given that the capability of re-organizing existing elements into new, meaningful combinations is one of the possible definitions of creativity, these groups of people can be defined as *creative communities*: people who cooperatively invent, enhance and manage innovative solutions for new ways of living (Meroni, 2007) .

The observation and analysis of these initiatives shows that these groups of people are progressively setting up a new service configuration: from services provided mainly by organizations, to self-organized models, from services based on anonymous performances between participants to those based on very personalized and mutual interpersonal relationships.

Relational services are: *services* in a innovative way because instead of being passively served, people are actively interacting – and relating – to produce a commonly recognised benefit; *relational* because the interpersonal *relations* are an essential component of these solutions. These relations are not an involuntary or spontaneous consequence of the solutions: the quality of interpersonal relations are intrinsically required by the service operation itself

The model we see behind the services produced by *creative communities* differs from the common sense related to the idea of "services". "*Living Room Restaurant*" (Meroni, 2006) is an example: the service lies in the possibility of booking a table for a dinner in a family house rather than in a restaurant, and the "client" even helps lay the table. There is also "*Jardin du Ceres*" (Meroni, 2006) where the consumer purchases – paying in advance – all the food that will be produced and supplied by the farmer, becoming his "partner" and co-producer. Other examples range from childcare to care of the elderly, from looking after green spaces in urban contexts to alternative forms of mobility, from the building of new solidarity networks to the realisation of new housing typologies (Meroni, 2006). These and other services manifest the emergence of a service model strongly based on the quality of interpersonal encounters between participants.

These services are based on active people and, strongly in their local contexts. They are being considered signs, prefiguring a sustainable future on which people could rediscover their own abilities to set up autonomously the solutions they need and they want to; could rediscover the value of their local resources, i.e., the benefits of obtaining wellbeing on their own localities and valorizing their common goods.

Collaborative services

Most of services produced by *creative communities* present this characteristic: solutions based on a collaborative approach, where participants co-produce a common recognized benefit, answering together problems posed by their everyday life. Considering these characteristics, this specific service model has been defined also as *collaborative services.* (Jegou, Manzini, 2008).

The collaborative approach have been promoted also based on open source and peer-to-peer spirit, i.e., service-oriented networks where users are co-producers of its own services and contents (i.e. *blogs, podcasts, wikis, social networking websites, search engines, auction websites*), generating non-hierarchical and network-based organizations (Bauwens, 2004).

[1] EMUDE, Emerging Users Demands for Sustainable Solutions, financed by the European Union and CCSL – Creative Communities for Sustainable Lifestyles, promoted by UNEP.

Standard service models

Relational and collaborative services are in contrast to what we could define the "standard" service model, i.e., the one on which the roles of the client and provider are clearly defined (Cipolla, 2008, Cipolla, Manzini, 2009). This diffused service model was progressively build based on an industrialization process which promotes rationalization, optimization and control over interpersonal interactions in service performances. Differently from the other service models considered here, standard services promotes an idea of "comfort" and well being that is identified with "inactivity" and with a passive attitude in users/consumers (comfort as "relief").

Ivan Illich about standard service models, experts and sustainability

> "I believe that a desirable future depends on our deliberately choosing a life of action over a life of consumption, on our engendering a lifestyle which will enable us to be spontaneous, independent, yet related to each other, rather than maintaining a lifestyle which only allows to make and unmake, produce and consume – a style of life which is merely a way station on the road to the depletion and pollution of the environment. The future depends more upon our choice of institutions which support a life of action than on our developing new ideologies and technologies. (Illich, 1973a)

This citation from Illich, written on 1973, still remains actual, synthetising some relevant issues that are being proposed today on the research activities and theories about *Design for Sustainability*. The demand to change our ideas of well being, materialized on products targeted to satisfy passive users, towards an idea of well being based on access and activity (Manzini, 2007) had been one of the main questions of the approach based on *creative communities*, manifested on the studies and practices related to the *relational and collaborative* service models.

The process of unlimited institutionalization, manifested in the *standard services*, accordingly with Illich, had dominated modern societies: "great swathes of the way we live our lives become institutionalized. 'This process undermines people – it diminishes their confidence in themselves, and in their capacity to solve problems. It kills convivial relationships. Finally it colonizes life like a parasite or a cancer that kills creativity" (Finger and Asún, 2001, cited by Smith, 2008).

Illich (1973b) analyses how the major social agencies have been reorganised according to scientific criteria during the last 180 years. Education, postal services, social work, transportation, and others have all followed this evolution. In brief: services were organised as industrial institutions (Levitt 1972, 1976).

He also describes how the industrialisation of medicine led to the break-up of the network of interpersonal relations in which people had always found relief and support in their everyday lives: "the exclusion of mothers, aunts, and other non professionals from the care of their pregnant, abnormal, hurt, sick or dying relatives and friends resulted in new demands for medical services at a much faster rate than the medical establishment could deliver" (Illich, 1973b)

The key question is the "abundance" of industrial tools and experts – including service provision – that suffocates people's freedom, creates dependence on producers and providers, and stimulates the development of an individualism that can go beyond personal realisation and reasonable self-interest, to become closure and indifference.

Against the enslavement of man to all these tools Illich (1973b) proposes the concept of "conviviality", expressed nowadays, for example, in collaborative and service models:

> "I choose the term 'conviviality' to designate the opposite of industrial productivity. I intend it to mean autonomous and creative intercourse among persons, and the intercourse of persons with their environment; and this in contrast with the conditioned response of persons to the demands made upon them by others, and by a man-made environment."

Service Design Education

Looking at the *relational and collaborative services* it's possible to observe options to the process of radical service industrialization, concentration of knowledge power and all the criticism that has been made, particularly by Illich. Instead of "industrial productivity", as a single and prevalent value, these models are proposing convivial effectiveness, but without forgetting the efficacy of the final results.

One relevant step in setting up a Service Design Education for Sustainability is consider the enlargement of the concept of "Service Design" itself, based on the consideration of other service models, beyond the industrial or standard ones. The central role of interpersonal relations, or non-hierarchical and networked-based organizations that collaborative services are inspiring, are some examples of practices that could open up the possibilities for students to set up new service architectures and alternatives to the mainstream modes of production and consumption.

The research activities on *Design for Sustainability* had not only contributed to set up services as an object of Design activity, but had also opened the discussion about what kind of services could we imagine and promote in the scenario of a sustainable and knowledge based society (Jegou, Manzini, 2008).

The theory and practice of *relational and collaborative services* – as is being proposed analysed here – is an opportunity for *service design* discipline to make its contribution also to the convivial reconstruction of our societies in a sustainable perspective.

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the Learning Network on Sustainability

Sustainability education for design students

A lesson in teaching and learning strategies

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Designers are to a certain degree culpable for providing new products and services that perpetuate unsustainable living. Consequently, sustainability education for future designers, who at some point will be in a position to shape the way we live, is undoubtedly important. This paper presents experience taken from the course "Sustainable Product Design", the outcome of which could contribute strongly towards planning and developing effective sustainability pedagogy for the future. The implication surrounding effective sustainability education regards not only "what" we learn, but also "how" we learn. In light of this, different teaching and learning strategies were utilised throughout the course to meet its main objective – that of implanting sustainability into students' head, hands and heart. The paper examines the key successes of productive course strategies including a personal footprint quiz, field trips, lectures, case studies, design projects, and critical self-reflection. With students not only trying to change their own lifestyle, but in addition influence those of others', the course objectives appear to have been successful. The students have furthermore come to alter their view of the design profession accordingly.

Introduction

Today we are confronted by the consequences of our unsustainable lifestyle – consuming beyond human needs. We have wasted natural resources, polluted the environment, and poisoned ourselves by living within that environment while consuming toxic matter that we ourselves have created (Papanek, 1995: 10). The need to change to a more sustainable way of living is no longer in question. Making each of us take responsibility for the damage we are causing does however remain challenging.

Inevitably, designers too are partially to blame, having contributed their fair-share of consumerist products and services that perpetuate unsustainable consumption patterns (Papanek, 1984: ix; Ramirez, 2006: 190). The role of the design profession in the consumerist world has increasingly been censured by many design professionals themselves (Whiteley, 1992: 1-4). Victor Papanek, a designer and educator criticised in his book, "Design for the Real World" that industrial design is the second most harmful profession after advertising design and demanded greater responsibility from designers (Papanek, 1984: ix-x). Eleven years later, in his book, "The Green Imperative", Papanek continued his demand for responsible design believing that designers remain in a position to influence clients with whom they work towards more sustainable production and consumption (Papanek, 1995: 11). Philippe Starck, a furniture designer, interior designer, industrial designer, transportation designer, architect, etc. renowned for his extremely commercial work, confessed to "Die Zeit", a German weekly magazine that "... I was a producer of materiality and I am ashamed of this fact. Everything I designed was unnecessary ..." (France24, 2008). It was a clarion call for all designers to reconsider the way they work. Another similar signal is to be found on the Website of the Industrial Designers Society of America. There has been a criticism of how US consumption patterns have contributed to today's crisis, as well as an urge for designers to minimise the negative impact of their work on our planet (IDSA, 2010).

Designers have a crucial role to play in leading our society in a sustainable direction and avoiding the opposite (Ramirez, 2006: 190). Thus sustainability education for tomorrow's designers, who come to find themselves in a position to shape the way we live, is unquestionably important (Vezzoli, 2003: 2). This paper presents experience taken directly from an undergraduate course, "Sustainable Product Design" at the School of Architecture and Design, King Mongkut's University of Technology, Thonburi. The course's objectives, content, productive teaching and learning strategies, including learning outcomes will be examined and discussed in relation to pedagogical theories and relevant case studies. The main purpose of this paper is to elaborate on experiences extrapolated from the course that could contribute toward planning effective sustainability pedagogy for the future.

Education for sustainability

Sustainability in higher education

After the Stockholm Declaration stated the need for integrating sustainability into education from elementary school through to adulthood, there has been continuous progress towards sustainability in higher education (Wright, 2002: 203-204). The Talloires Declaration was the first official statement made by university administrators calling for sustainability curriculum in higher education (Wright, 2002: 205). Talloires signatories increased from 20 original signatories in 1990 to 419 signatories in June 2010, including Chulalongkorn University and Chiang Mai University from Thailand (ULSF, n.d.). Another endeavour helping to develop education for sustainability is the United Nations Decade of Education for Sustainable Development (DESD). UNESCO has been designated to lead DESD from 2005-2014, supporting people in the development of relevant knowledge, values and skills needed to pursue a sustainable society (UNESCO, n.d. a). The DESD has suggested a pedagogy shift from the traditional approach to a more unconventional one including interdisciplinary and holistic learning practices rather than subject-based learning; values-based learning and critical thinking instead of memorisation; multi-method approaches, participatory decision-making, and locally relevant information instead of at national scales (UNESCO, n.d. b).

As a higher education institution is a place where professionals – future decision-makers – are trained, it has a responsibility to transform students into graduates who can engender change towards a sustainable society (Sibbel, 2009: 74). There are many challenges to accomplishing this task. For instance: how is it possible to nurture and prioritise sustainability vis-à-vis other values (Sibbel, 2009: 78); additionally how can graduates be made to recognise their important role and power in promoting positive change rather than feeling anxious, insignificant and hopeless, believing individual action to make no difference (Moore, 2005: 79; Ramirez, 2006: 191; Domask, 2007: 63; Sibbel, 2009: 79).

Sustainability in design education

In 2008, the Kyoto Design Declaration was signed by 124 members of Cumulus, the International Association of Universities and Colleges of Arts, Design and Media who committed to sustainable design education, leading us towards "sustainable social, environmental, cultural and economic development for current and future generations" (ICSID, 2008). Apart form this official stance, there have been many additional efforts to incorporate sustainability in design education i.e. a study of design, development and educational potential, the "Demi Project", linking sustainability with undergraduate design education in the UK through Web-based resources (Fletcher and Dewberry, 2002: 38-47); a study of sustainable product and service-design related projects conducted at the Politecnico di Milano University, in Italy for students and educators (Vezzoli, 2003: 1-9); a study of an "EcoDesign" course for doctoral students from 6 Swedish universities in relation to pedagogical theory (Bergeå et al., 2006: 1431-1442); a study of an integration of sustainability into an undergraduate industrial design engineering product innovation course at Delft University of Technology, in the Netherlands (Boks and Diehl, 2006: 932-939); a study of sustainability integration in industrial design undergraduate programmes in Australian universities (Ramirez, 2006: 189-202); a study of an operational model for integrating undergraduate teaching of 3 modules including building design, reduction of energy consumption, and computer aided visualisation, at Northumbria University, in the UK (Hamza and Horne, 2007: 3841-3847); and a study of a learning classroom

classroom model, a collaborative course for 4 Canadian education institutions on sustainable building (Holden et al., 2008: 521-533; Ramirez, 2006: 198).

To date, design education institutions have made progress towards sustainability. However, as long as mainstream design education still views sustainability as merely one component of the current design context rather than viewing design as one part of an entire sustainability dimension (Fletcher and Dewberry, 2002: 40-41), and as long as sustainable design abilities still fail to be regarded as one of the most needed skills for graduates to acquire employment in the design industry (Bergeå et al., 2006: 1435; Ramirez, 2006: 198), the path of design education towards sustainability remains full of obstacles (Ramirez, 2006: 191-192).

Goals and pedagogy of sustainability education

Sustainability education aims to redirect people's attitudes, behaviours and values towards a more sustainable social, environmental and economic future (UNESCO, 2007: 5). In order to conduct oneself sustainably, a learner must encounter the appropriate knowledge and understanding, correct values and motivation, as well as skills and capabilities (Department of the Environment and Heritage, 2005: 9-10; Svanström, Lozano-García and Rowe, 2008: 347). This indicates three principle learning outcomes of sustainability education: cognitive domain – knowledge and understanding of sustainability; psychomotor domain – skills of applying theory into sustainable practice; and affective domain – values and attitudes that motivate sustainable behaviours (Shephard, 2008: 90; Sipos, Battisti and Grimm, 2008: 74). Apparently, the challenge of successful sustainability education is to seek out appropriate teaching and learning strategies that can enhance a learner's head, hands and heart towards sustainability effectively. The implication is that effective sustainability education regards not only the content of "what" we learn but also the process of "how" we learn (Anderberg, Nordén and Hansson, 2009: 372; Department of the Environment and Heritage, 2005: 6; Jones, Trier and Richards, 2008: 342; Moore, 2005: 80).

The Sustainable Product Design course

Overviews

As a course lecturer, the author of this paper conducted a "Sustainable Product Design", three-credit elective course in the second semester of 2009, at the School of Architecture and Design, King Mongkut's University of Technology, Thonburi. The course was the only course of its kind in the undergraduate Industrial Design curriculum, entirely dedicated to sustainability education. The objectives of the course was to build students' understanding of sustainability and sustainable design, enable students to convert their knowledge of sustainability into realistic design practice, and simultaneously heighten students' awareness of their role and responsibility regarding sustainability as individuals and professionals. Put simply, the course aimed to implant sustainability into students' head, hands and heart. The class consisted of thirteen 3rd and 4th year industrial design students, plus three exchange students from Finnish engineering schools. Due to tight schedules and time conflicts, the three exchange students could not participate in class activities in their entirety.

What to learn and how to learn

The course covered a broad range of topics such as: Why is a shift towards sustainability now a necessity?, What does sustainability really mean?, What is the individual's and designer's role and responsibility regarding sustainability?, and moreover, How can individuals and designers contribute to sustainable development? In order to effectively cover all course content, diverse teaching and learning activities were employed throughout the course according to their perceived appropriateness.

Of the fifteen classes, the first class started by asking each student to take a Personal Ecological Footprint Quiz available on the Global Footprint Network Website. Students were required to answer a survey regarding their daily activities in relation to food, goods and services, mobility, and the home. The Quiz concluded with a result of how many planets would be required to support their lifestyle if everyone chose to live like them. The quiz result did not aim to assess students' Ecological Footprint since most of

them still lived with their parents who took care of most household issues, in which case Quiz results could not be considered representational. The actual purpose was to use the Quiz as a tool to make students realise how their daily activities impact on our planet and furthermore, how individuals can demonstrate responsibility by reducing their Ecological Footprint.

The second class was an introductory lecture on concepts of sustainability, imparting to students a clear understanding that sustainability is all about balancing three principals: Planet – sustainable environment, People – sustainable society and culture, and Profit – sustainable economics. Understanding these sustainability concepts was considered an important foundation of student knowledge and their ability to practice sustainability in contemporary design professions, since they might already know of sustainability though only from a popular environmental perspective.

Five further classes were field trips to various locations within Thailand, where sustainable efforts had been implemented. During the field trips, students saw examples of local contributions to sustainability at different levels – individual, design profession, community and corporate; different approaches for how to reach sustainable goals ranged from folk wisdom-based, technology-based, and behaviour-based; as well as sustainability successes in real business contexts. After each field trip, students were asked to write personal reflections in a report. The main focus of the field trips and self-reflection report was not to gain explicit knowledge, but rather to expose students to clear examples of local sustainable contributions, inspiring them to take responsibility both as individuals and designers.

The remaining classes were devoted to sustainability within the scope of the design discipline. Lectures on various sustainable design strategies were given to students. Following each lecture, students were required to find a case study that employed a similar strategy to the one seen in the lecture. The following class then required students to give a short presentation of their case study, after which discussion centred on the specific sustainable design strategy. The aim of case study presentation and its accompanying discussion was to reinforce the students' understanding of lecture contents, broaden their view of sustainable design solutions proposed around the world, and encourage them to share their knowledge and opinion on such issues with classmates.

Having been exposed to diverse sustainable design strategies through lectures and case studies, students were then required to work on two design projects, the aim of which was to encourage them to put their knowledge of sustainability – knowledge derived from different class activities – into practice. The first project involved students selecting everyday discarded materials and using them to design household products that could be marketable and produceable; the second project was a design competition that posited a search for new sustainable products appropriate to the competition organisers' brand and manufacturing process. Both design projects were intentionally focused on all three sustainability principals – Planet, People and Profit –enhancing students' understanding about relations between sustainability principals and design practices. Whilst working on the projects, students received feedback and advice from the lecturer as well as design, manufacturing and business professionals. This process was aimed at bringing the design projects closer to a real world context.

The course concluded with each full-time student writing a self-reflection report on the course. Students were asked whether and which different class activities had benefited them; whether what they had learned from the course had had an effect on them in terms of attitude, views, values, lifestyle, design work, etc.; whether there were any salient aspects about the course, positive or otherwise that could be improved, and if so, suggestions on how this could be achieved. The aim of the self-reflection essay was to gather insightful feedback from each student towards the planning of similar courses in the future, whilst subsequently acted as feedback for the university's standard teaching evaluation survey completed by each student quantitatively.

What had been learned

The course learning outcomes successfully met the course objectives – that of implanting sustainability into students' head, hands and heart. The university's teaching evaluation survey received great satisfaction (4.11 out of 5). Moreover, the self-reflection essays of all thirteen full-time students clearly showed positive feedback with no exception. Listed are key insightful responses from the self-reflection essays:

The Ecological Footprint appears to have been an effective first step with which to start the course. Students immediately came to realise how their daily activities affect our planet, effectively drawing sustainability closer to their lives, and engaged each of them in the course to varying degrees:

> Before I thought that I am someone who cares for and has done more for our planet, but after the Quiz, I was totally wrong. The result made me want to find out how I can actually contribute to our planet.

While in this course, the Ecological Footprint was beneficial in raising student awareness and gaining their attention, it was used elsewhere for analysing the effectiveness of sustainability education in transforming behaviours (Ryu and Brody, 2006: 163-169) and for encouraging students to think how to reduce their environmental impact (Crompton, Roy and Caird, 2002: 316-321). Instead of feeling overwhelmed and discouraged by the Quiz, undertaking it provided scenarios for how to reduce ones personal impact and left students with the feeling that individuals can make a difference: "After the Quiz, I want to reduce my Footprint. Although I cannot change my entire lifestyle, at least I can change some parts of it". Apparently responses indicate that this course's activity overcame the disempowerment challenge confronting sustainability education (Moore, 2005: 79; Ramirez, 2006: 191; Domask, 2007: 63; Sibbel, 2009: 79).

