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Introduction

The publication of *Design Issues* 20:4, which completes our twentieth anniversary year, invites a look back on how we have marked our anniversary's celebration. We began the celebration with an issue that indexed all the article, documents, and book reviews that appeared in the journal during the twenty previous years. This amounted to over five-hundred items from more than twenty-five countries. Perusing that list, one sees evidence of a community that embraces many different researchers who work in the areas of design, history, theory, and criticism.

To recognize design's global presence, we dedicated the second anniversary issue to design in South Africa, where a vital group of designers, historians, and theorists is not only producing stimulating design but also thoughtful reflection on it. Our third issue connected us across disciplines to the Science, Technology, and Society movement, which has now recognized design as central to its thinking about technology and its social effects.

Each of the articles in this fourth anniversary issue represents in its own way evidence of how design research has developed since *Design Issues* began publication in 1984. They indicate as well how the level of discussion and debate in the emerging field of design studies has become more richly textured. In his article on Darwinian design, John Langrish shows us how we might use concepts from biology to understand design as a developmental process. He challenges sociologist Herbert Spencer's notion of progressive evolution, which, he argues, has become a dominant paradigm for discussions of evolution and design. Instead, he proposes a study of "memetics," which derives from Richard Dawkins's concept of self-replicating ideas. Langrish claims that "memetics" follows Darwin's evolutionary thoughts more closely than Spencer's do and he argues for a Darwinian non-progressive theory of change. Unlike earlier design thinkers who sought replicate scientific theory in the realm of design, Langrish does not engage science as a model but instead as a metaphor that can elucidate the process of design's development without imposing inappropriate characteristics on it.

Tom Fisher shows us how an understanding of plastic as a material can be enriched by a use of multidisciplinary research methods from sociology, history, anthropology, and psychology. He seeks to understand plastic as a material that evokes particular feelings in the consumer, while recognizing that these feelings are not universal. Instead, they depend on the consumer's personal orientation to plastic as physical material and immaterial sign. Among the consumers

he interviews are fetishists who interpret their bodily contact with plastic in a highly erotic manner.

Lucinda Kaukas Havenhand draws on feminist scholarship to reinterpret the social meaning that has historically been attributed to interior design as a profession. She begins her article with an account of how interior design has been historically understood as the weak feminine binary in relation to the stronger masculine practice of architecture. Then she draws on theories propounded by Donna Haraway, Carol Gilligan, Karen Franck and others to propose a new empowered reading of interior design that is based on feminine strength.

Suga Yasuko, in her article on the "Chamber of Horrors" at London's Museum of Ornamental Art in the 1850s, addresses a subject that was assiduously avoided by early design historians, the "ugly" object. Suga describes the moral impetus for the Chamber of Horrors, noting that it was a way to teach the public about good taste by showing them bad examples to avoid. Suga characterizes this bad taste according to ideas of the time and shifts the moralizing about it to theorists of the period such as Henry Cole rather than incorporate that moralizing in her own interpretation of history.

Anthony Crabb presents several case studies carried out by the Design Contract Research Unit at Britain's Nottingham Trent University in order to explore the different ways that pragmatic research can contribute to a pool of "design knowledge." Crabb's emphasis on applied investigation forms part of a debate that is particularly strong in Great Britain on the nature of design practice as a form of research. Crabb argues that even research for commercial clients allows for the formulation of interesting research questions.

Sulfikar Amir, in his article on design policy in the Third World, shifts the debate on design for development away from the early ideas of Victor Papanek about low-tech design towards questions of how design can become part of a national industrial policy. Although studies on design policy have been carried out in industrialized countries for a long time, little work on this topic has been done in the developing world. Amir sees design policy as a way to encourage local corporations to make better and more intensive use of design in the processes of product development and innovation. He is particularly interested in a "human-centered design policy," which can direct design activity towards goals of well being while also addressing the conditions of the market.

Chris Rust returns us to the topic of design knowledge by exploring the question of designers' tacit knowledge and how it can be used constructively in the design process. He is particularly interested in strategies of teamwork and looks at how tacit knowledge can complement the contributions of other members of a design team such as those who produce quantitative data. Like Anthony Crabb, Rust is interested in the different kinds of activity that might be considered within an expanded definition of design research.

Our book review section in this issue has an unusual feature. Three different reviewers have considered books by critic Steven Heller on issues of design history and practice. Not only do the reviews provide a detailed depiction of Heller's thought as it is evident within several volumes but they also show how diverse critical responses to an author's work can be.

In sum, the conclusion of our anniversary year leaves us with a sense that design studies is in a healthy state. In the sense that John Langrish reads Darwin's theories, its evolution is fueled by the continued production of new ideas that are expanding the scope of its investigations and deepening its methods of inquiry.