There is a consensus that the field trips significantly benefited everyone in many ways. The field trips gave the students firsthand experiences as well as broadened their understanding and perspective on sustainability engagingly: "Each field trip encouraged me to walk through the real world, where there are so many factors to be concerned when applying knowledge of sustainability into practice". Seeing with their own eyes what local individuals, organisations, and communities have been doing regarding sustainability and furthermore, what they have accomplished definitely inspired students to do their own share as individuals and designers: "A visit to Osisu[1] gave me a vision of how design can turn waste into valuable products … it took me to a sustainable gateway, where I have made a decision to step in". It becomes evident that field trip is one of the most effective pedagogic strategies for sustainability (Alvarez and Rogers, 2006: 177-186; Department of the Environment and Heritage, 2005: 20; Domask, 2007: 63).

Eight out of thirteen students mentioned lectures as essential regarding their sustainability learning. The lectures provided them a better and broader knowledge and understanding of sustainability and sustainable design. Introductory lectures seemed to be necessary for many students, who had previously perceived sustainability solely from a narrow perspective: "Before, I thought that sustainable design is about using green materials but the lectures gave me a clearer understanding. Sustainable design actually concerns the whole lifecycle – from raw material extraction, production, distribution, consumption to disposal". Hence, within this sustainability course and in few others, traditional lecture-based learning played a crucial role as pedagogic tool (Bergeå et al., 2006: 1432-1441), while in many courses, its role seemed to be less significant (Alvarez and Rogers, 2006: 177-186; Crompton, Roy and Caird, 2002: 313-323; Domask, 2007: 53-65; Fletcher and Dewberry, 2002: 41-46; Holden et al., 522-532; Segalàs, Ferrer-Balas, and Mulder: 275-283; Sipos, Battisti and Grimm, 2008: 72-81; Warburton, 2003, 50-54).

Case study presentations and discussions were highly appreciated by eleven out of thirteen students. Self-study – searching for a relevant case study, preparation, and class presentations – reinforced students' understanding of the lecture: "To be able to present my case study, I was forced to study the subject further by myself. I had to really understand it, not just let the lecture go in one ear and out of the other." Knowledge sharing – listening to other students' presentations and discussing them – broadened the student's view of current sustainable design practice: "Some content I didn't know while some I already knew, but it was about sharing information, knowledge, and opinions. I loved this part and always looked forward to listening to my friends' presentations". Apparently, self-study as well as knowledge and view-sharing prove to be favourable in creating a better understanding of sustainability in practice (Balsas, 2001: 320-322).

Twelve out of thirteen students considered hands-on experiences from the design projects to be fruitful. During the projects, the students learned how to apply principles of sustainability into design practice: "I got a chance to apply the knowledge gained from lectures and field trips into my project, where I had to design a product from garbage, to become valuable, saleable, and possible to manufacture". Clearly learning by doing is an effective means of building-up students' skills for applying and turning sustainability into practice (Department of the Environment and Heritage, 2005: 20; Holden et al., 2008:522-529). Bringing outside professionals into the classroom was further appreciated by students: "Last week when I totally got stuck with my project, the guest's advice helped me a lot". The input from practitioners can definitely add valuable and realistic perspectives to the class (Balsas, 2001: 322-324; Holden et al., 2008:522-529).

Unanimously, the students become more aware of their impact on our planet. Not only are they trying to become more responsible individuals and designers, but in addition influence others:

[1] See http://www.osisu.com

> I didn't think much about sustainability before. This course has changed my attitude, lifestyle, and design. Now I'm concerned about sustainability when doing things. I separate waste, eat less imported food, reuse things, ... design sustainable solutions, and also suggest people to take the Quiz to persuade them to change their lifestyle.

Moreover, the students' view on the design profession has been changed significantly. A designer is no longer someone who designs cool and attractive products but a person who has a great responsible for our mutual sustainability:

> This course has changed my definition of design. Design is not about using aesthetics and features to increase consumption ... I want to design things that are practical and do not damage our planet, unlike some of Philippe Starck's that cannot be used, although they are popular.

Therefore, one could claim that this course and others elsewhere (Alvarez and Rogers, 2006: 185-186; Crompton, Roy and Caird, 2002: 321-323; Domask, 2007: 58-63; Holden, 2008: 529-532;) have partially transformed the students towards their affective learning outcomes of sustainability education while others seem to struggle to do so (Boks and Diehl, 2006: 935).

There was a consensus that the course was knowledge and perspective-enlightening, inspiring, engaging, and fun: "At the beginning, I thought that this class would be a boring lecture class but you impressed me with a number of real field trips and case studies". The students thought that the course not only benefited them, but would also benefit others: "I have learned a lot from this course. I think that others should definitely enrol in this course". There were some comments on minor details that could be done better such as increasing interdisciplinary cooperation, having design projects focus more on the diversity of sustainable approaches, or generally making the class atmosphere more fun and interesting.

Conclusion

To achieve our sustainable future, individuals have a responsibility to do what they are able to do and there is no exception neither for designers nor design educators. In the Sustainable Product Design Course, teaching and learning strategies were planned and used to achieve course objectives without any particular pedagogical theories in mind. Apparently, the course success was a result of an effective combination of diverse pedagogical methods: traditional lecture-based, awareness-raising, firsthand experience, self-study and knowledge sharing, hands-on, and critical thinking. It becomes clear that a singular pedagogical method alone can hardly nurture sustainability into learner's head, hands and heart. It is rather an integration of various strategies complimenting each other that leads towards success in sustainability education. The experience gained through course teaching and learning strategies is probably relevant to planning future sustainability pedagogy for design education and may also find application in other fields.

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the Learning Network on Sustainability

Free Design Bank

www.freedesignbank.org

Dr. Manuel Baño Hernandez
CEU-UCH University, Valencia, Spain

FREE DESIGN BANK is a pedagogical project carried out by volunteer students based on the use of design as a means of cooperation. On the project student volunteers collaborate with craft-workers/producers through the concept of fair-trade.

FREE DESIGN BANK without making a profit offers a space on the net for both craft-worker/producer groups of the disadvantaged countries of the South and design schools worldwide. Both can use the free design bank as a meeting place. A design bank defined as a commitment to student participation in design knowledge, integration and development of the production processes of the disadvantaged producers of the South.

This on line cooperation project has been created in the University of (CEU-UCH), under the directorship of Professor Dr. D. Manuel Baño, and has the financial support of the University itself, the Valencian Government and the Santander Group.

Background

Since 1999 teachers and volunteer students from The School of Engineering Design of Cardenal Herrera University (CEU-UCH) have collaborated with craft-workers (artisans) of different countries in cooperative projects with the aim of achieving development through design. Financed by the University, the local Valencian Government and the Santander Group, the project is called “Design for the Real World and is the conceptual framework from which the project that we present was born and we have named it “FREE DESIGN BANK”

The framework for the project “Design for the Real World” consists of the study (by teachers and volunteer students) of the commercial, social and geographic circumstances etc. of different groups of craft-workers who are living in a situation of extreme necessity in poor countries of the South. The project focuses on the training and the applying of product design concepts to their own work thus providing them with an element that differentiates their product from the aggressive trading policies of the North.

Volunteer design students from all over the world collaborate with local craft-workers/producers, freely offering them their skills and knowledge in the development of craftwork projects .This collaboration is carried out through the web-site www.freedesignbank.org.

As a result of these experiences all the student volunteers who have participated during the last ten years have developed a more global and human awareness of their studies as well as improving their professional training. (figures 1,2) For the craft-workers/producers themselves they have improved their own productive systems through a greater understanding of how local and global markets work. All this has been confirmed by a substantial increase in their exports leading to an increase in the number of jobs and the consequent improvement in peoples´ quality of life.

Currently products designed in the University of CEU-UCH can be found in Fair-trade shops in Japan, Canada, France, Italy, Holland, UK, Germany and Spain where Intermon-Oxfam have been the main support for the project.

The project has ten years of history to count on and this has made possible the consolidation of a strong methodological base and organizational techniques on which the current work is based. The work carried out so far with producers from other parts of the world allows us to generate new expectations that can be tested and validated in accordance with our fixed objectives.

Experience demonstrates that the project offers the students a new and interesting perspective of their profession, giving them new ethical values and new methodological techniques for university teaching. Experience also demonstrates that cooperation in design, trade and diffusion of craft products is essential in the development of craft workers/producers of the South.

Introduction

The Project Department of the School of Engineering and Design of the University Ceu. Cardenal Herrera of Valencia presents the cooperative project called FREE DESIGN BANK.

Utilising information technology we want to bring new experiences to teaching practice by following criteria and methodological principles based on voluntary student participation and integration in the global pedagogical project which has human values at its centre. By using information technology we are able to reach worldwide, giving a new focus to the teaching of a profession – Product Design – connecting it with cooperative design projects and the producers themselves of the poor countries of the South in accordance with their knowledge and way of life.

Through this project we intend that the results of the work (and learning) of the student volunteers will be much more than a mere academic hypothesis, that the results will have real positive repercussions on the people and communities of the real world. We want to collaborate closely with the unprotected producers of the South in order to improve their quality of life by selling their products on the world market under the laws of fair-trade. (figure 3,4)

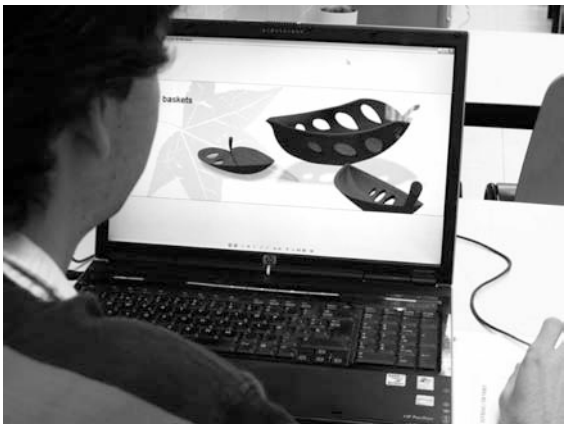

Figure 1

Figure 2

Project Description

The project consists in the creation of a web-site that offers – freely- collaboration in design development with poor craft-workers, through the unselfish participation of design schools worldwide. FREE DESIGN BANK is a bank of free design destined not only to improve but also to optimize the production and commercialisation of products made by craft-workers/producers of the South.

FREE DESIGN BANK is a web platform, created in the University CEU – Cardenal Herrera of Valencia in which the shared interests of producers of the South and design students of the world meet. Producers in the South require assistance in the design of their products and design students need to gain experience. (figure 4) Experience in the realities of a globalised market place. This web-site provides a meeting place, a web-site conceived by the need of both producers and designers to reach a global objective: for North and South to work together on the basis of cooperation and equality.

The web-site www.freedesignbank.org is run from the Project Department at the University CEU-UCH. The department acts as a nexus, channelling and evaluating the design demands coming from craft-workers/producers of the South (and also the Fair-trade NGO´S worldwide) who are interested in improving their products by increasing production, improving methods of billing and market presence. And

finally, and obviously the central objective of improving peoples quality of life. Any offers of collaboration from other universities worldwide are also evaluated and managed.

This web-site is a potent tool in spreading the idea of connecting university training with cooperation and development worldwide and through this providing open lines of communication between the three main protagonists in the design development process: The universities where design is taught (volunteer students), the craft-workers/producers of the South and the NGO's that sell Fair-trade products.

Making contact easier with universities of the North we hope to involve students and teacher volunteers from developed countries that want to collaborate with this project.

Through establishing contact with universities of the South we intend to involve university students and local teachers in the project thereby promoting a production and local design culture that helps to create jobs and generate collaboration between different social layers in the same country.

We intend to establish agreements with NGO's of Fair-trade through which they request new designs for the craft-workers/producers that they work with in exchange for a commitment to increase the amount of orders.

To the disadvantaged craft-workers of the countries of the South we offer them free product design assistance according to their demands and necessities as well as taking into account other players in the commercialisation process such as NGO's of Fair-trade. From this experience we intend to deepen our relations with craft-workers and extend our support well beyond the academic limits of Engineering Design. (figure 3)

Figure 3

Figure 4

Operative Scheme

The www.freedesignbank.org will manage the needs and requests of craft-worker groups, universities, and designers interested in collaborating with craft-worker groups in the design of their products.

Universities interested in the project and that desire to collaborate in the development of design projects with local craft-workers/producers, Fair-trade organisations that need to improve the characteristics of the products they sell can apply to collaborate through the web-site.

Craft-worker groups can request and apply for design assistance through the web-site. After studying the characteristics of the request the Project Department of the University CEU-UCH will define and structure the case providing a technical briefing that is easily understood by any work group worldwide who wishes to ask to participate in the project.

Finally the briefing that defines the problem will be handed in to the person responsible at the collaborating university or the person responsible for team design that has offered to collaborate in projects of cooperation and design.

The participants; student volunteers, university teachers and other professionals will study the craft-workers/producers problem and their concrete circumstances. They will develop product engineering proposals and propose different product designs adapted to the cultural characteristics and productive capacities of each group, always taking into account cultural and social factors etc. (figure 5)

Once the proposals (always free) coming from different design schools worldwide,

have been developed and finished they then will be offered through the web-site (access will be given only to those craft-workers/producers, NGO's and design schools involved), and modified only by agreement of those involved.

The finished products of this cooperation are better adapted to the craftwork techniques of production and their manufacturing is more rational and profitable for the cooperative producer.(figure 6) This results in a product that is more competitive and therefore more marketable. The craft-workers increase their sales volume substantially thereby becoming integrated in western markets.

The quality design proposals carried out by students and that for other circumstances (of price, material, commercialisation etc.) cannot be used by the parties involved will be offered openly and freely on the web-site to all accredited groups who commit themselves to develop and commercialise according to the norms specified on the aforementioned web-site.

Craft producers are required to be signed up to the Fair-trade commercial network and fulfil the requirements of this trade system.

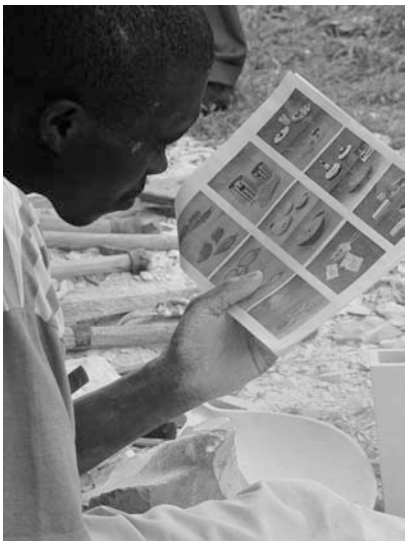

Figure 5

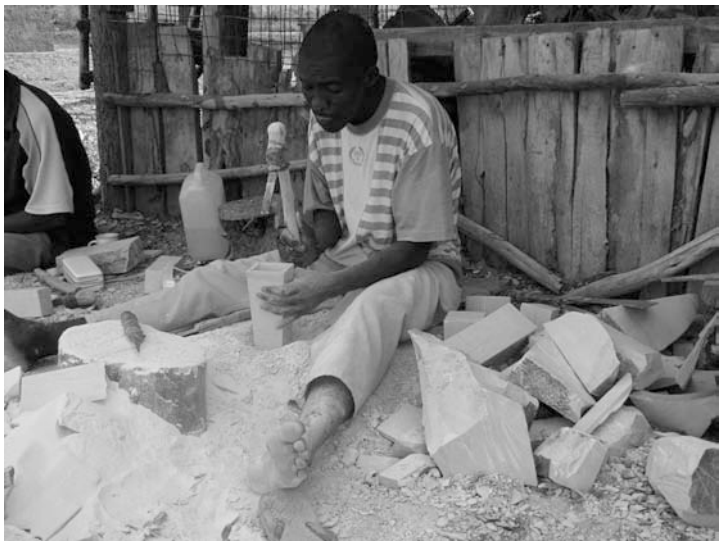

Figure 6

Concrete objectives of the project

To develop a new pedagogic teaching system that links university teaching with the reality faced by the producers of the South, in which the student becomes aware of his/her role in the making of a more just and equal society. A teaching project where students voluntarily and actively connect the social reality of the world which they live in with their university education through Industrial Design Engineering.

To introduce Industrial Design and Product Engineering in an environment of commercial solidarity, and as a rational tool to increase productivity and the attractiveness of the products of the disadvantaged producers of the South. (figure 7) To increase the interactivity of design and fair-trade with other disciplines, such as architecture, the fundamentals of economics, law and international trade, engineering, marketing, communications and publicity… etc. and to open the design concept universally.

To collaborate in the introduction of systems of knowledge management in university teaching that are more modern, more sustainable and more cooperative than those of the last century. To utilise information technology to give more opportunities to the producers of the South

To establish contacts with universities of the South in order to increase the interchange of information, experiences and students within the environment of design and product engineering (figure 8).

To enable the most disadvantaged producers of the South to employ knowledge and techniques derived from the application of Industrial Design and Product Engineering (and associated disciplines). And to assist them in the development and commercialisation of their products, proposing new design concepts that are more commercial and current with the final aim of increasing competiveness and sales.

To make the world aware that a viable sustainable egalitarian way exists in which to understand commerce and consumption, and from the university it is possible to impart a solid and efficient professional training in the fundamentals of international cooperation, in social justice and ethical values.

Figure 7

Figure 8

Project Necessity

From a macro-economic point of view, it is obvious that the whole world would benefit if there existed a more balanced and equitable system of the world's productive forces. And there is no doubt that a redistribution of the world's wealth is both desirable and necessary.

One of the problems that craftwork producers of poor countries face (only one of many) is that the peculiarities of rich countries markets are unknown to them. The basic universal fundamentals of product design, the face of their business, are also unknown to them. In addition to this in the majority of cases they are unfamiliar with a number of important aspects of business ; systems to increase productivity and production, how to get financial backing, access public funding, principles of international law or finally how to draw up a business plan.

FREE DESIGN BANK can be used to develop a new operative method of project teaching based on the participation of volunteer students worldwide in the problems of cooperation in such a way that the students take the responsibility for the training of the disadvantaged craft-workers/producers in the South, so that they themselves can solve their own commercial problems derived from the lack of knowledge of the fundamentals of Industrial Design Engineering (among many other things)

With making easier the access to good commercial designs free of rights (with logical restrictions) we try to reduce the distance that separates the North from the South in terms of aesthetics, economics, commercialisation, and technologies. In other words if the price and form of the product is not attractive it will never reach the markets of the rich countries of the North.

Finally, with the help of this and other training projects we hope to contribute to the creation of jobs and competitive industries in the South that are able to place their products in the North and in this way generating knowledge, work, wealth and hope in the South.

Starting from the practice of university teaching, FREE DESIGN BANK is a project where we can see the heuristic potential whereby using the "excuse" of design we are able to work on a scale that usually remains outside of the students´ experience on a conventional academic project.

Volunteer students collaborate in an innovative project utilising tools of communication on a world level to relate both personally and professionally with other cultures with different necessities. Through this process students see the importance of solidarity on a global scale. The actual training placements in third world countries turn students into citizens of the real world.

It seems necessary to us to show that a complete university education/training has to be related not with economic or social success but with values, ethical principles and universal morals with which to work professionally and grow as a person.

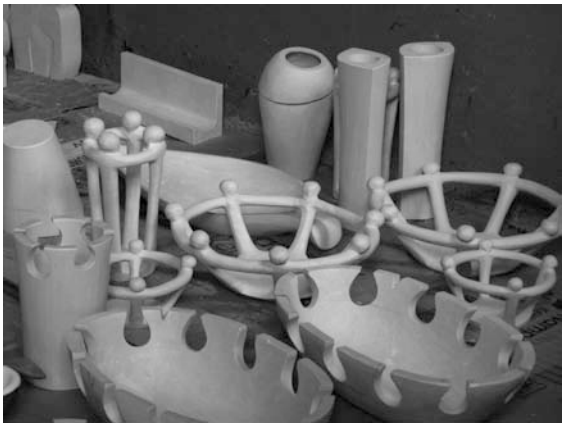

Figure 9

Figure 10

Project benefits

The designs that will be carried out during the present Investigation Project will face the most difficult commercial reality, that being to achieve competitive results in the first world with disadvantaged groups of producers in the Third World. For this reason we can consider the project as a rich experiment where only the best initiatives will bear fruit.