Richard Buchanan
Dennis Doordan
Victor Margolin

Darwinian Design:
The Memetic Evolution
of Design Ideas
John Z. Langrish

Introduction

There seems to have been a recent slight increase in the number of design papers with the word, "evolution" in their titles. Unfortunately, these papers are either vague about what is meant by this word, or they use the word in a non-Darwinian sense which owes more to Spencer's version of progressive evolution than to the process of natural selection.

One interesting example is a paper by A. Can Ozcan, who writes:

> Let's assume that the one we know as Darwin is born in our times and he is very curious not about species but designed objects and artifacts. Instead of looking at birds he is looking at refrigerators, cars, kettles, microphones, bicycles. Our number one question is whether he would come up with similar principles of evolution like selection of the fittest or progression from simplicity to complexity for designed objects.[1]

My short answer to that question is an emphatic "No." The longer answer is that Charles Darwin did *not* come up with "principles of evolution," and if he had done so then progress towards complexity would not be one of them. The original full title of his great work was *On the Origin of Species by Means of Natural Selection*—nothing about "evolution." In fact, the word "evolution" is only used once in the first edition. He originally intended to call this work just "Natural Selection," and a Darwinian theory is one based on natural selection—not on some inevitable force for progress.

The term "survival of the fittest" was used by Herbert Spencer before Darwin was persuaded to copy it in later editions of his work. The notion of progress from simple to complex is a key part of Spencer's evolution, but it does not correspond with what we know. This paper suggests that Spencerian notions of progressive evolution have dominated discussions of evolution in design, and now it is time to examine what a Darwinian theory of design evolution might look like. Darwin, of course, did not know anything about genes, genetics, or mutation. The term neo-Darwinism is used

1   A. Can Ozcan, *An Evolutionary Approach for Design—Contradictory or Complementary with History* (3rd International Conference on Design History and Design Studies, Istanbul, 2002.)

to mean Darwin's natural selection plus genes. It is not suggested that design is somehow genetic. Design evolution is the evolution of ideas, and the Darwinian evolution of ideas is called "memetics" from the concept of self-replicating ideas called memes by Richard Dawkins.[2]

Four Arguments Against Evolutionary Design
A good example of the way in which design historians equate evolution with Spencerian notions of progress is provided by Adrian Forty's *Objects of Desire*.[3]

> In his otherwise excellent attempt to tackle the problem of why artifacts are the way they are, Forty dismisses evolutionary explanations of change on the following grounds:
>
>> Historians of design have often tried to get around the problem [of explanations involving creative individuals] by attributing the changes to some sort of evolutionary process, as if manufactured goods were plants or animals. Changes in design are described as if they were mutations in the development of products, stages in a progressive evolution towards their most perfect form. But artifacts do not have a life of their own, and there is no evidence for a law of natural or mechanical selection to propel them in the direction of progress. The design of manufactured goods is determined not by some internal genetic structure but by the people and the industries that make them and the relationships of these people and industries to the society in which the products are to be sold.[3]

Forty has four arguments against what he calls evolution. They may be good arguments against vague ideas of Spencerian evolution, but they are not valid arguments against Darwinian change. His four arguments are:

1. **The progress argument.** This has nothing to do with Darwinian change, but Forty does not restrict himself to the progress towards complexity mistake: he adds the astonishing "a progressive evolution towards their most perfect form." There is no such thing as a perfect mammal, perfect kettle, perfect car, or perfect tree. In all cases, they exist as different varieties which have to fit into different environments. "Progressive evolution towards a perfect form" is an example of what Ernst Mayr refers to as "finalism" or "the belief that the living world has the propensity to move towards ever greater perfection." According to Mayr, supporters of finalism "postulated the existence of some built in force... but Darwin emphatically rejected such obscure forces." [4]

2. **"Artifacts do not have a life of their own."** This argument is also known as the "machines don't mate" argument. The short answer to this is that the evolution of design ideas is the issue, and that ideas do have a "life."

2   Richard Dawkins, "Memes: The New Replicators," Chapter 11 in *The Selfish Gene* (Oxford: Oxford University Press, 1976), 189–201.
3   Adrian Forty, *Objects of Desire: Design and Society Since 1750* (London: Thames and Hudson, 1986), 8.
4   Ernst Mayr, *What Evolution Is* (London: Basic Books, edition: Phoenix, 2001), 82.