In this way, we can determine that the applied methodological systems in this project are potentially transferable to any other design project with similar characteristics in a less critical environment, resulting in an advance in sustainable knowledge.

One of the characteristics of design is to offer a good and different solution for each point of view. Design doesn´t have the solution to certain questions of moral importance but its use needs to be based on the awareness of social problems. Good design practice helps each designer to decide where to draw the line, and how far to go in their commitment to a fairer society. Therefore in the investigation project we look for a personal commitment from the student through the design project. We understand that this could be considered as a "technical-ethical transference"

Requiring a lot of political debate the project inevitably obliges students and teachers not only to give their opinions but also to be coherent with them.

The idea of responsibility is introduced, professional responsibility in the pursuit of real objectives and real social facts and not, as is the norm, an unreal simulated situation.

By putting into the hands of craft producers designs that they themselves despite their limited resources can produce, our commitment with craft producers strengthens and we feel satisfied with our personal commitment as teachers-designers. Products that our consumer society wants to buy despite the fact that these products are produced by craft-workers. Furthermore we will have helped craft-workers to enter into a market where their products have a guaranteed sale – and all under the banner of Fair-trade, something unthinkable months ago. During the Latin American summit meeting celebrated in Madrid at the beginning of May 2002, underdeveloped countries called for the opening of markets for their goods.

They pointed out the fact that receiving help in the production process counts for nothing if those very same countries that give that help close their borders to the goods produced by countries of the South.

With our intervention and with access to the web-site, producers should be able to increase their sales and with this their expectations for the future (commercial and social). They also should be more able to understand the laws of the market place that govern international trade thereby being better prepared and organised to compete in the global market.

Our objective is to fulfil a debt with the disadvantaged countries of the South. This debt is as designers of often unnecessary objects produced for our enjoyment by craft producers without resources who receive not even a fraction of our welfare.

Through the teaching of design professionals we intend to give a fresh impetus to the system of Fair-trade and we hope that the countries of the South can get back a small part of what we owe them. We feel encouraged to continue convinced that the idea of the transmission of knowledge through teaching design and solidarity can continue to grow inside the World University community. (figures 9,10)

About the author

Dr. Manuel Bañó alternates his work as the director of teaching projects with his work as a product designer.

Since 1985 he has worked in the furniture, toy, home and footwear sectors. Some of his designs form part of a permanent collection at the Museum of Decorative Arts in Barcelona. His work has also been exhibited at the Reina Sofia museum, the Valencian Institute of Modern Art (IVAM) and the Museum of Ethnology in Valencia amongst many other multiple collective expositions on Spanish design worldwide.

This work has recently been acknowledged by the winning of two Ángel Herrera Solidarity awards by the San Pablo Foundation in 2000 and again in 2005. The work has had further awards such as the Distinction of Solidarity of the Professorship 2002 and from the Department of Fair-trade of the foundation Intermon-Oxfam.

The director of the project, professor Dr. Manuel Bañó Hernández has been recognised with the award Ángel Herrera 2006 for his teaching according to the opinion of students.

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On the development of culture industry and the personnel training of creative design

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In the times of global economy characteristic of knowledge-centered competitiveness, culture industry, praised as "Sunrise Industry" which has commercial value and cultural connotations in the 21st century, assumes an unprecedented development trend. Being an act of culture creation, designing plays an important role in culture industry. The lack of qualified personnel in creative designing constrains sustainable development of culture industry, which is a key issue at present. The top priority of higher learning institutions which train talents in creative design is to pay special attention to talent demand in culture industry and study as well as construct scientific mode of personnel training. Based on the development status of Chinese culture industry and combining the development trend of international culture industry, the present paper points out that the personnel training of creative design ensures sustainable development of culture industry. It also views that to explore and set up new goals of personnel training and teaching system is significant to shape complex art and design talents who possess creative consciousness, entrepreneurship and practical ability.

In the context of knowledge economy in the 21st century, praised as " Sunrise Industry" or "Green Industry", culture industry with its own characteristics has become one of the most dynamic industries in the world. According to the statistics of UNCTAD, the global culture industry increases averagely at a rate of 7% per year and the added value of it accounts for about 8% of global GDP. Today, culture industry is an important sign measuring economic and social development of a country or a region. Many countries take culture industry as a new power to cope with financial crisis and promote economic development. In recent years, Chinese government also attaches much importance to the development of culture industry. It has issued a series of policies which aim to promote culture industry development and continuously increases support for culture industry. Faced with a historic opportunity for development, China is still in its initial stage as far as scientific research of culture industry is concerned compared to countries with rapid development of culture industry. Therefore, studying the development status of culture industry as well as exploring new goals and mode of personnel training is significant to promote the sustainable development of Chinese and world culture industry.

1. Creativity-centered Culture Industry

Culture industry refers to creative practice with culture as its basis and creativity its core. Depending on the wisdom, skill and talent of the creator and with high technology to create culture resources, it manufactures and markets different forms of cultures, entertainment products and services in the form of industrialization. In modern times, economic development and social progress promote the development of culture industry, and in turn, the development of culture industry plays a positive role in satisfying people's higher levels of psychological needs in culture, education, entertainment, leisure etc..

Creative design highly praises originality and emphasizes the function of artistic design in supporting economy and promoting emerging economic practice. Creative design in the field of industry, urban envi-

ronment, animation film, web game, and exhibition design etc. is characterized by intensive knowledge, highly added value and high integration and plays a significant role in optimizing the structure of culture industry. In a knowledge-based economy and information age, the leading factor for economy development is not only restricted to the promotion of investment, technique and institution, but to use culture as productivity and creativity as a promoter to enhance the economic value. Excellent planning and originality have a function for raising notability, increasing the added value of products and expanding market share. The high value-added originated from creativity is an important feature of culture industry. Some scholars view that culture industry can be divided into two parts, namely, the core part and the additional part. The core part is characterized by cultural creativity, while the additional part aims to transform the intangible creativity in some form of carrier into tangible and materialized form, making it become product for consumption and as a result, realizing the value of its industry. The core part of culture industry is highly dependent on knowledge and innovation. Whatever carrier it uses to carry it to the market, its high value-added is mainly from the core----originality.

In recent years, culture industry rises at an unprecedented rate in China and some cities consciously focus on cultivating culture industry. The development of culture industry is actively promoted in some Chinese cities such as Shanghai, Shenzhen, Chengdu, Beijing etc. and a group of ground-breaking culture industry bases are established in these cities. Beijing Municipal Development and Reform Commission puts forward a policy of vigorously developing the cultural industry and mainly supporting six industries such as cultural performances, publishing industry, film and television production, animation and online game development, cultural exhibition and antique trade. A leading group is also set up to research preferential policies of supporting the development of culture industry.

Shanghai is a city where Chinese culture industry develops most rapidly. According to statistics, the value of cultural industry has accounted for 7.5% of GDP of the city. In 2005, the first 18 “Creative Industry Gathering Areas” were established in Shanghai with official approval given by the Municipal Economic Commission and more than 400 various design agencies with over 10,000 designers from nearly 30 countries and regions were set up there. In 2007, Shanghai creative industry total output value reached 310 billion RMB, increasing about 3% compared with that of the previous year. Creative culture industry has become a new potential industry which promotes the economic development in Shanghai.

The cultural resource conditions in China enjoy exceptional advantages. The cultural resources not only hold rich cultural and historical relics, but also have a unique and rich cultural sedimentation in folk culture, folk art and modern technology, which provides an inexhaustible source of creativity for creating cultural products.

2. The Significance of Creative Designing in Culture Industry

“The concept ‘disegno’ stems from the Italian Renaissance.” Design is a carrier and an external manifestation of creativity. It is a creative activity that communicates a planning, conception and tentative idea through an appropriate way. In a broad sense, design is a kind of culture carrying a wide range of economic, social and political significance, which not only means the creation of material basis for life in modern society, but also means the planning and foresight for the construction of an ideal future society of mankind. It conveys the values and aesthetic standards of people from a visual angle. “The broad meaning of designing contains creative thinking in the artist’s mind.” In a narrow sense, designing means the specific design of a product or work. In recent times, with highly developed production capability, modern design that merges with science and art has organically combined to society, economy, science and technical progress. Modern design is a part of modern economy and market and different market activities contribute to different design categories. “Design has become a’ marginal area’ which combines the field of art with that of technology.” Brilliant design with innovation is viewed as a product which reflects aesthete and creativity of human beings. As far as modern life is concerned, designing reflects the most common aspect of everyday life and is an important activity closely related to the life of mankind.

Each time the progress in science exerts tremendous influence on the transformation in the field of art and design. Just as Mr. Zhengdao Li, a famous scientist and Nobel Prize winner, put it, “Like the two sides of a coin, art cannot be separated from science and technology. Their common ground is man’s creativity and the goal they pursue is universal truth. “The development of information technology has created broader space for expression. Computer graphic design, which rapidly appears in mass media and the

field of visual art design such as television, film, industrial design, exhibition design and architecture design etc., has become sophisticated visual representation means and form.

"Innovation originates from the inspiration or creativity of artists, designers or planners who are the real promoters of culture industry." In recent 10 years in the United Kingdom, known as the world's creative capital, culture industry develops rapidly and its growth rate has reached the highest in the world. Together with the financial services industry, they become the two pillars of the UK knowledge economy. Mainly relying on British professional design, some enterprises establish international brands to reach the consumer market. Famous enterprises, for example, Samsung, Nokia and Yamaha etc. have established design and R&D center in the United Kingdom. Taking advantage of British design talents, these enterprises create products catering to the tastes of European and world consumption. The creative design inspiration of some world famous international brands such as Apple iPod and BMW's MINI cars originates from British designers. During the evolution of film, fashion design and digital media, the UK has set up many world-renowned festivals such as London Film Festival, London Fashion Week and London Design Festival etc.. Culture industry has become a major force in the UK economy.

2008 Beijing Olympic Games is the most comprehensive large-scale creative and planning activities, which consist of visual communication design, stadium design, fashion design as well as planning and design of opening and closing ceremonies. From the creative point of view, the creative design of Beijing Olympic Games integrates various design elements and design types. With the opportunity brought by the 2008 Olympic Games, Chinese culture industry has established fashion culture and global market depending on itself and it is bound to create a huge industry and economic value.

In the 21st century, digital art and design industry represented by digital imaging, CG effects and network technology has become core industry of knowledge economy. In America and Japan, the output value of digital art and design industry exceeds that of auto industry, while in South Korea, digital content industry represented by the games is the foundation of the nation and has become its new driving force for economic growth. Currently, the global digital content is constantly expanding in deeper and broader field, and this industry will also become one of the most promising culture industries in China. In the next few years, talents in digital media creation are in great demand. Faced with such a huge market environment and talent demand, education concerning digital art and design is still in its initial stage and has not yet set up a sound scientific theoretical system concerning new media art and personnel training mode, which results in the lack of professional design talents badly needed by culture industry and problems during the evolution of new media art and design.

3. Personnel Training Ensuring Sustainable Development of Culture Industry

Issues concerning talents constitute the key issues during the development of culture industry in China. As far as culture industry is concerned, creative personnel training is an effective way to ensure its sustainable development. From 1997 on, the British government began to support the development of culture industry by issuing corresponding policies. Based on the analysis of British industry and its development strategy, 4 relative measures concerning sustainable development of culture industry have been taken and supported: first, exploration of technology and education potential; second, exports promotion; third, tax and policy adjustment; fourth, intellectual property protection. From what is mentioned above, we can see that emphasis on education is an important factor for healthy development of British culture industry. For this reason, the British government has established organizations of higher education forum for creative industry, combining higher learning institutions with industries and making full use of university resources to train creative personnel for industries. Meanwhile, responding to demands from industries, some universities set up colleges of creativity and culture industry and offer new courses conforming to culture industry such as digital television, animation and multimedia etc..

At present, the discipline of art and design covers almost all the comprehensive universities. Enormous wealth of cultural, scientific and technological resources and advantages of blending disciplines in comprehensive universities ensure sustainable development of talents. Talents serve the society for the construction of economy and culture is demanded by modern society. In a new era in which global economy tends to be characterized by digit and network, "modern design education with epochal and opening character shows greater vitality. " An important goal of curriculum reform in modern art and design education is to make major establishment plan with prediction and to explore original specialties with devel-

opment potential, greater compatibility, high technology and needed badly by Chinese culture industry by paying close attention to changes in social demands and sticking to the policy of opening to the market in specialty design.

As far as designing is concerned, "originality" distinguishes outstanding designs or products from imitations."An increasing number of facts prove that the fundamental difference between outstanding design and ordinary design or poor design is the gap between different creativities."The training of creative personnel in China and the development of modern art and design disciplines should highlight the advantages of regional culture while emphasizing individuality and originality conforming to principles of modern design. To enhance the overall competitiveness of China, we should create a large number of innovative design talents who possess distinctive features, innovative consciousness and pioneering spirit and are able to adjust themselves to the need of Chinese culture industry development.

It should be said that the rich historical and cultural resources as well as national culture resources in China provide exceptional conditions for education innovation in art and design disciplines of higher learning institutions. These resources are inexhaustible treasures for creating culture industry with Chinese characteristics, which should be highly valued. However, rich culture resources did not help China create powerful culture industry. The embarrassment of rich resources and small industries reflects that rich cultural resources in China have not been developed effectively and utilized to transform into cultural products, thus to form a cultural industry chain. So lack of innovative design talents is one of the key factors that restrict the development of Chinese culture industry.

Therefore, the top priority is to promote comprehensive reform in art and design education and cultivate design talents with innovative consciousness, pioneering spirit and practical ability. Universities and colleges in China should cooperate with each other and establish coordination bodies to build a platform for cooperation and exchange between higher learning institutions and businesses, enterprises as well as research institutions. Meanwhile, a teaching staff with a combination of full-time teachers and part-time teachers should be set up. Experiences, artistic accomplishments and influence should be taken into consideration when selecting the teachers. Part-time teachers whose profession is animation, environmental art and digital media etc. can be selected from the front-line units such as enterprises, design companies, TV stations and museums etc.. These talents are directly involved in cutting-edge art and design activities and their new design concept and means can help their students develop various thinking patterns and explore their creative potential. Just as coal and oil are resources, talents with innovative consciousness are also a resource. As a result, talents training will be a key factor in future development of economy and culture industry. Therefore, the training of creative design talents in Chinese universities and colleges will inject new vitality and lay a foundation of human resources in promoting the sustainable development of Chinese and world culture industry.

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Status of womenfolk in art education among the tribal societies

A case study of north-eastern region

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A society has two dimensions to guide the human resources such as social responsibility and social welfare. Education is an integral part of social awareness, which has not reached out to the majority of tribal women living in North-Eastern region. Due to this, ignorance, superstitions, non traditional livings, lack of awareness, etc. exist in the concerned tribal societies of North-Eastern region of India.

The responsibility, awareness, accountability and commitment towards each and every tribal society should be developed among the new generation through education. The rate of tribal women work participation is so high in North-Eastern region compare to the male participation.

The North-Eastern tribal womenfolk have a vast traditional knowledge on their indigenous products and the themes, ideas, technologies of their approaches must be documented and covered in the tribal studies. In the same way, everyone should follow their traditional guidelines and identify their cultural roots.

This paper seeks to search the degree to which the opportunities of education among the tribal societies and economic progress have been shared by them.

Introduction

Purnendu Kumar describes that "*Human society is dynamic whose rise and fall depends upon various socio-economic forces in operation. Since time immemorial the society has moved from the primitive stage to the present industrial stage. This has caused many changes on the spectrum of human life – human attitude, way of living, social and economic activities, occupational pattern, etc*."[1]

In this paper an attempt has been made to focus some aspects of technological devices and acceptance by few tribal communities in North-Eastern region.

It has been observed that in the total North-Eastern region of the country comprising eight states the indigenous people may be divided by two ways such as hill people and plain people. There are so many tribal communities in this region and each community has different classifications and among of them any one can be identified of their roots through their socio-cultural life.

Observation-I

Traditional education among the tribal people is very attractive and these kinds of practices are fading away due to acceptance of modern strategy. Everyone have a choice to get a formal education through the implications of technological devices. There are a good percentage of tribal people who want to live in the capital of the state and getting also different assistance from the State and Central schemes. It is a good effort for every human being and s/he has the right to get education as because education for all and in the present situation the principal condition of each state is everyone should become literate. In the same way, they are leaving the traditional background as well as language, culture, habits, etc. In spite of

this, the new generation of each tribal community is always straight forward. They will not go back to their own society to settle in permanently.

Now the question is whether they are developing only themselves or doing the all activities for the new generations by which someone will follow them?

Is this development or the primary level of crisis?

Every State Government have to think to **preserve the cultural scenario** of each tribal community and doing the best also as per instructed by Govt. of India. Now the question arises that is it the true policy to develop a country as whole or particularly for tribal peoples?

Observation-II

Now **education is accepted as a fundamental human right** and simultaneously it is an integral part of social awareness also. Moreover, importance has been given on the tribal studies, where womenfolk are engaged themselves in maximum times compare to the male members. So the education policy has to be concerned with the practical oriented knowledge and that should be related with the indigenous process and technology. The design also may be covered with the idea, themes and techniques of the tribal situation so that the tribal people will have to move to read more and they can achieve their primitive idea to the real scenario. This study will be helpful for their further education by which one can survive him/herself through the research of their cultural roots or trends.

Observation-III

The **education may be implemented in the informal way** also. Education that does not mean – one should go through the bookish knowledge only. The design should be implemented around the culture, traditional possibilities, skills, material culture, the prospects of the local handloom and handicrafts, performance of the ritual and festivals, etc. Keeping all these things in mind if the education policy is designed, the percentage of the tribal students may desire to get a further research study and which will become the net assets of the society as well as tribal communities.

Womenfolk are in sustainable development

A study has been taken around the North-East India, found that the tribal womenfolk are engaged themselves from the keeping child to marketing. In maximum cases, the womenfolk of each tribal community are only the main earners of their family. They participated in the *jhum* or shift cultivation as a cultivator during the seasons and take different initiatives to go to market by which they can contribute for their livelihood.

According to *B.P.Sahu "Agriculture occupies an important place in the economy of the State. Till date is a traditional agriculture based economy and forms the major occupation of the people of the State. It is relatively non-mechanized and hence requires manual labour during various stages of production like ploughing, weeding, harvesting and threshing, etc…. As seen the shifting of the trend is towards females as agricultural labourers and cultivators. It is also evident that the males have diverted from the primary sector to secondary or the tertiary sector for their livelihood and sustenance*."[2]

In this respect, it can be mentioned that **education can be designed on the basis of local resources, languages, elements, concepts and traditional practices**, etc. so that every tribal human being will become a part of education.

Observation-IV

In North-East India each tribe has its specific design in its costumes which carries a significant meaning. It has been found that in every case; only the womenfolk weave dresses for their members in the family.

The **womenfolk are very expert in weaving** – beginning from the process of collecting seeds to the production of raw cotton and dyeing of the yarn to weaving. Even to operate a loom, the tribal women artisans are skilled enough. Almost **every tribal woman has a very powerful artistic sense and creates beautiful designs which reflect their skill, hard work and patience.**

In tribal societies, weaving is a common practice which is gradually becoming popular in the North-East region. The womenfolk engage themselves from their childhood at the age of 10 to 12. Generally, there is no training programme for them to teach how to handle the loom. They acquire this skill as they go on assisting their grandmother while she weaves the indigenous clothes. The girl follows the tradition and gradually she gets maturity.

The indigenous clothes of a tribal community get popularity due to the following reasons:

1. **Colourful costume** is found among the tribal societies due to their choices and practicing modes. The primary colours red, yellow and blue are used during their weaving and black or deep brown or green are introduced in between these colours.
2. A **suitable design** introduced by a specific community and that is popularly accepted among their societies and that design has a special significance for others.
3. The **designs and decorations** are planned in a distinct dress with a peculiar idea so that it also is used in the other part of the costumes. In some cases, it reflects the beliefs and truths of a tribal society. A presentation of a decorated or gives pleasure to the weavers and may have a meaningful ideas or sources all over that design.
4. The **purpose of wearing dresses** is not same. Some dresses are used both by the womenfolk in a specific tribal community but some garments have a special purpose to wear in festivals, dance etc. Again, some special dresses are reserved only for head hunters or warriors or performing activities. But in case of daily wearer, these costumes do not carry any special meaning.
5. Some forms indicate some **special ideas and events** in a given society. In the costumes, it is found that there are often human, animal and natural objects woven in them. Some clothes are used only to maintain a certain social status in a society. Some clothes are only worn for ritualistic activities. Generally, common people do not use these clothes ordinarily.
6. Clothes are normally used in the tribal community also as in other societies to protect one's body from heat, cold and wind etc. Even for the **common purpose** the tribal women use a variety of costumes.
7. Generally, the **main purpose of weaving fabrics** among the tribal women is to meet their domestic needs and if there is any surplus it is taken to the market to be sold. Usually, the male members of the family go to the market with the surplus product. So, weaving becomes one of the main occupations of the tribal people and women manage it along with their household activities.
8. The fabrics woven by the tribal women are **designed with laces, borders,** and sometimes there is a **division of horizontal and vertical lines.** This is one of the prominent features found in this type of fabric. In some cases, the dress is a two part while in other cases it may be more than two parts stitched together to form one complete dress.
9. **Different natural objects, geometrical shapes or other images** are objects of design in the fabrics woven by the tribal women. Normal objects like Sun, Moon, stars, mountain and trees etc. gives an impression of the local atmosphere wherein a tribal society exists. In some cases, some natural objects like a certain variety of flowers found in the near by forest and used as designs by the great grand mothers and used even today by the tribal weavers as a mark of respect to the tradition though the flower may be extinct by now.
10. **Some common motifs** are used repeatedly in the fabrics. Simple and straight lines are drawn following the tradition. Similarly, dotted motifs, bands etc. are commonly used in the same textile wherever these are necessary. Again, for the purpose of beautification, they weave diamonds, lozenges, zigzags and different kinds of angular shapes.
11. They use **home made colours** and prefer contrast of different colours in their clothes. The rate of contrast varies from one tribe to another. The local artisans prepare both the bright and the deep colours. The preparation is known to them traditionally. The sources of the preparation of these colours are indigenous herbs, flowers, and leaves, the bark of the specific woods and some sorts of seeds found in the forest of North-East India. The colour extracted from the natural sources is used to dye the hand made yarn. In this way, a weaver produces colourful fabrics with the help of this dyed yarn.

12. The **techniques of production and the tools** used by the different tribal communities are almost same. Generally, they use a loom – or a fly shuttle loom for the purpose of weaving. Every community has a specific name for this loom. Of course, the sizes and shapes may vary from one community to another depending on the processes and techniques and on the availability of raw materials also. These tools are generally made out of bamboo, cane and wooden pieces indigenously made.
13. These indigenously woven fabrics are **sold in weekly or bi – weekly markets or in near by urban markets.** A survey was undertaken in different markets of North-East India and it is found that the demand for such fabrics woven by the tribal women is high, which shows the demand of the tribal product among the non-tribals. Although the fabrics produced by the multinational textile companies are cheaper it seems the indigenous fabrics have attracted the elites and the rich because these fabrics may heighten the social status of this class of the non – tribal population

Conclusion

A significant change has been noticed among the plain tribes because of their changing habits. This study is based on the following basic points and these should be countered for the remedial measures:

i. Constraints of nature and non-availability of other suitable method.
ii. Introduction of technological devices to maintain the status in the society.
iii. Highly competition in the market scenario.
iv. The traditional cultural trend is in the process of diminishing.
v. Lack of infrastructural development and entrepreneurship
vi. Engagement of family member as an artisan and other traditional inputs having very low productivity.
vii. The basic feature of organizational mode of production is almost absent.
viii. Traditional handloom and handicrafts are producing at a large scale only for the domestic consumption.
ix. Reduction of transportation costs and risk management is not yet calculated among the tribal communities.
x. Percentage of the women artisans is higher than the male artisans.

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Entrepreneurship, design, and sustainability

An exploratory study focusing on an educational program

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This paper explores the interrelations between entrepreneurship, design and sustainability theoretically first and then in practice by focusing on an educational program on entrepreneurship and its participants, who are industrial design students. The *Entrepreneurship Program* is being run by Istanbul Technical University (ITU) in collaboration with Small and Medium Enterprises Development Organization of Ministry of Trade and Industry, Turkey (KOSGEB) and it is the second year of the program. In this study, the motivation and business plans of the industrial design students, who participate to the program, were explored and their concern on design for sustainability was investigated. The aims are to gain insight on the planning phase of design entrepreneurship through an educational program and to build suggestions on developing such programs in similar contexts towards sustainability.

Theoretical background on the interrelations of design, sustainability and entrepreneurship

Design for sustainability

The concept of sustainable development was formulated the first time in the report *Our Common Future* by Gro Harlem Brundtland, which was commissioned by World Commission for Environment and Development (WCED) in 1987 and was defined as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (UN Documents, 1987).

Design for sustainability, Manzini (2008) defines as "*everything design can do to facilitate the social learning process towards a sustainable society. That is, to sustain promising social and technological innovations and to re-orient existing drivers of change towards sustainability*". He suggests that sustainability requires a systematic change in both local and global scale, which can happen through a wide social learning process and design research has to feed this process with visions, proposals, tools and reflection to enable different actors of the change.

Vezzoli and Manzini (2008) describe the role of industrial design as "*activity that connects technologically possible with ecologically necessary and tends to give birth to new significant socio-cultural propositions*" and define its four levels of possible intervention to sustainability as (1) Environmental redesign of existing systems, (2) Designing new and sustainable products and services, (3) Designing new production-consumption systems with sustainable satisfaction of need and desires, and (4) Creating new scenarios for sustainable life styles.

Architect Buckminister Fuller and product designer Victor Papanek are early pioneers of design for sustainability in 70's, who advocated that design could and should integrate commercial needs with those of society and the environment. But despite the oil crisis, unemployment and economic recessions, growth of gross domestic product (GDP) was the ambition worldwide, which design followed. In the second half of 1990's, the concept of *product life cycle* (assessment / design) has emerged as a method for measuring the environmental impact of products in two steps, the input substances from the environment and the output substances into the environment. Eco-efficiency challenged businesses to change, it was

successful to one extend in improving products and services but didn't achieve to improve the whole picture, and overall consumption of environmental resources continued to increase (Fuad-Luke, 2007; Vezzoli and Manzini, 2008).

Eco-design strategies are suggested by Lewis, et al. (2001) as (1) selecting low-impact materials, (2) avoiding hazardous materials, (3) choosing cleaner production processes, (4) maximizing energy and water efficiencies, and (5) designing for waste minimisation. 3 R's of eco-efficiency, to reduce, reuse and recycle forms its main logic, which brings economical thriftiness with. There are successful cases like of 3M, which saved $ 750M through pollution-prevention projects (McDonough and Braungart, 2002).

McDonough and Braungart (2002) suggest that recycling in the existing production system today with its problems can rather be called *down-cycling* and suggest rethinking the concept of waste and from the beginning designing the products to be up-cycled as nutrients to nature or industry itself in a continuous flow. They define these two types of nutrients as *biological and technical nutrients*. The biological nutrients are "*useful for the biosphere*", which are the materials that biodegrade and support the balance of the eco-system in the soil or water, where it degrades. And the technical nutrients are "*useful for the technosphere, the systems of industrial processes*", which return into the industrious cycle for continues re-use. They call this as *cradle-to-cradle* approach.

McDonough and Braungart (2002) suggest that the scenario with technical nutrients should also be supported by product-service-system (PSS), where products are purchased for a period of time and then upgraded by the manufacturer, using the previous version as technical nutrients in the manufacturing system. Morelli (2002) states that although PSS is considered as a part of management and marketing domain, its efficiency, visibility and usability are issues of design.

Thackara (2006) states that 80% of the environmental impact of today's products, services and infrastructure is determined at design stage. For designers to be a part of the solution, "*sustainability should be the meta-objective in every possible design research activity*" was the main message of the conference Changing the Change held in Turin in July 2008 (Manzini, 2009). Still, much of the sustainable design debate is dominated by design research and academics, and sustainable design practice is driven mostly by assumption and preconception (Chapman and Gant, 2007).

Design entrepreneurship

Entrepreneur is a term, which has been used in French language since the twelfth century. One of the early definitions was made by Jean-Baptiste Say around 1800's as "*one, who shifts economic resources out of an area of lower and into an area of higher productivity and greater yield*". Schumpeter is the main figure in the literature on entrepreneurship, who integrated his ideas on entrepreneurship into the economic theory by focusing on economic change and development and later he concentrated on the sociological aspects of entrepreneurship in the early 1900's. (Drucker, 1985; Swedberg, 2000; Landoli, Landstörm and Raffa, 2005).

Schumpeter (1934) defines *enterprise*s as "*the carrying out of new combinations*" and *entrepreneur*s, as who does this. He states that entrepreneurship is not a profession, nor a lasting condition. He defines entrepreneurship as a mechanism to create changes in the system through innovation and entrepreneurs as "*the agents of creative destruction*". He states that the concept of the carrying out of new combinations defines development and it covers five cases, (1) the introduction of a new good or of a new quality of a good, (2) the introduction of a new method of production, (3) the opening of new market, (4) the conquest of a new source of supply of raw materials, and (5) the carrying out of the new organisation of any industry (Schumpeter, 1934).

Until 1970's, the Keynesian economic theory, suggesting increased government interventions to manage cyclical fluctuations was accepted following the positive economic development in society, and the importance of entrepreneurship started to fade away. But after the oil-crisis and the economic up-swing in 1970's, large companies were inflexible to adjust to new market conditions and unemployment became a major problem in Western societies. As a consequence, entrepreneurship along with the topics such as innovation, industrial dynamics and job creation came to dominate the political debate. Then, David Birch was especially influential with his work suggesting that it is not the large firms in the economy that create new jobs, but the small and young firms with twenty or fewer employees (Landoli, Landstörm and Raffa, 2005).

What an entrepreneur is not necessarily or only is Drucker (1985) lists as a capitalist, investor, risk-taker and an employer. Entrepreneurship he considers as a behaviour rather than a personality trait, which lies on a theory of economy and society. He states that an innovator is opportunity-focused rather than

risk-focused, and "*the entrepreneur always searches for change, responds to it, and exploits it as an opportunity*". And to overcome the risks of not succeeding, entrepreneurship needs to be managed and based on *purposeful innovation*.

And *systematic innovation*, Drucker (1985) defines as "*consisting in the purposeful and organized search for changes, and in the systematic analysis of the opportunities such changes might offer for economic or social innovation*". He states that most of the innovations exploit change, which already occurred, whereas they also form change in themselves. Thus, he classifies the discipline of innovation as a *diagnostic discipline*, searching for change systematically, which would offer entrepreneurial opportunities.

Drucker (1985) lists seven sources for systematic innovation, with an order of descending reliability and predictability as (1) the unexpected, (2) the incongruity, (3) process need, (4) changes in industry structure or market structure, which are internal and manifest themselves within a business, an industry, or a market; (5) demographics, (6) changes in perception, mood, and meaning, and (7) new knowledge, both scientific and non-scientific, which are external, and happen in the social, philosophical, political, and intellectual environment. He states that the sources may overlap with each other and none of them can be claimed as more productive than another.

Recent changes in society, triggered a new discipline adjacent to entrepreneurship, social entrepreneurship. Nicholls (2006) defines social entrepreneurship as "*innovative and effective activities that focus strategically on resolving social market failures and creating new opportunities to add social value systematically by using a range of resources and organisational formats to maximize social impact and bring about change*". And Skoll (2006) defines social entrepreneurs as "*practical dreamers, who have the talent and skill and the vision to solve the problems, to change the world for the better*", and they operate with both aims of financial profit and of improvement of people's lives. The literature on social entrepreneurship usually stands in the intersection of the fields, not-for-profit management and commercial entrepreneurship, in business and economics context; also marketing, cultural studies, political economics and sociology have valuable contribution in the field.

The literature on design entrepreneurship is limited, as well as on its definition. Both founders of organisations -Dyson being one of the most given examples for that, and also managers of design consultancies like IDEO are considered as design entrepreneurs (Borja de Mozota, 2004; Heller, 2002). The most comprehensive research on design entrepreneurship was gathered in the conference Entrepreneurship and Design: Society – Technology organized by Cumulus International Association of Universities and Colleges of Art, Design and Media in Norway in 2004.

Entrepreneurship, although influenced by various personal and external factors, can be and is being encouraged, developed, controlled or influenced within the contexts of a governmental aid or development programme (Walsh and Clement, 2004). And Suokas (2004) states that to encourage entrepreneurship and to commercialize innovation and research is the new third task of universities besides education and research, as it benefits the whole society.

The interrelations of design, sustainability and entrepreneurship

The interrelation of design and entrepreneurship is being established mostly through innovation. Hietemaki, Hytönen and Lammi (2004) state that design can contribute in innovation process by originality, collaboration, adapting the new and experimenting. The correspondence of design and innovation elements is shown in Table 1.

Table 1: Design and innovation correspondence

Source: Heap, 1989, cited in Hietemaki, Hytönen and Lammi, 2004

Design element	Innovation element
Research	Assessment of needs of society and market place
Concept development	Part of idea generation
Concept validation	Part of idea generation
Design resolution	Development and design
Productionization	Use of new technology, manufacturing
Communication	Marketing and sales

Verganti (2009) defines *design-driven innovation* as "*radical innovation in meaning*" and as an exploratory research project, which happens before the concept generation step of a design process. He suggests that designers, to be experts in envisioning and investigating new products meanings through a broader sense, should be radical researchers, who explore of the evolution of society, culture and technology in depth. He adds creativity and user centred approaches only help in incremental innovation, as creativity is not a scarce source and user centred approached doesn't question existing meanings but rather reinforce them (Verganti, 2009).

Besides innovation, design is claimed to contribute into competitiveness and ethics of a company in relation to entrepreneurship. Hietemaki, Hytönen and Lammi (2004) state that design methodologies can contribute to the competitiveness by (1) faster rapid-prototyping and so speeding up the product development process, (2) adding higher value to products and (3) strengthen the systematic development of a company. According to Guellerin (2004) discusses that designers are the key persons for ethics in a company.

Listing different actors within production-consumption system in social learning process, Vezzoli and Manzini (2008) comment that companies and enterprises play a central role, which hold the most of the resources in terms of knowledge, organisation and capacity for initiative. On the contrary to previous encounter between companies and environmental issues as a treat, they point a recent question, "*How can sustainable processes make the company more competitive?*", which they interpret as providing great opportunities (Vezzoli and Manzini, 2008).

A recent development about sustainability in business is the rise of importance of Corporate Social Responsibility (CRS), that companies are taking responsibility in sustainable development. This is driven by the rising importance of intangibles in determining stock price. Today over 70% of a company's market capitalization is driven by intangibles such as reputation, goodwill, and stakeholder relationships, whereas one hundred years ago, 70% of it was based on tangibles such as plant, property, equipment, and hard financial assets (Laszlo, 2008). Another important reason why CRS should be developed is that according to the list, where United Nations Conference on Trade and Development (UNCTAD) ranks world's hundred largest economic entities on the basis of value added, twenty-nine of them are transnational corporations and this arouses questions on re-evaluating the role of companies in society (UNCTAD, 2002, Nicholls, 2006, Laszlo, 2008). While corporate social responsibility, is gaining importance worldwide, entrepreneurs will need to incorporate corporate social responsibility in their business plan for long-term success. (Wyatt and Archer, 2004).

On the other hand, design for sustainability even started to diffuse in luxurious design scene, such as famous designer Philippe Starck designed a "micro wind turbine" for home usage in 2010, after two years of research in collaboration with the Italian company Pramac (Designboom.Starck, 2010).

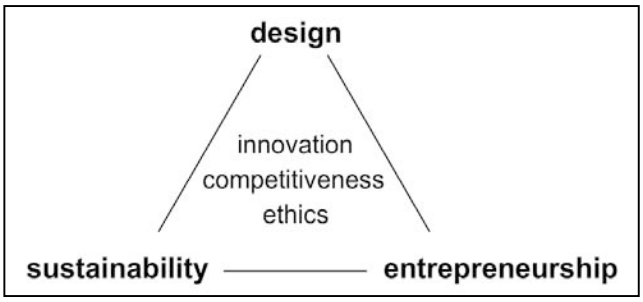


Figure 2: The interrelations of design, sustainability and entrepreneurship

A good compilation of sustainable design practice is showed in the exhibition *Design for the Other 90%*, curated by Cynthia E. Smith in 2007 in Cooper-Hewitt, National Design Museum, which was also published as a book. It gathers the best examples of socially responsible, sustainable and humanitarian design which transforms, solves problems, even in some cases saves human lives, which are of limited function or not necessarily attractive but are extremely cheap. These design examples are products of social entrepreneurs. In the book also the principles that need to be considered when designing for the other 90% are being explained by the entrepreneurs, based on their own experiences on the field (Bloemink, 2007).

A study focusing on an educational entrepreneurship program

Focusing on an educational entrepreneurship program and its participants, who are industrial product design students allows us to monitor the motivations, concerns and difficulties in developing a business plan before the business is started. In this way, the specific needs of the participants focusing on specific areas can be determined. In this study, the focus will be the process of industrial design students and how the topic of design for sustainability is integrated in their business plan. Although the results will heavily depend on the education of Department of Industrial Product Design at ITU, the entrepreneurship program of KOSGEB and the individual characteristics of the participants, this study aims to build suggestions on developing such programs further following the findings that can be repeated in similar contexts.

To start with the provider of the *Entrepreneurship Program*, KOSGEB is Small and Medium Enterprises Development Organization, which is formed under the Ministry of Trade and Industry in 1990. They offer the most comprehensive support on entrepreneurship in Turkey, along with other supports for SME's such as *Market Research and Export Promotion*, *Research-Development (R&D)*, *Innovation and Industrial Implementation Programme*, *Regional Development*, and *Technology Development and Innovation*. The objective of the *Entrepreneurship Development Program* is "*to enhance culture of entrepreneurship and train potential entrepreneurs about how to prepare a business plan*". The program consists of four sub-programs, which are *Applied Entrepreneurship Training*, *New Entrepreneur Support*, *Centre for Business Development Support*, and *Business Plan Prize*. The educational program, which will be investigated in this study, is in the scope of the first sub-program, is being run in collaboration with Istanbul Technical University and it is open and free to all students of the university. The education is carried out by a private company that KOSGEB assigned. The selected business plans are later supported by KOSGEB the following four years financially as well, which varies from supplying office and equipment to consultancy (KOSGEB, 1990).

The final business plan, which the participants are expected to develop consists of seven parts, (1) general information, (2) the characteristics of the entrepreneur, the partners and the business, (3) market information and marketing plan, (4) production plan, (5) management plan, (6) financial plan, and (7) the support that is being requested from KOSGEB. The financial support that KOSGEB offers consists of four levels, (1) business start-up support, (2) start-up equipment and office support, (3) business expenses support, and (4) permanent investment support. Only the last level of support is to be re-paid, others are given to the entrepreneur not to be re-paid (KOSGEB, 1990).

Methodology of the study

In the study firstly, the undergraduate and graduate students of Dept. of Industrial Product Design have been informed about the program and encouraged to participate.

The 7 participants, who are industrial product design students, have been interviewed with questionnaires, which also include open- and closed-ended questions (Esterberg, 2002), questioning their motivations and experiences in participating the program, the advantages and disadvantages they experienced during the program as designers and whether their business plan focuses on sustainability, if not what the reasons for that are. The fourth year students, who didn't participate to the program, were also interviewed as a control group for investigating, why they didn't participate to the program and what their future plans after the graduation are.

The documents that can be reached in KOSGEB (1990)'s web-site, such as the application principals and the forms for the business plans are taken as the data on the entrepreneurship program. In this way, the two-way perception, expectation and experiences between the design student participants and the KOSGEB are compared as well.

Analysis of the study

The first result, that out of 27 participants of the *Entrepreneurship Program*, 7 of them were students of Dept. of Industrial Product Design (5 undergraduate and 2 graduate students), was surprising considering the very small number of students of the department compared to the total number of ITU (approximately

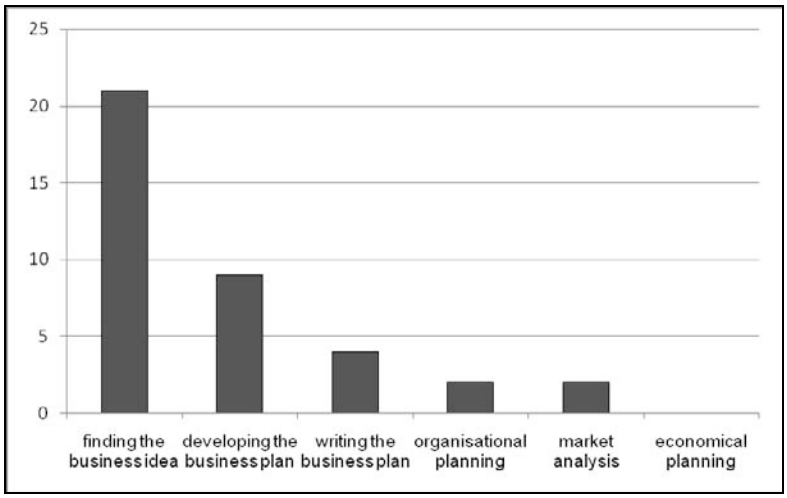
1.45%; 190 undergraduate + 100 graduate / 14.000 undergraduate + 6.000 graduate students). Besides, all the participants from Dept. of Industrial Product Design are female students.

About the motivation of the participants, 4 of 7 students participated to the program as they plan to start their business, 1 of them only aims to improve herself and 2 of them noted both aims relevant for themselves. They rated the success of the program 4,3 out of 5 in average.

To investigate the future plans of the control group, the 4th year industrial product design students, who didn't participate to the program were asked to rate their future plans on entrepreneurship from high to low as planning, thinking and hoping, the numbers of answers are 9, 13, and 10 respectively. The students, who are planning to start their business, are planning it after finishing their graduate studies or after gaining experience while working for a while.

To continue with the participants of the program, 3 of them developed the business idea that they figured out before the program started, 2 of them developed their business ideas further and 2 of them developed a new business idea. In the process, the topics that they have the most difficulty were economical planning, organisational planning and writing the business plan respectively. The advantages they observed as industrial design students and listed as ordinally scaled are shown in Figure 1.

Figure 1: The advantages that the participants observed during the process



Before focusing more on the business plans of the participants and the level of integration of the topic design for sustainability in their plans, it should be noted that in Dept. of Industrial Product Design, there is no specific course on design for sustainability, although it is being taught as a topic in the courses *New product development* and *Quality Control*, as well as in *Product Design* studio courses in varying years of education. The participants evaluated their knowledge on the topics of design for sustainability such as eco-design, life-cycle design and PSS in various levels from low to high i.e. some of them stated that they applied these topics in their projects. In addition, it should be also noted that the subject of sustainability is not listed as important or primarily supported by the *Entrepreneurship Program*.

Considering the confidentiality of the business plans of the participants, they were only asked for the scope of their business plans, which is shown in Table 2.

Table 2: The scope of the business plans (named as A – G)

	A	B	C	D	E	F	G
Product design			X	X	X	X	X
Production			X	X			
Service design		X	X		X		
Service delivery	X	X	X		X		
Design consultancy				X	X	X	X

It is interesting that 4 of 7 participants focused on designing or delivering services or both, which offers the opportunity of applying PSS effectively. On the other hand, when listing the most important assets of their business plans ordinally, which are shown in Table 3, only one of the students listed sustainability as her third most important asset.

Table 3: The most important assets of the business plans (1 highest, 3 lowest)

	A	B	C	D	E	F	G
Market niche		1	1		1	1	
Innovation	1	3		1	3		2
User needs	2	2	2				
Quality	3			2			2
Export			3		2		3
Design							1
Differentiation						2	
Sustainability				3			
Tailor-made products						3	

To elaborate how the participants held design for sustainability in their business plans without being encouraged by the program, they were also asked if they are applying the mentioned topics of design for sustainability in their business plan, or if they would reconsider evaluating their plans following a more intense study on design for sustainability. 2 students are applying the topic of eco-design and 2 students are applying the topic of PSS in their business plans already, but only one of the former group stated sustainability as one of the most important assets of her business plan. All participants were keen to re-consider their business plans focusing more on design for sustainability but 2 of the student stated that it would be hard to integrate the aspects of design for sustainability in their business plan as well. Moreover, 5 of 7 student stated that they think that business plans similar to the compilation *Design for the other 90%* are economically unrequited.

Conclusions

Following four suggestions are drawn from the theoretical background on the interrelations of entrepreneurship, design and sustainability and the analysis of the study focusing on the educational program to lead design entrepreneurs towards sustainability;

- to encourage sustainability including all partners of educational programs,
- to strengthen the knowledge on design for sustainability, to comprehend the subject with its all levels, potentials and economical feasibility as well,
- to emphasize the interrelationship of entrepreneurship, design and sustainability through innovation, competitiveness and ethics, and
- to start the support of research on design for sustainability in an early stage of developing the business plan.

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Design Practice for Sustainability (DPfS)

the Learning Network on Sustainability

Design practices for developing a sustainable environment

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In a world with a continuously increasing population and limited resources the idea of a sustainable development is of major importance for the future in the 21st century. The built environment is now the largest negative factor in the stability of ecosystems and the climate. Only research and innovation will allow the development of economic and fulfill the requirements of and social networks and processes that sustainability. Sustainable development is a widely applied term now -a-days, which originally was meant to describe development and resource use that can meet human needs while preserving the ability of the environment to sustain us, not only for the present but for future generations as well. Sustainable development as a definition is further divided into the economic, socio-political and environmental aspects. To an environmentalist, the term is connected with natural capital and carrying capacity, and as such is defined as development that does not exceed the carrying capacity of the environment.

It is clear that no single organization, profession or nation can achieve the goals of sustainable global development. It will require a combination of solutions form low/no carbon buildings; sustainable economic systems; enhanced mobility; sustainable planning and energy policies.

Recognizing the need and opportunity to improve sustainable building practices, as a environmental engineer, part of a large construction industry have started implementing various design practices for proposing environmentally sustainable buildings.

The aim of this paper is to explain with a case study on various design practices such as adopting water efficient fixtures, waste water reuse, rainwater harvesting system, solid waste management, which an environmental designer has to adopt while designing public health engineering systems for buildings with sustainable environment.

Introduction

Building construction and operation have extensive direct and indirect impacts on the environment. Buildings use resources such as energy, water and raw materials, generate waste (from occupant, during construction and demolition) and emit potentially harmful atmospheric emissions. Building owners, designers and builders face a unique challenge to meet demands for new and renovated facilities that are accessible, secure, healthy, and productive while minimizing their impact on the environment.

Concern for environmental sustainability

Considering the current economic challenges, retrofitting an existing building can be more cost effective than building a new facility. Designing major renovations and retrofits for existing buildings to include sustainability initiatives reduce operation costs and environmental impacts, and can increase building resiliency.

Recent answers to this challenge call for an integrated, synergistic approach that considers all phases of the facility life cycle. This approach, often called "sustainable design," supports an increased commitment to environmental stewardship and conservation, and results in an optimal balance of cost, environmental, societal, and human benefits while meeting the mission and function of the intended facility or infrastructure.

The main objectives of sustainable design are to avoid resource depletion of energy, water, and raw materials; prevent environmental degradation caused by facilities and infrastructure throughout their life cycle; and create built environments that are liable, comfortable, safe, and productive.

Role of environmental engineer towards sustainability

From a sustainability perspective, total water system management may be the most critical feature of a building. Engineers should understand this importance and create designs that provide water-efficient solutions, while maintaining performance. Waste management system also equally important to make a building more sustainable. Environmental engineers are involved with systems that overlap into the mechanical, civil, and chemical engineering disciplines and help influence the water efficiency, sustainable site, energy and pollution systems of a facility.

In a building, the design of Plumbing system incorporates all aspects such as

- **Plumbing fixtures** are evaluated by the plumbing engineer to determine that the type, arrangement, space requirements, and standards are met.
- **Potable water building supply and distribution piping.** The objective in designing the water supply systems for any project is to ensure an adequate water supply at adequate pressure to all fixtures and equipment at all times and to achieve the most economical sizing of the piping.
- **Sanitary drainage** refers to the discharge from the fixture through pipes and stacks to a sewerage system. Sanitary piping is installed in a building for the purpose of removing waterborne wastes. Flow of air is the primary consideration in the design of a venting system for the ventilation of the piping and protection of the fixture trap seals of a sanitary drainage system.
- **Roof drainage & Storm water drainage system.** Storm water is considered to be rainwater collected from roof, surface runoff, groundwater, subsurface water, or similar clear wastes, exclusive of sewage and industrial wastes. Every building must have adequate provisions for draining water from roofs, paved areas, courts, landscaping areas and yards.
- **Plumbing Equipment** including water heaters, hot water circulating equipment, sumps and ejectors, water treatment equipment, booster pump systems, and backflow equipment.
- **Private water supply and private sewage disposal applications** are for remote areas where sanitary sewers are not available and areas with inadequate water supply.

Sustainable practices in plumbing systems

An Environmental Engineer is in a key position to influence the water efficiency, sustainable site, energy, fire protection, and pollution systems of a facility for a building. The future of Environmental Engineering lies in the ability to design systems with the "whole building" in mind using, preserving, and respecting the natural biospheric earth systems of recycling air, waste, and water.

Reducing water consumption and protecting water quality are key objectives of sustainable design. One critical issue of water consumption is that in many areas of the country, the demands on the supply-

ing aquifer exceed its ability to replenish itself. To the maximum extent feasible, facilities should increase their dependence on water that is collected, used, purified, and reused on-site.
The protection and conservation of water must be considered throughout the life of the building, and facility owners and developers must seek to:

1. Reduce, control, and treat surface runoff;
2. Use water efficiently through low or ultra-low flow fixtures, elimination of leaks, water conserving cooling towers, and other actions;
3. Improve water quality; for example eliminate lead-bearing products in potable water;
4. Recover non-sewage and gray water for on-site use (such as irrigation)
5. Establish waste treatment and recycling centers;
6. Apply Best Management Practices for Water Conservation.

Water efficiency practices in water supply sector

Using large volumes of water increases maintenance and life-cycle costs for building operations and increases consumer costs for additional municipal supply and treatment facilities. Conversely, facilities that use water efficiently can reduce costs through lower water use fees, lower sewage volumes to treat energy and chemical use reductions, and lower capacity charges and limits. Many water conservation strategies involve either no additional cost or rapid paybacks. Other water conservation strategies such as biological wastewater treatment, rainwater harvesting and grey water plumbing systems often involve more substantial investment. . Different engineering practices that can help users to conserve water are listed below.

Use of water-efficient fixtures

a. High-efficiency toilets

The most efficient commercial toilet on the market is the high efficiency toilet. HETs use less than 1.28 gallons per flush. This performance is achieved by an improved flush and fixture design. HETs combine high efficiency with advanced design for high performance. It offers the highest water savings potential.

b. Dual-flush toilets

Dual-flush toilets employ a dual-action flush valve or two-button system; one for a full flush (1.6 gpf to eliminate solid waste) and the second button for a reduced flush (1.1 gpf for liquid waste).

Figure 1: Dual-flush toilet

Images available at http://imagesme.net/homedosh/dual-flush-toilet2.jpg *and*
http://www.luxuryhousingtrends.com/wp-content/uploads/2009/01/brondell-perfect-flush-dual-flush-toilet.jpg

An electronic sensor-activated dual-flush unit also is available, in which the sensor activates the appropriate flush, depending on the length of time the user remains seated. Dual flush retrofit valves are available for existing 1.6 and 3.5 gpf units.

c. Composting toilets

Composting type of toilet as shown in Figure does not require any sewage disposal system instead it decomposes the waste products into useful fertilizers and manures. There are many odorless and waterless models available for this type. Composting toilets (also called biological, dry or waterless toilets) are systems that treat human excrement through biological processes, turning it into organic compost material that can be used to fertilise the soil. They are small-scale, complete sewage processing systems not connected to the mains sewage system.

Figure 2: Composting toilet

Image available at http://upload.wikimedia.org/wikipedia/commons/c/c8/Compostingtoilet.jpg

d. Waterless urinals

Waterless urinals can save time and money and conserve significant amounts of water.

The waterless urinal involves a vitreous china or stainless steel fixture and a replaceable oil-filled cartridge that traps odors. Waterless systems are more economical to purchase and install than flush urinals because they have no flushing mechanism. Waterless urinals offer the savings of flush water and sewer charges, but these operational savings are balanced with the cost of cartridges for the drain which typically are replaced every 7,000 uses.

Figure 3: Waterless urinals

Image available at http://www.greengopher.com/images/w-less urinal.jpg

e. Washout and washdown urinals

Some models can be retrofitted to use less water per flush by replacing a part in the flush valve or float levels in tanks. Make sure any retrofit will continue to allow adequate removal of liquid waste. Again, bowls and flush valves need to be compatible in design use to function properly.

Installing new models that use 1.0 gpf can achieve the maximum water savings for urinals.

f. Low-flow or aerated fixtures

Low-flow aerators are efficient devices to save water without compromising on the pressure. They can be directly fitted on the faucet head and help control the water flow. Low-flow faucets as shown below are also based on control flow technology to manage the water flow and considerably save on water consumption. The non-aerating spray can save energy due to less heating time. The more recent Sensor operated faucets allow contactless water flow and help in conservation to a significant limit.

Figure 4: Aerated faucets

Image available at http://kitchendesignnotes.files.wordpress.com/2009/05/980t-ss-dst_in_context_on-tif.jpg

Figure 5: Low-flow shower heads

Image available at http://www.countryliving.com/cm/countryliving/images/shower-head1-de-48294203.jpg

Table 1: Comparison of fixture flows between conventional and high efficient fixtures

Fixtures	Conventional fixtures	EPA Act 1992 (at 80 psi)	LEED 2009 (at 60 psi)
Water closet	1.6 GPF	6 LPF	6 LPF
Urinals	2-3 gpf	4 LPF	4 LPF
Lavatory faucets private	2.5 gpm	0.16 LPS	0.14 LPS
Kitchen faucets (Residential)	2.5 gpm	0.16 LPS	0.14 LPS
Shower heads	2.5 gpm	0.16 LPS	0.16 LPS

Wastewater reuse or recycling systems

The water usage for building premises by recycling and reusing the wastewater generated from it also helps in creating a sustainable environment. Some of the practices which can be adopted are as follows

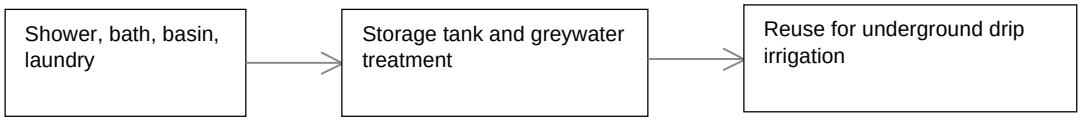
i. Reuse of grey water
ii. Recycling of wastewater

Grey water is wastewater generated from domestic activities such as laundry, dishwashing, and bathing which can be recycled on-site for uses such as landscape irrigation, flushing and constructed wetlands Grey water reuse system can be broadly classified into two

a. Primary greywater systems

These systems directly reuse virtually untreated domestic grey water from a single family dwelling for sub-surface lawn and/or garden watering with minimal treatment as shown in the Figure 6.

Figure 6: Primary grey water system

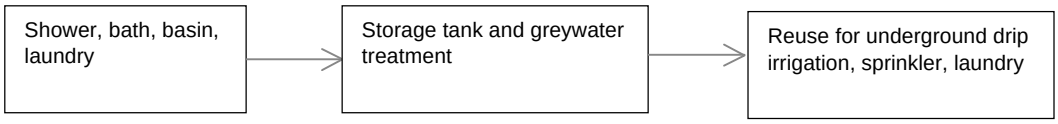


These systems do not allow storage or treatment, apart from some surge storage and coarse screening/filtration which removes hair, lint and coarse particles. Grey water diversion systems which falls under this category, can be both designed-in to new homes, and retrofitted to many existing homes. Such systems use a diversion device is probably the simplest and most common method of grey water reuse.

b. Secondary greywater systems

In these systems grey water has to be treated and stored for toilet/urinal flushing and/or lawn and garden watering including surface watering methods as depicted in the below Figure. Grey water from all sources after comprehensive treatment (eg. Screening, sedimentation, biological treatment, sand and/or carbon filtration, membrane techniques and disinfection) aims to achieve high quality of the treated grey water.

Figure 7: Secondary greywater system



The treated grey water can be reused for various purposes like landscaping, flushing etc. In some of the countries, the highly treated grey water is even used for potable purposes.

The sewage generated from the buildings can be treated in a sewage treatment plant in the building premises and the treated water can be reused for various non potable uses like flushing, landscaping and cooling water requirements. Some of the industries it is also reused as process water. Presently there are various systems for treatment of sewage like Extended aeration, MBBR, SBR , MBR etc.

Rainwater harvesting

Rainwater harvesting is the accumulating and storing, of rainwater. In urban settlements it has gained momentum due to the recognition that usage of water were it has both economic and ecological advantages.

There are a number of types of systems to harvest rainwater ranging from very simple to the complex industrial systems. Generally, rainwater is either harvested from the ground or from a roof. The rate at which water can be collected from either system is dependent on the plan area of the system, its efficiency, and the intensity of rainfall. Different methods of rainwater harvesting are

Urban areas

Roof Top Rain Water /Storm runoff harvesting through

- Recharge Pit
- Recharge Trench
- Tube well
- Recharge Well

Rural areas

Rain Water Harvesting through

- Gully Plug
- Contour Bund
- Gabion Structure
- Percolation tank
- Check Dam/ Cement Plug/ Nala Bund
- Recharge shaft
- Dug well Recharge
- Ground Water Dams/Subsurface Dyke

Some of the common rainwater harvesting methods adopted in urban areas are described below

Roof top rainwater harvesting through recharge pit

Recharge pits are preferable in alluvial areas where permeable rocks are exposed on the land surface or at very shallow depth. The technique is suitable for buildings having a roof area of 100 sq.m. and are constructed for recharging the shallow aquifers. Recharge Pits may be of any shape and size and are generally constructed 1 to 2 m. wide and 2 to 3 deep which are back filled with boulders (5-20 cm), gravels (5-10mm) and coarse sand (1.5- 2mm) in graded form. Boulders at the bottom, gravels in between and coarse sand at the top so that the silt content that will come with runoff will be deposited on the top of the coarse sand layer and can easily be removed. For smaller roof area, pit may be filled with broken bricks/ cobbles. A mesh should be provided at the roof so that leaves or any other solid waste / debris is prevented from entering the pit and a desilting /collection chamber may also be provided at the ground to arrest the flow of finer particles to the recharge pit.

Figure 8: Typical recharge pit

Image available at http://www.aboutrainwaterharvesting.com/images/wellandboremethod.jpg

Roof top rainwater harvesting through recharge trench

Recharge trenches are suitable for buildings having roof area of 200-300 sqm. and where permeable strata is available at shallow depths. Trench may be 0.5 to 1 m wide, 1 to 1.5m. deep and 10 to 20 m. long depending upon availability of water to be recharge. These are back filled with boulders (5-20cm), gravel (5-10 mm) and coarse sand (1.5-2 mm) in graded form – boulders at the bottom, gravel in between and coarse sand at the top so that the silt content that will come with runoff will be coarse sand at the top of the sand layer and can easily be removed.

Roof top rainwater harvesting through existing tube wells

In areas where the shallow aquifers have dried up and existing tube wells are tapping deeper aquifer, roof to rain water harvesting through existing tube well can be adopted to recharge the deeper aquifers. Rainwater down take pipes are directly connected to tube wells through PVC filter. The filter may be provided before water enters the tube wells. The filter is 1 –1.2 m. in length and is made up of PVC pipe. Its di-

ameter should vary depending on the area of roof, 15 cm if roof area is less than 150 sq m and 20 cm if the roof area is more. Filter is divided into three chambers by PVC screens so that filter material is not mixed up. The first chamber is filled up with gravel (6-10mm), middle chamber with pebbles (12-20 mm) and last chamber with bigger pebbles (20-40 mm).If the roof area is more, a filter pit may be provided. Rainwater from roofs is taken to collection/desilting chambers located on ground. These collection chambers are interconnected as well as connected to the filter pit through pipes having a slop of 1:15. The filter pit may vary in shape and size depending upon available runoff and are back-filled with graded material, boulder at the bottom, gravel in the middle and sand at the top with varying thickness (0.30- 0.50m) and may be separated by screen.

Roof top rainwater harvesting through trench with recharge well

In areas where the surface soil is impervious and large quantities of roof water or surface runoff is available within a very short period of heavy rainfall, the use of trench/ pits is made to store the water in a filter media and subsequently recharge to ground water through specially constructed recharge wells.This technique is ideally suited for area where permeable horizon is within 3m below ground level. Recharge well of 100-300 diameter is constructed to a depth of at least 3 to 5 m below the water level. The number of recharge wells in the trench can be decided on the basis of water availability and local vertical permeability of the rocks. The trench is backfilled with boulders, gravels and coarse sand to act as a filter media for the recharge wells.

Rainwater harvesting through open wells

Rainwater can be harvested with the help of open wells also. Where ever abandoned open wells are available. The rainwater can be diverted to these wells which will help in recharging the area.

Figure 9: Typical open well

Image available at http://www.sriaurobindosociety.org.in/sharanam/well.gif

Solid waste management practices

The solid waste management scenario in the recent years has shifted towards a more sustainable approach. Integrated waste management system is proposed as an option, which includes collection, transport and processing of wastes in an environmentally sound way.

There are various methods of disposal and treatment for solid waste. The treatment or disposal methods are depends upon characteristics of waste generation. Some of the common methods used for treating the waste by Bio gas method, Vermi composting and using organic waste converter etc

Vermicomposting

The vermicomposting is a process, where pre-composted waste is fed to earthworms, which digest the material. To maintain adequate moisture content, water is to be sprinkled over the whole mixture at regular interval. Sufficient time should be given for composting the waste and after composting, heap the compost in a cone shape and separate the upper portion of heap. Sieve the lower portion of heap to separate the worms. Pack the compost and store it in a cool space. The composting process produces an environmentally stable product which is typically free of disease causing organisms, offensive odors, insects, and weed seeds.

Organic waste convertor

The details of commercially available Organic Waste Converter are given below

1. OWC130 capacity: 1000kg/day
2. Composting cycle after Treatment: 10 – 15 days
3. Power Consumption: 8 HP
4. Cabin Space for OWC: 3m x 4m
5. Curing Space requirement: 75 Sq.m
6. Manpower: 4 Man days

The waste should be fed in batches of 25 kg/batch, 50 kg/batch, 100 kg/batch. Amount of waste fed per batch will depend on the amount of solid waste generated per day. The output can be used in two ways-as pellets which can be used for fuel application or as bio-manure for landscaping after proper curing.

Figure 10: Organic waste convertor

Image available at http://www.wired.com/images_blogs/gadgetlab/view_lidTrayOpen.jpg

Conclusions and recommendations

Cities are growing rapidly with population due the developmental activities and technological advancements. In the upcoming years it will be difficult to provide sufficient water to the end-users. So, along with authorities individual should look into various alternate sources of water. Treated water within the development premises is one of the most suitable sources which can be dependant most and with which one can reduce the usage of potable water usage. Also due to the letting out of sewage in to the municipal sewers increases the total sewage generation day by day for which the present treatment plant capacities are less which will incur huge implementation cost. Also this will lead to the pollution of streams and other surface water sources. Ground water extraction also can be reduced by using the treated water for non potable purposes which will increase the quality of ground water. The pollution on the ground water due to the sewage discharge on the open areas also can be reduced by treating the sewage within the premises of source generation. Reducing the sewage discharge in to the surface waters also helps the aquatic life.

Above all these advantages, the developer can go for green building rating which will fetch the following points for adopting the sustainable designs for **“GREEN HOMES”.**

Water Credit 4.0 Rainwater Harvesting, 75%, 95% -maximum 2 points

Water Credit 5.0 Grey Water Treatment: 50%, 75%,95% – maximum 3 points

Water Credit 6.0 Treated Grey Water for Landscaping: 50%, 75%, 95%- maximum 3 points

Water Credit 7.0 Treated Grey Water for Flushing: 50%, 75%, and 95% – maximum 3 points

Water Credit 8.0 Water Efficient Fixtures: 20%, 30%- maximum 3 points

These designs also help the developer to get the MOEF Clearance for the development. Various METRO Cities have taken action to reduce the water demand for non potable usage and they have already taken action to include in the local approval norms for getting the approval for the development. Finally the awareness of the people for creating a sustainable environment makes an important role for reducing the potable water demand, Pollution etc.

Some of the recommendations for creating sustainable environment are as follows

Reduce, control and treat surface runoff

1. Use low impact development principles.
2. Use rainwater cisterns, vegetated swales and depressions to reduce runoff.

3. Reduce the amount of impervious site area.
4. Filter surface runoff.
5. Use pervious paving materials.
6. Use Integrated Pest Management to reduce water pollution from pesticides.
7. Consider incorporating green roofs into the project where feasible.
8. Plan for storm water events in the overall management of surface water runoff.
9. Follow EPA's Green Infrastructure policy for managing storm water.

Use water efficiently

1. Incorporate water efficiency and conservation in construction specifications.
2. Use low or ultra low water-efficient plumbing fixtures and integrate other water-saving devices into buildings.
3. Design landscape for water efficiency through the use of native plants that are tolerant of local soil and rainfall conditions.
4. Meter water usage; employ measurement and verification methods; comply with the Department of Energy's International Performance Measurement and Verification Protocol (IPMVP) for water use.
5. Install water-conserving cooling towers designed with delimiters to reduce drift and evaporation.
6. Reduce evaporation through controlled scheduled irrigation at dawn and dusk.
7. Eliminate leaks; caulk around pipes and plumbing fixtures; conduct annual checks of hoses and pipes.
8. Specify Water Sense labeled products for quality, water-efficient products.

Protect water quality

1. Install water quality ponds or oil/grease/grit separators as storm water runoff filtration systems.
2. Eliminate the use of lead materials.
3. Use non-toxic bathroom and kitchen cleaning products.

Recover non-sewage and greywater for on-site use

1. Use non-sewage wastewater for irrigation and other uses permitted by Code or local ordinance. Work with local water jurisdiction officials to get approval for grey water projects.
2. Use roof water, groundwater and groundwater from sump pumps for on-site activities.
3. Capture and use condensate from HVAC systems.
4. Work with local water jurisdiction officials to get approval for grey water projects.

Establish site based treatment and recycling programs

1. Use biological waste treatment systems to treat waste on-site.
2. Use grey water, roof water, and groundwater for on-site activities.

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the Learning Network on Sustainability

Ergonomically designed sustainable handloom

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Handloom is a prime employment generating sector in the Indian Textile Industry which has immense impact on the economic growth of our country: India. Weavers are an integral part of this industry, who works dawn to dusk carrying our rich tradition forward amid poor working and health condition in their workspace. Serviceability of machines and tools can be improved by proper maintenance but how the sustainable health condition of the weavers can be assured in their work area? The answer could be ergonomics. Ergonomics is a branch of science that deals with the 'fit' between the people and their work. Study shows us that ergonomics has potentially been applied to heal some physical health ailments. In the present endeavour, effort has been put to design ergonomically suitable seating arrangement for the handloom. This arrangement will replace the traditional handloom seat that will provide more comfort especially to resolve spinal and lower back ache of the weaver for their long serviceability to the industry. In addition to this modification, studies have also been done for making the handloom sustainable, environment-friendly. Handlooms are made of wood and leave carbon foot print on our environment. Recycling of resources reduces the emission of green house gases (GHG) lessening the carbon footprint of a particular product or process in the atmosphere. Thus, replacing the wooden parts with recyclable iron would help decreasing the carbon footprint of handloom and thereby help reducing its impact on global warming of our planet.

Introduction

India is the fourth largest economy in the world and textile industry occupies a unique and significant place in the Indian economy. Undoubtedly, Indian Textile industry is the largest income and employment provider for the Indian people after agriculture. Handloom, being a part of Indian Textile industry, represents one of the largest economic activities in the unorganized sector and is also recognized as a prime employment generating sector which has immense impact on the economic growth of our country. This industry has also a long tradition of excellent craftsmanship, forming a part of the country's cultural heritage-a pulse beat of Indian cultural life.

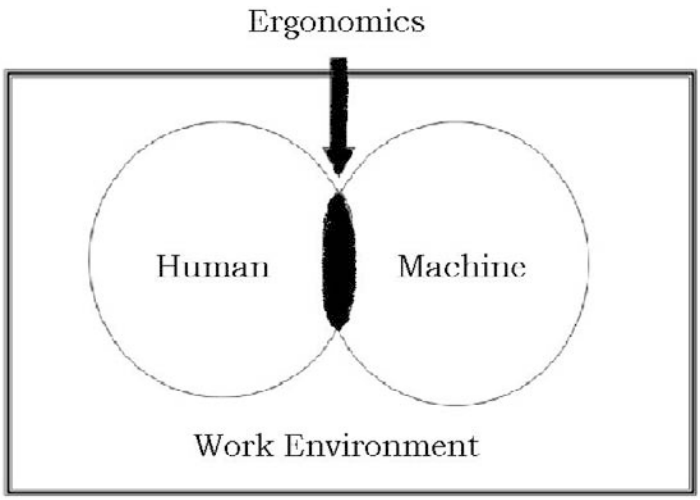
Weavers who are known for their knowledge, innovation and brilliance in designs, are an integral part of this handloom industry. They are working dawn to dusk to carrying our rich tradition forward amid poor working, livelihood and health condition in their workspace. As of now, the issue of sustainability of tools, machines, equipments and environment has been catered to but the issue of health of the handloom workers is still at a distant view. Handloom is facing a tough competition from the power loom sector and struggling hard to keep its rich cultural heritage alive in the rear locations of this country. Producing goods on handloom is a very labour intensive technique and requires a lot of efforts and hard work from

the weavers at the cost of their health. As, handloom sector is already going through the sunset phase, getting extra benefits like medical or health insurance facility other than wages is also a distant thought. Though Government of India has started providing health benefits to the weavers, it can't be the ultimate solution for the industry.

> "Ergonomics has been defined as the scientific study of the relationship between man and his working environment". The International Ergonomics Association defines ergonomics as "the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance".

Figure 1: Utmost goal: "humanization of work"

Image available at: http://www.authorstream.com/Presentation/Davide-54696-Occupational-Ergonomics-2005-AGENDA-Course-Objectives-Science-Workplace-Safety-Defined-Applying-Basics-er-Education-ppt-powerpoint/



Ergonomics is employed to fulfill the two goals of health and productivity. It is relevant in the design of such things as safe furniture, comfortable & sustainable seating arrangement and easy-to-use interfaces to machines.

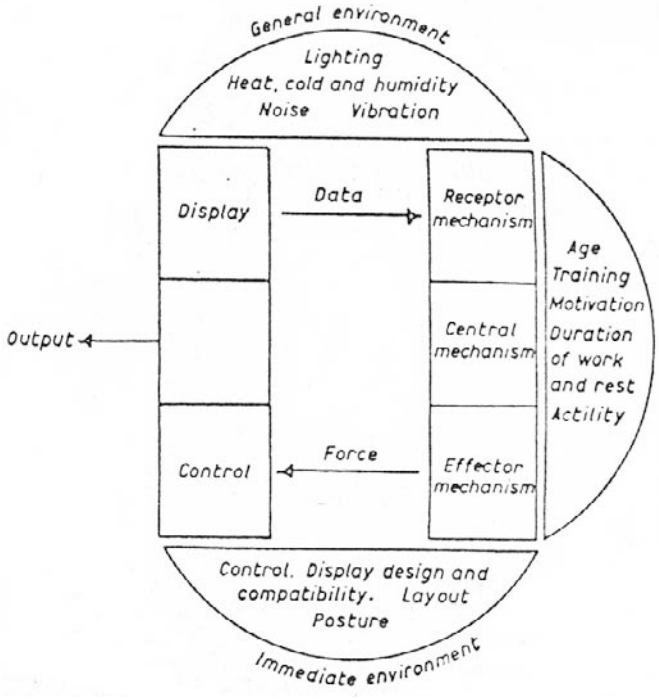
On close observation one can realize that the work area of the handloom worker happens to be very cluttered, damp and dull. Also the posture in which a worker generally works is not very comfortable which accounts to various health-related problems. Such posture related problems such as sitting on the conventional seat of handloom can be resolved with the application of ergonomic laws.

Why ergonomics in handloom?

It is already mentioned in the earlier section that handloom has immense impact on our economic growth and has also become an important foreign exchange earner for our country. The technology behind handloom is environment friendly. The products are more eco-friendly than the power loom one's as they do not use any power. Due to the pressing need to address the problem of global warming, people, around the world, are giving more emphasis on the use of eco-friendly products, green product which has lesser impact on our environment. So recently a remarkable growth has been noticed in the handloom sector. In an effort to provide sustenance and facilitate growth, there are several schemes & incentives to boost the sector. Recently health insurance scheme has been introduced by the government to ensure the good health and to provide medical benefit to the handloom weaver. But the question is- Is that the ultimate solution for betterment of the health condition of the handloom weaver? It has been known for ages that "prevention is much better than cure". This ideology gives us the inspiration to think beyond the box, beyond the conventional thought.

Figure 2: Man/Women as a component in a closed loop system and factors which may affect efficiency

Source: Murrel, Hywel (1975)



As in handloom industry, the workers are required to execute many tasks in repetition or to exert excessive force only on some parts of the body, working more than 8 hrs a day (resulting in inadequate recovery time), having tighter grips when using tools accompanied by poor machine design, tool and workplace design leads to severe health related problems and the most badly affected parts are:

- Arms, hands and wrists
- Legs and feet
- Back and neck
- Shoulders
- Eyes

And the symptoms of the problems might include:

- Numbness of fingers
- Numbness of thighs
- Difficulty moving your fingers
- Stiff joints
- Back pain (especially lower back)
- Headaches
- Lack of concentration
- Fatigue

It is notable from the above that most of the problems evident among the handloom workers are associated with the working posture of the weavers and that is where the role of vertebral column plays a major role. Vertebral column of the humans consists of 24 separate movable irregular bones in three groups, viz., 7 cervical, 12 thoracic and 5 lumbar. The vertebral column of the humans have some important functions that include protection of delicate spinal cord lying within it, movement, skull support, shock ab-

sorption, protection of the brain and forming axis of trunk giving attachment to ribs, shoulder girdle and upper limbs and pelvic girdle and lower limbs.

Figure 3: Anatomy of human spine

Image available at: http://www.limestonehealth.ca/assets/Image/Upright_Skeleton.png

The present research aims to address their health problems (especially backache) by the application of ergonomic science can be a good option to solve the problems of the weavers by ergonomically changing and designing the seating arrangement in the handloom. It has also been found that backache is one of the major problems of the handloom weaver which leads ultimately to the poor health condition of the weavers, due to the ill-designed seating arrangement in the handloom. Ergonomics is the science of designing the job to fit the worker, rather than physically forcing the worker's body to fit the job. Adapting tasks, work stations, tools and equipments to fit the worker can help reduce physical stress on a worker's body and eliminate much potentially serious, disabling work related musculoskeletal disorders (MSDs).

Sustainable design concept and development

In India, great number of handlooms are pit looms where the weaver has to stand waist deep inside the pit and with hip support they have to stand for the weaving operation where peddles that are used to create the shed are being operated with the feet movement and the insertion of weft followed by beat- up is done with hands. This requires weaver to remain in the position for long hours thereby resulting in acute health problems. As a proposal, the solution to this problem can be ergonomically designed half back movable (sideways) chair for weaver which would be set up on metallic rails (shown in the figure 5) so that the movement across the width of the loom becomes easier and operations of threading the loom and patterning while weaving also become easier. This chair gives firm support to the back and easy movement to the legs and feet thus causing lesser strain to the muscles and bones.

Design concept

Ergonomic design is the organization of human-machine interface services or products that make the workplace more efficient and comfortable. In the current study it has been an effort to incorporate ergonomic principles in the design process of making ergonomically sustainable seating arrangement or the half back movable chair for handloom.

Conventional seating arrangement

The seating arrangement which is currently being used by the unorganized handloom industry looks like the following figure (Figure 4).

Figure 4: Conventional seat used in handloom.

Source: Kalna Mahukuma Taant Shilpi Sangha, Dhatrigram, WB, India

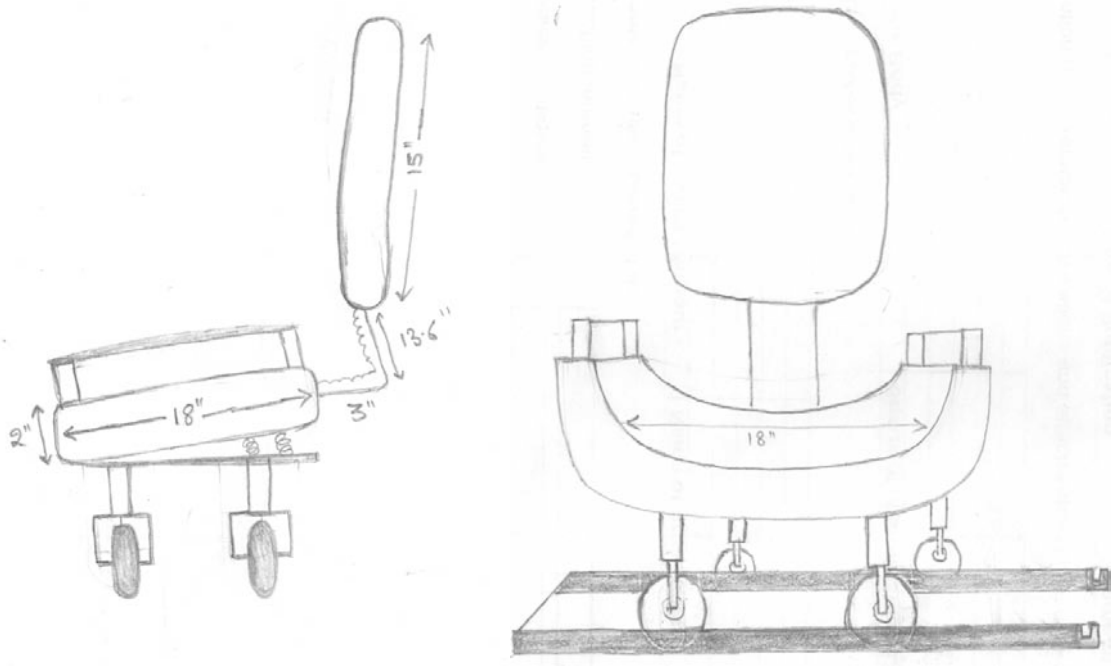
This is a wooden flat bench with four legs. The dimension of the bench ranges between length 4-4.5 feet and width 8-9 inches. Weavers generally work in the handloom sitting on this conventional bench which does not follow any ergonomic rules. As the weaver works for a long time sitting on this flat bench, one may feel strain on one's lower back due to uneasy and uncomfortable movement of the body

parts (especially waist and legs) required for the weaving operation. This seat gives a rigid position to the body parts which in turn hinders the different muscle group to change their posture. Consequently, the muscle groups get strained. Due to the long period of strain on the lower lumbar spine, it results in pain in the waist leading to backache in human body. It has been advised by Hywel Murrell, in order to maintain a good posture which will not cause overstrain of any particular group of muscles, a person would require a proper seat. Due to the flat design of the conventional handloom seat, it does not support human's back thus causing postural abnormalities. It could not absorb the downward force coming along the spine. As a result, it returns to the spine generating strain to the weavers. Herein arise the need for designing a suitable seating arrangement for the weavers so that while working they can feel comfort at their work place and enjoy their work.

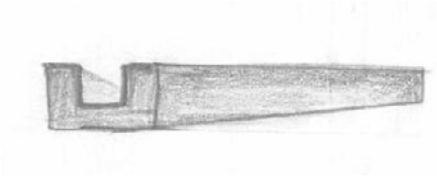
New design approach to the seating arrangement

Figure 5: Side view & front view of the ergonomically designed seat for handloom

Source: Designed and illustrated by the authors



Rail

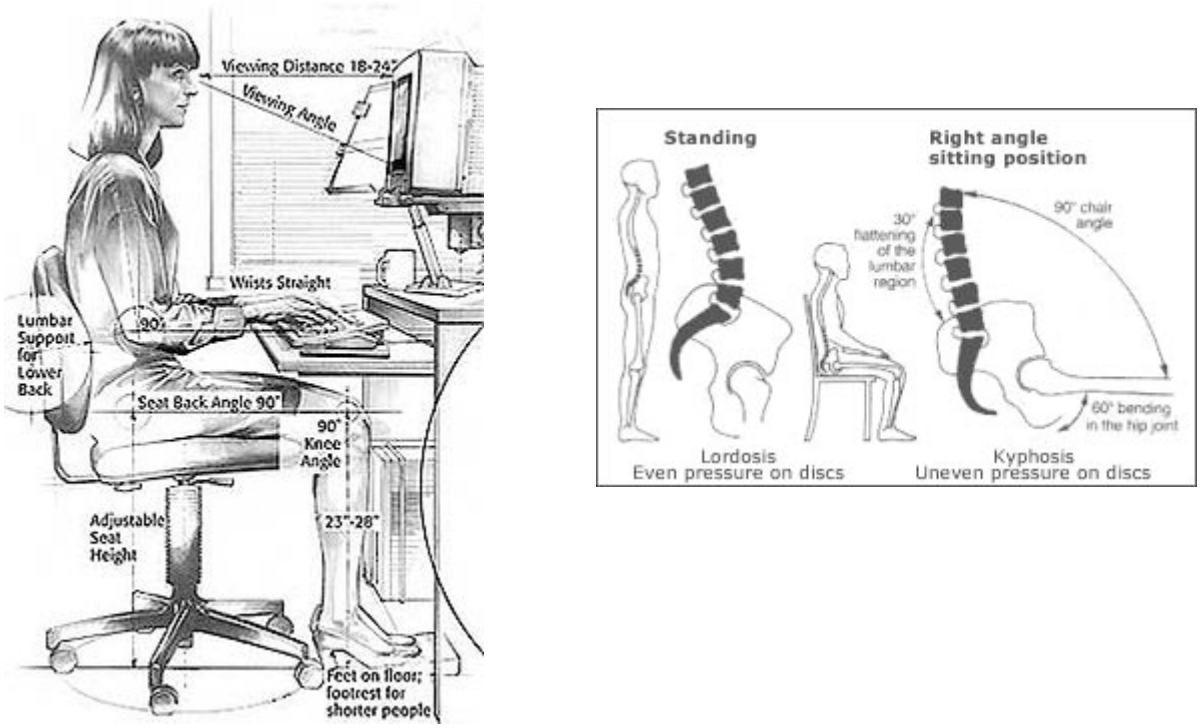


Front view of Rail

To overcome the postural discomfort and abnormalities, in the present endeavour a seating arrangement is designed which is ergonomic and sustainable with respect to the level of improvement in health condition of the weavers. In figure 5, design concept of the proposed ergonomically designed chair for the handloom (pit loom) has been shown. The chair is movable sideways being set up on a pair of rails as shown in figure 5. It has been studied that a person's body (upper part) should make right angle with the thigh while sitting, i.e., the seat back angle and the knee angle should be both 90o as shown in figure 6.

Figure 6: Right angle sitting posture of human body

Source: www.acmandal.com, accessed July 2 2010



As the handloom workers have to work slightly inclined towards handloom. So to maintain the right angle between the upper part of the body and the thigh (seat back angle and knee angle), a seating arrangement has been which is a bit inclined (8-10o) toward the front using springs which can help the weaver to lean forward during the weaving operation and during the recession period, they can relax. The back rest has also been designed accordingly to maintain the right angle and good sitting posture of the weaver (Figure 6).

Another point of focus is the sustainability of the environment. The handloom industry utilizes wood as raw material for construction of loom which is considered as natural resource and also helps absorb carbon di-oxide (CO2) from the atmosphere. Thus helps the earth in reducing the temperature that is caused due to green house gases. Due to rampant urbanization in the developing countries, ruthlessly people are cutting trees and fastening the speed of deforestation which in turn helps increasing the global warming around the world. Studies show that recycled metals like recycled iron has lesser carbon foot print (measurement of the amount of CO2 emission during a particular process) than the ordinary iron. So instead of using wood, if we can design handloom with recycled iron, it would be more environment-friendly and be more acceptable leaving less carbon foot print than the conventional loom.

Further Work

Foremost work that needs to be done is to draw a comparative evaluation of the effectiveness of the new handloom design as compared to the conventional design of handloom on the basis of the health problems and functionality of the new design.

Newly designed seating arrangement is mainly meant for resolving the problem of backache among the weavers. But still many health related issues remain unanswered like proper air circulation (run without power) in the working environment, a modification in the shedding mechanism as well as in the jacquard system applying pneumatic and electronic control devices attached with them. Along with previous new developments, these modifications can also provide better and comfortable working condition at the work place leading towards the betterment of the physical and mental condition of the weavers.

Conclusion

Applying ergonomics to the modification of handloom is new concept and probably first of its kind. The new design approach contributes to better health of the weavers as well as maintaining sustainability in our environment by encouraging re-use & recycling of materials. It will also prove to be a solution to major health ailments and provides a breathable work area to the weaver. Thus, by replacing the entire wooden handlooms by recycled iron and an ergonomically designed seating arrangement suitable for better working comfort for the weavers can do wonder to our handloom industry as well as to our world, providing a cleaner, greener and a better world for all of us and generations to come.

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Sustainability and growth of traditional textile cultures and societies in India

Printed textiles from Gujarat, India: a case study

Sharmila Dua
PhD scholar

Dr. Anjali Karolia
Guide & Head

Introduction

The production of textiles within the Indian subcontinent has prehistoric origins. The flourishing civilizations of the Indus Valley already knew how to spin, weave and dye. The tremendous range of the cloth produced in India can be seen in the surviving examples of textiles from the seventeenth century to the present day. The fundamental reason for the continuing success of Indian textile manufacture over the centuries has been its ability to cope with a broad range of market demands especially for export. Textile symbolism in India may be laid down by tradition but the unique characteristic of the Indian craftsman is to integrate foreign influences so completely that they appear to be Indian. Hence, Indian fabric art was never stagnant. Indeed the 'decorative' instinct of the Indian craftsman enabled him to assimilate and absorb newer ideas, which kept him even adaptable regardless of the medium of dye, the loom or the needle. These textile traditions were influenced by the geo-cultural traditions of the areas as well as the influence of migrants of many ethnic groups into India. This led to large variations in textile techniques, in the use of materials, in the art of dyeing and in the form of design expression.

The craftsman's design expression in all of the above manifests itself in motifs & patterns that represent the life around. India has a legacy of motifs that have appeared and reappeared in all their variety on sculpture, painting and textiles. The fascinating evolution of these motifs over the ages and their ability to blend completely within the parameters of all textile techniques is unique.

The region of Gujarat in the west has been an important textile export zone of India and remains an important source of printed cloth, in terms of both volume and quality. Early evidence of Gujarat's involvement in international trade of colourful block printed textiles comes from the fragments found at the Fostat excavations in Egypt. These have been dated back to the fifteenth century and have been printed by the resist printing technique. The designs, motifs and colours are typical of the hand block printed textiles characteristic of the region today. Till date, the region of Gujarat in India and the towns and villages of the state well known for hand block printed textiles are Surat, Bharuch, Deesa, Ahmadabad, Rajkot, Jamnagar, Bhavnagar, Jetpur, Bhuj, Dhamadka, Khavda and Mundra. Though Ahmadabad is known for its production of fabrics with designs of floral sprays and bandhini lookalikes, Deesa is known for designs of floral sprays with Mughal and Persian characteristics.

However, Khavda and Dhamadka villages in Kutch are known for printing the exotic rich blue and red cloth known as Ajrakh. These cloths are printed in a complicated sequence that involves both resist and mordant techniques. The deep blue sheen is derived from repeated dipping in indigo followed by vigorous beating and polishing. The most highly prized Ajrakh textiles are bipuri, i.e. the ones printed identically on both sides. Traditionally these were used by men as turbans, lungis and shoulder cloths.

Over the centuries as communities and cultures have changed and evolved, no section of the Indian society has remained unaffected. The last fifty years has witnessed a tremendous change in every sphere of life, be it economic, social, technological or aesthetic. These changes have had a major influence on the traditional handicraft sector. These overwhelming changes have broken down systems and contexts in which these traditional cultures functioned and sustained themselves. More and more, old techniques, design structures and patterns are disappearing or losing integrity as a result of transition into other regional or cultural contexts. Ajrakh, with its rich visual vocabulary is in a state of transition, as traditional

processes, raw materials, designs, product categories and markets are evolving within the world wide phenomenon called globalization.

Objectives & Methodology

Indian designs have has always been influenced by global trade and overseas fashion, but design in India has taken on a whole new dimension, and there is a strong return by contemporary designers to an appreciation of the Indian heritage. All researches related to textile design in India today need to have a fresh approach, which would demand a study of elements that contribute to the emergence of design in its richest form and the understanding of all the factors that have provided the support and stimuli for new creative solutions.

The purpose of this contribution was to trace the evolution of Ajrakh- the resist printed textile of the Gujarat region, from its origin to present day. The present study was aimed at documenting traditional textile motifs of the Ajrakh, and to record the changes that have taken place over a period of time. The study specifically aimed to review the effects of this transition in order to understand the role of various factors, which have helped in preserving old skills and experience for the future.

It also attempted to review the role of educational and training institutes in imparting the necessary know how and technical up gradation for better adaptation towards the contemporary scenario.

- The study was conducted to examine the role and intervention of various organizations for growth and sustainability of the traditional textile society of Ajrakh.
- The focus of this paper was to look at fresh trade channels that have motivated the adaptation of traditional motifs and ornamentation styles of Ajrakh textiles, to suit contemporary tastes.
- This study was aimed to diagnose the role of designers in reinterpreting Ajrakh for modern ideas and how this in turn has helped the development of this craft.
- To achieve the above objectives an exploratory research methodology was employed. A case study of one of the first families who have been involved in this craft for generations was taken up. The two master craftsmen namely Mr. Abdul Razzaque Siddique and his younger brother Dr. Ismail Mohammad Khatri were interviewed to understand the evolution of this craft within the past few years, as their father and his fore fathers were also involved in this craft.

An interview schedule was prepared and administered during visits to Dhamadka and Ajrakhpur, villages near Bhuj, where these craftsmen live and practice this craft. The specific areas on which the interview was conducted included demographic data on the craftsperson's like age, sex, marital status, level of education, family size etc. Questions pertaining to specific details about the craft like blocks, raw materials, dyes, process, and marketing channels were also included.

Several questions pertaining to their contribution to the craft as well as various problems and interventions that they had experienced were asked. Their understanding of the changes in raw materials, processes, designs, technology, products, colors, markets were documented. Experiences with reference to participation in fairs and orders received from different organizations and buyers were also included and details of product, designs and motifs were also procured.

Observation of their living and work areas along with specific facilities for dyeing, printing and finishing were carried out. The existing as well as earlier specimens of Ajrakh textiles were photographed and documented.

Existing literature on this craft by eminent scholars was reviewed and this served as the secondary data for the purpose of this study.

Findings

The Fostat (Egypt) findings, yielded colorful block printed cloths which have been linked to the early evidence of Gujarat's involvement in the international trade. These fragments dated to the 15th century A.D. were printed using the resist printing technique and their motifs are symbolic and typical of the hand printed textiles (Ajrakh) of the region. Taking these findings as the starting point, the study was carried

out to trace the evolution of ornamentation styles and motif vocabulary of Ajrakh textiles of Gujarat as well as to examine the influencing factors from a contemporary point of view.

In spite of the omnipresent changes that have occurred over the last millennium, the printers of Ajrakh in Kutch continue to print some of the same design motifs that have been popular since very earlier times. The origin of Ajrakh can be traced to Sind, Pakistan. Although the name Ajrakh has many legends as to its origin but more popularly the term seems to be derived from *Azrak,* which means blue in Arabic.

The artisans who made these textiles belonged to the *Khatri* community (both Hindus /Muslims) and have had artisans from the Gajjar community making the blocks in a place called Pethapur, near Ahmadabad. Many *dalit* artisans trained under the Khatri community members also pursued this craft. Some of the printers themselves were skilled block makers and resorted to making blocks for exclusive blocks or new designs for fear of copying. Another community who specialized in preparing the cloth for dyeing and printing was the *Bhavsars.*

The review of existing research and literature on Ajrakh revealed many interesting facts about this exotic textile with special emphasis on its evolution and sustainability. Vardarajan (1) had discussed the cotton rich area of Gujarat in terms of its printed textile traditions, laying special emphasis on Ajrakh as a unique textile, with a distinct style, In her monograph she explained that although, mechanized production of cloth and mass produced items had become popular but fortunately for Ajrakh, the domestic consumer's requirement of unstitched garments such as dhoti, lungi, turban and shoulder mantle could only be met with the flat textiles produced by hand. In Gujarat, regional costume also showed a preference for handcrafted ware. Due to this it was possible to keep the tradition of Ajrakh alive both in pattern as well as technique in modern times.

Barnes(2) had discussed the various textiles from Gujarat, on the basis of their designs and mentioned in her article, that as compared to the silk patola, which followed a fairly strict and limited design repertoire, the cotton textiles of Gujarat were far more varied in their iconography and their technical execution. She had in this contribution dealt with the printed trade textiles from Gujarat with special emphasis on the ones which were exported to Indonesia, including many from the Ajrakh category.

Gittinger(3) had in her research documented the Fostat fragments and had also given a visual record of Mr. Mohammad Siddique of Dhamadka, near Bhuj, demonstrating the process of decorating a textile with wax resist. She had documented the process used in resist printing in great detail, giving stepwise documentation both verbally as well as visually.

Cousin (4), had mentioned how the tradition of Ajrakh printing is maintained in Dhamadka in Kutch. He had also mentioned that this tradition is maintained by Mr. Mohamedbhai Khatri and that he had revived the tradition of using vegetable dyes. He had given a detailed account of the tradition of Ajrakh in Sind, Pakistan and discussed the factors affecting the growth and sustainability of Ajrakh in Modern day, Pakistan.

Although some of the old printed textile specimens are scarce due to poor preservation and extreme climatic conditions but documentation by some of the above eminent researchers and collections by museums and private collectors have preserved them for eternity. These documents not only served the purpose of academic interest but also inspired the printers of the next generations to recreate these motifs and patterns. They also became essential reference points for future research. The Calico Museum set up in 1949, in Ahmadabad, Gujarat, have a collection of rare printed textiles and these have served as links in time for studying the progress and evolution of these textiles.

Most traditional textile societies in India follow the process of passing on the knowledge about the craft from generation to generation by word of mouth and by the process of being involved in the activity right from childhood such that there is no documentation of design, and or process. Since the earlier materials, processes and design of the various stages of the textile are not documented, hence they are lost to future generations. Fortunately, one of the first families of the Ajrakh still exists who have had the opportunity of gaining this traditional knowledge from their fore fathers by actually working hands on for several years.

A family associated with this craft for approximately 8–9 generations is that of late Mr. Mohammad Siddiki. His two sons, Mr.Abdul Razzaque and Dr. Ismail Mohammad Khatri, are both master craftsmen residing in Dhamadka and Ajrakhpur respectively and continue to print the resist printed textile called Ajrakh.

This textile tradition was started in their family when in the year 1586, their fore fathers were invited by Raja Bharmal 1, to migrate from Sind and settle in Dhamadka.

Dhamadka, a village 40km from present day Bhuj had all the necessary natural resources required for the production of resist printed textiles using natural dyes. The two brothers have been pursuing this trade together and both were initiated into the craft at a very early age. However, the river water at Dhamadka

dried in the year 1989, and the subsequent earthquake in 2001, led to the creation of a village called Ajrakhpur, 12 km from Bhuj.

Case study 1: Mr. Abdul Razzaque Siddique, Master craftsmen, Ajrakh

He lives in a house in Dhamadka with his family comprising of wife, 8 sons and 3 daughters. Although Mr. Abdul Razzaque did not receive formal education himself, beyond primary school, but he has chosen to educate all his sons, till the 10th grade. His house has a front room which serves as an office complete with a computer and internet connection. His printing unit is close by and has a separate room for housing samples and product lines for buyers and tourists. He has procured farm land in Dhamadka where all dyeing, pre and post printing processes are carried out. All his sons are involved in various aspects of the trade but he also employs workers for printing in his unit.

He started working on the craft at the age of 14 years under his father and learnt everything from him. He procures all his blocks from Pethapur and initially his father used to draw the designs and sometimes the block makers made the designs. The blocks are still made of teak wood but of a cheaper quality. For most of his production of Ajrakh textiles he continues to use natural dyes. His product line for traditional markets comprise of lungi, shawl. rumal, odhna, dupatta and saree. While as for the city consumer and exports he is producing stoles, bed sheets, cushion covers, table cloths, and dress material. He has domestic retail and wholesale buyers in Ahmadabad and Mumbai and several buyers overseas.

His father, Mr.Mohd.Siddique Khatri was awarded the National Award for Ajrakh in 1981, while as he received the National Award in 1998 and also received the National Merit Certificate for the years 1993 and 1997. His son Abdul Rahim received the National Award in 2002 for his exceptional work in Ajrakh.

He participated in the EPCH sponsored fair at Martinique, France from 1- 6 March, 2006. He also participated in a craft development workshop in Srilanka in 2006, organized by Dastkaar Haat Samiti. He has also several times participated in Crafts Mela at Suraj Kund. More recently he was invited to deliver a skill demonstration workshop at Canada for students.

Case study 2: Dr. Ismail Mohammad Khatri, Master craftsman, Ajrakh

Ismailbhai as he is popularly known has been awarded an honorary doctorate for his commendable work and contribution towards the development of Ajrakh, by the De Montfort University in 2003. He has studied till the 8th grade but due to his never ending penchant for learning, he taught himself the English language by conversing with all the foreigners who visited him as tourists or researchers.

He has been responsible along with his fellow craftsmen for the setting up and development of Ajrakhpur a village 12km from Bhuj. Interestingly, it a village named after a craft rather than the other way around. It was his vision and perseverance that has led to the creation of this village which has *pucca* houses with modern amenities for all the craftspeople and their families. He lives in a house along with his wife, 2 sons and their families. His house has all the modern amenities like western style toilets and kitchen. His sitting room doubles up as his office and has all means of the latest communications. He has an in-house printing and drying facility while as dyeing and finishing is done at the common facilities provided in the village.

His sons work with him and take care of production and marketing. He is a well travelled man and understands markets both in India and abroad. He also continues to follow the traditional process and dyes for Ajrakh and procures his blocks from Pethapur.

His products range from the traditional to the modern like his elder brother and he manufacture a lot of yardage for foreign buyers. His House which also serves as his showroom is frequently visited by domestic and overseas buyers and tourists. He has participated in a number of trade fairs both in India and abroad. He was also invited by the De Montford University to deliver a lecture on Ajrakh.

As mentioned earlier, the Fust at, (Egypt) findings yielded colorful block printed cloths which have connected the current hand block printed textile production in this region to an era when India had a monopoly on textile export to the world. . Interestingly, these initiated a reverse process of the past becoming the future, wherein Dr. Ismail Khatri, decided to print textiles with the same motifs and patterns as are seen on some of these fragments.

The case studies of the two main artisans of present day production of Ajrakh revealed that various factors played a very vital role in the progress of their trade. These factors include level of education of artisans, association with textile researchers and exposure to earlier traditions through books and samples, intervention of various organizations, interaction of artisans with trained designers, participation in national and international fairs and exhibitions, direct interaction with consumer and training workshops at various institutes.

The study revealed that it has become imperative for craftspeople to be educated so that they can keep abreast with the changing scenario. Also training workshops and courses for skill and design development are important for newer ideas and innovation.

Interaction with several researchers leads to a greater interest in the documented textiles and in continuing the tradition. Many eminent scholars from India and abroad have carried out research on traditional aspects of these textiles and are able to reveal interesting details which create awareness as well as serve as a reference point for the understanding of processes, materials and designs used at that time.

According to, Mr. Abdul Razzaque Siddique and Dr. Ismail Mohd. Khatri, several organizations like Gurjari, EPCH (Export Promotion Council Handicrafts), Development Commissioner Handicrafts, and Weaver Service Centre, to name a few have brought in various projects and orders for different target markets to encourage and boost the production of Ajrakh. They have also attended various workshops and skill demonstration exhibitions organized by Govt. and Non Govt organizations, which has helped them learn newer methods to reduce time and use of natural resources as well as newer techniques of production. These workshops also help in better understanding of the urban markets.

Several individual designers as well as those working with the organizations like Gurjari and NID (National Institute of Design), brought in design intervention as well as new product ideas. These design projects normally concluded in exhibitions. After the earthquake of 2001, several design interventions took place and that is why a number of artisans are still pursuing this craft.

Both the brothers have participated in several domestic and international fairs. They have over the years interacted with buyers and individual customers on a one to one basis and thus developed a very clear understanding of colour palette, design and product category for each city and type of consumer. These consumers could be individuals buying products for their own consumption or brands like Fabindia. These fairs help crafts persons liaison with the brands, designers and retailers and get orders. This exposure opens up many avenues for the development of the craft as well as creates alternative markets for the textile craft. Craft bazaars like Delhi Haat at New Delhi are also a step in the right direction as it provides a platform for the artisans for showcasing their products to a city clientele. A number of boutique owners or designers frequent Delhi Haat for sourcing newer fabric options as well as craft oriented products for their designs.

Conclusions & Recommendations

- A traditional textile culture's symbolic imagery is subject to change with the course of time as well as with the influence of outside forces.
- In spite of the omnipresent changes that have taken place over the last millennium, the printers of Ajrakh continue to print some of the same designs that were prevalent in the 15th century.
- The rather recent intrusions of tourism and commercial markets have influenced both the technical and aesthetic traits of Ajrakh textiles.
- Education & exposure, design and technical intervention, participation in national & international fairs and exhibitions, interaction with customers and training workshops can play a vital role in giving a boost to the development of craft societies.
- A detailed documentation of these changes, would enable the stakeholders understand these traditional textile societies for better growth and sustainability.

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Best practices of design management

Prospects and retrospect of design management education in India

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Very few institutions offer specialisation in design education in India and even in the world there are not many institutes which offer design education programmes. However, there are many examples to show that 'design' actually make a business more effective. Design Management as a specialised course, don't attract many students in India. This paper of mine attenpts to assess the current best practices in design management of various design studios and boutiques in India and among relevant faculties, attempts to discuss various methodologies for design management education.

Design management is a complex entity and challenging tasks for many a creative mind. While design and design management in general discussed in marketing text that discusses new product development, by and large there is no mention of design in the indexes of the strategy, economics, law, human resource management, or finance texts.

It is easy to show that a company that develops no new products will eventually decline and fail. It is only marginally harder to show that if a company develops new products that are failures, that company is likely to go out of business more quickly than if it developed no new products at all. It's not hard to see design as an important factor. However, there are many examples to show that 'design' actually follows certain guiding principles (Box-1) and make a business more effective.

Box 1: Twelve principles of design management

Source: Jens Bernsen, Danish Design Center, Denmark

> Design is a tool for defining and communicating the goals of a company in operational form, a means of establishing, visualising and communicating corporate aims. By creating an environment geared to goal oriented action, design is a tool which makes the creative resources of the company come to life, with all the prospects this holds for the growth and development of the company.
>
> - **Use design as a management tool**.
> - **Get your definitions right**.
> - **Make commitment to good design a board room issue**.
> - **Introduce design step by step**
> - **Use design to create unity of purpose**.
> - **Look for challenges to stimulate innovation**.
> - **State your goals in a design brief**
> - **Identify the big idea**
> - **Accept the limitations of the task**
> - **Make design a dialogue between complementary skills**
> - **Seek identification between user and tools**
> - **Create positive feedback between image and identity**

During the early years of post independence India, manifold changes were taking place in economic and social scenario and in production processes with the introduction of new technologies even in the remotest corners of the Indian sub-continent. There were at that time, great thinkers who realized that the process of development demanded a closer look at the future policies and resources that would later on determine the pattern and pace of growth envisioned for India of the future. The Industrial Policy Resolution of 1953 outlined these concerns and indicated broad guidelines. It was as result of these activities that the Government of India invited the renowned design team of **Charles and Ray Eames** to recommend a programme of design to serve as an aid to the newly established small industries in India. As a consequence quite a few design institutes such as NID and NIFT emerged in India.

After 40 years of emergence of design institutes, Design Management as a specialised course; still don't attract many students in India. When it is offered as an optional module, the take-up tends to be low. But, when design management is included as a compulsory module or part of a module, it tends to be more successful. Although some students will be initially reluctant, a good lecturer can win them over in the very first lecture-perhaps by demonstrating to them that their purchase of any garment; textile; dress material; accessory was very likely the result of that product's design. Also one can make emphasise that 'design' includes servicing, availability, and disposal. Professional academics have a responsibility to research, acknowledge, and build on the work that has gone before.

Challenges to and emerging issues in design management education

As Henry Ford said, 'had I asked people what they wanted they would have told me: faster horses.' hence designing per se is about synthesizing differing requirements into one solution where the result is greater than the sum of its parts. And design management is about developing new solutions that are simple and easy, that look and feel like 'why did we not think of this before'.

There are two main views how design be managed. On the one hand design is seen as special, even unique – and by that token it presents special difficulties for managers. On the other hand design is seen as an element of business – to be managed like anything else.

It is reasonable, of course, to argue that design as an activity and designers as professionals should operate within normal managerial constraints, within budgets, to time targets, within the limits of known resources – personnel, facilities equipment and so on. But it is known that deign by tradition woefully, and sometimes wilfully, fails to be constrained. This is not merely a problem of designers who have creatively invented new processes while devising new products, but more that there are some fundamental differences between managers and designers that need exploration in detail.

Many managers experience great difficulty and unease when making judgements about 'things'. This uncertainty can be traced to an educational gap. The education and training of managers tend to be based on analytical studies (such as accountancy and operations research); therefore they are not very well equipped to deal with projects which involve unfamiliar concepts, predominantly visual information, fuzzy problems, high levels of ambiguity, and assessments which are, variously, subjective, personal, emotional and outside quantification. Without making design sound mystical, as if it relied solely on intuition and higher non-rational insights, it does have the quality of many complex human skills in resisting analysis.

Fashion design management in Indian industry – perspectives

India is the world's seventh largest country, the second most populous at over a billion people, and has one of the fastest growing economies in the world. The country has a diverse range of people, languages, traditions and lifestyles. The success of India as a developing nation- with its software, IT, manufacturing and outsourcing Industries- has led to a strong, emerging middle class of young, educated people with increased disposable income.

In a country building upon the creative success of their film industry, and just beginning to understand 'life beyond advertising' design is slowly being identified as ' underleveraged too' in India's regional, national and international presence. As the number of consumers grows dramatically, so brand awareness and design awareness are on the increase. People are becoming more selective about the consumer requirements they have, the lifestyle choices they make and where their brand loyalty lies. They are becoming more brands aware, more brand conscious, more conscious of the differences between local and global brands- and the difference design can make to their expectations for high quality products, services and consumer experiences. There is an emerging opportunity for design to be valued, to be managed, and to take into account the dramatic changes in progress.

In a dynamic fashion industry like India's, the difficulty and expense of introducing new products often puts immense pressure on firms to skillfully launch new brands while managing existing brands. Fashion designers and marketers today are expected to be equipped with valuable perspectives to interpret and evaluate design strategies. The fashion industry is manpower hungry and will remain so for the distant future. There is mobility, growth, opportunity, returns, and prosperity in the Fashion Industry. World over Indians are at the helm of several branded fashion companies. Not just India, but also the world beckons Indian youth to join the fashion industry and contribute to its accelerating prosperity. Yet many Indian designer entrepreneurs have divergent views on the design management practices in India.

Perspectives on and practices of Design Management

Ms. Asmita Marwaa
Proprietor & Chief Designer,
M/s. Asmita Design

It's easy to feel overwhelmed by the mass of messages that clamour for our attention. We are surrounded by direct and indirect demands on our time. So I believe a design manager's role is to ensure that every form of 'Brand' we experience makes sense to us.

The role is therefore so much more than strategy and creative ideas. A design manager has the diversity of business and creative experience. The will and the people skills to make things happen. They have the ability to nurture good ideas and deliver them in a way that makes sense. But of course this requires us to address all factors that influence successful project- timing, content, location, structure, materials, process, costs, consistency and return on investment.

It would be very easy to over- intellectualize a response to this question. I think many design managers are as concerned as our creative cousins that design cannot be taken seriously unless we secure a place on the board and use the word "strategic' as often as possible. For me the design management is something that can take the whole design process from great idea to even greater reality.

A design manager must be a diplomat, peacemaker, planner and plate spinner. It's about rolling your sleeves up and doing what it takes to nurture every good creative idea from everyone in and around you organization, regardless of rank. And then it's about making sure that the best ones get to live and breathe and build your brand.

The best design managers that I have worked with, from both sides of the client divide, are those who take a much humbler and hands on approach, who educate through example by delivering what others cant'. We don't mystify our colleagues with complexity; we gain their trust by demystifying the complexities of implementation- to many, the biggest burden of any project. We impress and influence through our supportive, professional approach and our uncommon common sense. And in this way we make brands make sense.

Ms. Bina K Rao
Proprietor & Chief Designer,
M/s. Creatrive Bee

One of the interesting issues facing designers and leaders today is the confluence of responsible initiatives. Staying focused on people, not just consumers, is a key counterbalance the design team offers. Design is about people, and today more than ever society needs leaders and creators who try to hold on to two things: integrity and perspective. As Sun Tzu, Drucker, Rand, Jung and others have observed in different forms, the results of our work are often determined beforehand by preparation, approach, individuals, and natural conditions. The best thing design leaders and managers can do is to find the right people,

explain the opportunities and goals, and provide the resources that allow design teams and businesses to create meaningful solutions.

Design can express the brand and impress the consumers. Today's consumers are becoming more 'active' and less 'passive'. To express a brand to active consumers, more than ever, designers must act as brand strategists who must consider how to deliver consistent design solutions that impress consumers with their actual physical form. Hence, I see no boundaries between designers and design managers. In a competitive marketplace, designers must have the knowledge to fortify design solutions to compete in the battle of recognition. Design managers must understand good design and be able to incorporate an appropriate design for each branding or marketing strategy.

The designs of twenty-first century are based on both artistic and analytical logic, because the market place is very competitive and the world economy is more evenly spread throughout the world.

Mr. Ashok Mayya
CEO
M/s. ZeroStoc

Design management is the organization of the process for developing new products and services. As design is multidisciplinary and iterative, It will involve coordination and leading a large number of specialists. The process needs to list activities, time, costs, concurrencies, priorities and people, if the outcome is to be successful (which means profitable) on time and within budget, and leading this is part of the design manager's role.

The design manager's effort will be mainly focused at the early low cost stages of design where the main management decisions are made and the finance committed. It is also where the main causes of design failure are rooted. The design manager must also contribute to the strategic positioning of the organization and the planning of products and services well beyond those currently being designed. As such, good design management isn't easy.

Traditionally in many companies in India, designers are not asked to be part of the strategic conversation. At the point where executives are having conversations about the company's strategic intent, designers need to be directly involved in that conversation, not 'looped-in' to that conversation later. Designers can execute directly on an organizations strategic intention by saying for example, "if our intention is to be profitable, we can do the following things. If our intention is to also care about our community, we cannot do the following thins.' Design management is the bridge between design and business that enables the designer's voice to be heard. We in our company consciously bridge that lacunae.

All in all I believe design management in essence is the totality of the design activity, its administration and contribution to an organization's performance. Therefore I would recon design management as encompassing the organization and implementation of the process for developing new products and services.

Ms. Seema Kakkar
Managing Director
M/s. Remanika Apparel Private Limited

In our daily work we are confronted with two faces of design management:

First it is a kind of managing the design process within our design team. Although this is a typical management task, the difference is that it will be fulfilled by designers. This means that even the planning of resources, the planning of the project execution of each project is designed – is a design process by itself. The advantage of this approach is that we can adapt the whole or parts of our team, as necessary, to the given requirements of a project.

In my opinion, this is one of the significant differences between management and design management. Design processes, but also about designing management processes.

The second kind of design management we are faced with is to manage the design strategy of our clients or, at least, support them in doing so. Designers can help their clients to set up a strategy to strengthen their brand and their position in the market. This is especially true of designers who work in diverse industry areas, who work in diverse industry areas, who can give an outside view to the client and supply advice on what they need to do to achieve maximum impact with the product portfolio; how to expand the product portfolio; how to position the brand, and how to differentiate themselves from their competitors.

The primary task of design management in this case is to capture the corporate identity, the philosophy of a corporation, and to visualise and communicate this through the product and product experience, so that the core brand values are tangible to the customers. This has the effect of both strengthening the brand and making it robust in the market.

Ms. Asha Reddy
Proprietor & Chief Designer,
M/s. Eucalyptus

A design manager forms the link between the creative and the business world. They have the ability to communicate with both sides of these industries and speak their different languages. A successful design manager is capable of managing the development of a piece of creative work, smoothly introducing the concept to a business environment, and then further managing the process through to its success – ultimately ensures that all parties are satisfied. Design management entails exploring a wide range of design disciplines such as interior design, product design, packaging, branding, graphics, advertising, website design as well as film and media.

Corporations need leaders, design leaders. Design leaders are concerned with innovation, design and strategy. The only reason to hire designers is because you want to lead your marketplace. We know that every company has tried to improve its competitive position with better design than the next guy, increasing productivity, outsourcing, and so on. But that's just not enough today.

Integrating the design thinking process into the other strategies by which an organization plans to achieve its goals will improve its competitive position. To develop a leadership organization and culture, one must hire talented people who work, and play well together, to collaborate on a constant stream of always improving products, communications, services, experiences and processes that customers didn't know they needed or wanted, but do and will spend a premium for when they see them.

This is a competitive advantage in the twenty-first century and it's impossible to knock-off.

Ms. Divya Lakshmi
Head-HR
M/s. Celebrations Apparel Limited

I am closer to being a creative people manager, but as this is so general, I prefer to be called either a design or innovation manager. I manage designers and non designers working creatively for a common goal – asking the right questions and getting to the best solutions. In a certain way, everyone ends up doing design management within their profession, the difference is that I am involved in solutions for new products and services.

Design and innovation are closely linked by their core responsibility – change. You could do one without the other, when you do both = powerful solution. The major difference I see in both is that design seems to be a restricted field for designers, though everyone knows non designers are making design decisions every day. Designers tend to see this as an attack to their professions, it becomes a richer process. Today, designers are in most of the cases out of the decision loop, they are the ones that have to enter other territories, sharing their specific skills and knowledge and leading the process.

Designers may not be better leaders, but they lead the change process very little and they have to lead more, trust their special abilities, stop winning and move into the playing field. The fact that designers can go into a project they never worked with before, learn enough not to say or do dumb things, abstract the problems, ask good questions, search for creative and differentiating solutions and then communicate them to very different audiences in a powerful way must be worth something.

Ms. Uma Prajapati,
Proprietor & Chief Designer,
M/s. Upasana Design Studio

Design management for me is one of the main strategic tools that the management of an organisation should use to define and realize change. Organisations have to respond to changes in order to become successful (keeping up with change).

Information Design and interaction design improve administrative and communications processes. Within the organisation as well as the dialogue with its clients and other stakeholders, both online and offline. Finally, user experience design improves usability, accessibility and comprehensibility.

On all levels, design management ensures that the identity of the organisation, its products and services are steered in the right direction in order to build the desired relationships with all its stakeholders, internally and externally. Well executed design management is the art of synergizing all these design fields.

For me design management has several components not least the following three:

- Most importantly, the injection of design thinking into organizations; in particular, helping leaders of organizations understand and appreciate the value and contribution of designers, design and design thinking;
- Providing a bridge between designers and non-designers as their values and beliefs are often very different; this includes the management of the designers, internal as well as external;

Conclusions

Design management is summed up as the identification and allocation of creative assets within an organization to create strategic, sustainable advantage. Design management is design-minded leadership. It is the bridge between design and business. It moves beyond the aesthetic to change experience, organizations, and opportunities.

Building a future for business in the twenty-first century will require organization, innovation, direction and the ability to imagine new possibilities. Designers are able to look at a problem and wonder, ‘what if this was completely blank and I could start over again? That kind of intelligence is now really necessary. It’s a creative intelligence that enjoys problem-solving and can find opportunities in places where other people have given up.

Greater understanding between those who design and those who manage industrial organisations can enhance both profitability and quality of the product or service delivered. Design management education is one of those means by which the gap is bridged. The cultural and attitudinal gaps between managers and designers needs to understood and appreciated. A survey of design tutors attitudes confirms the needs of customers to be the business input perceived as most important (Trustrum et al. 1987).

The present paper identifies certain topics which need attention in design management education:

- Demand theory in the context of design
- Design and product strategies
- Design project management
- Evaluating design results and
- Nature and scope of design management for commercial exploitation

From the current tutoring and pedagogical perspectives, the students need grooming on the following aspects:

- As a first step in the design making process, the students needs articulation of the design in textual matter.
- The evaluation of the textual matter in the context of the design proposed and obtained
- Exercises need to be done using real marketing briefs for the visualisation of a design.

Design education therefore should inculcate the balance between controlling and creating, while imparting the bodies of knowledge characterised as management theory and design theory, and the balance must be reflected in the philosophical stances underpinning educational programmes.

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A Srinivasa Rao is an Associate Professor & Placement Coordinator at NIFT, Hyderabad. Spanning 16 years of rich and diverse experience, He has worked with some of the leading consulting and marketing research firms including IMRB International; AC Nielsen ORG-MARG; Marketshare Pvt Ltd. Executed major marketing research and consulting mandates during his stint with various reputed companies across various verticals. Led profit center for Marketshare Private Ltd, Singapore as India representative; and Southern head for B2B division for AC Nielsen ORG-MARG. Conducted executive development and marketing training programmes as part of APITCO Ltd. Obtained an IPR (Geographical Indication) for Nirmal Craft in 2008. Presented papers on “IPR in retail education” at TIWC, Hong Kong, 2008; and on “emerging trends in brand building” at an international conference held at IPE, Osmania University, Hyderabad. He runs an EDP for working professionals on ‘fashion brand management’ and ‘fashion retail store operations’. As placement coordinator, for the last 3 years guided around 170 students annually for placements in various companies of repute.

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