The machines don't mate argument was answered convincingly by Samuel Butler more than a hundred years ago. Butler's arguments were written in three chapters of his novel *Erewhon* (anagram of nowhere, and pronounced with three syllables). One of Butler's responses to "machines don't mate" was "Does anyone say that the red clover has no reproductive system because the humble bee must aid and abet it before it can reproduce? No one." Machines use humans to "aid and abet" them. He makes the obvious points about individual machines requiring feeding and tending by humans, but he also makes the much more subtle point that the improvement of machinery relies on competition, the destruction of inferior machines, and the creation of better machines. These three tasks all require the enslavement of humans. In Butler's words:

> The lower animals progress because they struggle with one another; the weaker die, the stronger breed and transmit their strength. The machines themselves being unable to struggle have got man to do their struggling for them; as long as he fulfils this function duly, all goes well with him—at least he thinks so; but the moment he fails to do his best for the advancement of machinery by encouraging the good and destroying the bad, he is left behind in the race of competition; and this means that he will be made uncomfortable in a variety of ways and perhaps die.[5]

Butler, of course, did believe in progress, and this lead him to part company with Darwin.

A modern answer to the "machines don't mate" argument would involve the fact that life on earth went on for about one-thousand million years before sexual reproduction appeared. The early bacteria mixed up their genetic material in a variety of ways including lateral transfer. This is more like the way in which design ideas mix together. Some of the bacteria which are around today are very similar to the ancient bacteria that first appeared about thirty-eight hundred million years ago. This does not suggest that Spencer was right in his ideas of progression.

3. The law of propulsion argument. Natural selection is *not* a law like the law of gravity: it does not propel things in some predetermined direction. It is a filter, which is different. If we have a mixture of different sizes and shapes of things being shaken on top of a sieve, then some things will pass through the sieve and some will not. The force at work here is the force of gravity, which is impartial. The sieve which "selects" things as being below a certain size is not a "force." Some things just pass through it, and some things don't. And there is a little luck involved here in that some small things which ought to pass through the sieve don't because they get stuck, and some large things which happen to be long and very thin manage to wriggle through. So there is no precise prediction of the separation.

5 Samuel Butler, *Erewhon: or Over the Range* (London: Jonathan Cape, 1872).

It took time for the difference between natural selection and some kind of propulsive force to be appreciated. In the early years of the twentieth century, there were several people postulating a "force." One was the French philosopher Henri Bergson, whose "creative evolution" was propelled by an *élan vital*—a vital impetus. According to the French art historian Germain Bazin, Bergson influenced art history. Referring to this influence of the "philosophy of Bergson," Bazin claims:

> Art historians, following a certain finalist tendency which showed itself particularly in neo-vitalist doctrines, began to seek the determining factors in the work of art no longer in circumstances outside the work, but in the artistic activity itself. They credited this activity with a capacity for development or expansion of its own, to be understood like life in terms of a "creative evolution" working towards a more efficient use of its inherent properties.[6]

Bergson's evolution, like Spencer's, has no evidence in its favor. Natural selection has more than a hundred years of evidence in its support.

4. The argument that manufactured goods do not have some "internal genetic structure." The short answer to this is to point out that Darwin knew nothing at all about genes or genetics, so whatever is meant by Darwinian change does not have to include some "internal genetic structure." Darwin, of course, was aware that something had to be passed on from one generation to another; otherwise natural selection would not work. However, his ideas about the nature of this "something" were confused. The modern term for a "something" that gets passed on is a "replicator" as popularized by Richard Dawkins, who points out that there must have been chemical replicators before the emergence of DNA, and also that human society rests on a new type of replicator which he calls a "meme"—a replicating idea.[2] Ideas that get copied, modified, and stuck together with other ideas can form the basis of a Darwinian theory of changing design. The study of replicating ideas is called "memetics," but before moving to a discussion of memetics, it is necessary to say more about the ideas of Spencer and Lamarck.

Spencerian Progress

The idea that there is some propulsive force or "law" of progress behind evolution seems to have arrived in the history of art and design as a result of the writings of Herbert Spencer. In a 1961 paper, Thomas Munro claimed that Spencer produced "the first detailed systematic attempt to fit the history of art into a naturalistic theory of evolution."[7] Increasing complexity, according to Spencer, was a change from the homogeneous to the heterogeneous, and from the indefinite to the definite. The development of the arts, he believed,

6   Germain Bazin, *A Concise History of Art* (London: Thames and Hudson, 1958), 522

7   Thomas Munro, "Do the Arts Evolve? Some Recent Conflicting Answers," *Journal of Aesthetics and Art Criticism* (Summer 1961): 407–417.

illustrated this tendency and thus exemplified the larger process of mental and social evolution.

Spencer wrote about this in 1857, two years before Darwin's *Origin.* The title of his 1857 essay was "Progress, its Law and Cause." He called the process of increasing complexity "progress," which then became "evolution." The evolutionary process took in everything from the stars to the arts. Later on, the process of social evolution came to be described as "cultural evolution."

After discussing notions of evolution in the history of art, Munro asks:

> ... if the term "evolution in art" is so ambiguous, so loaded with inconsistent meanings, is it usable at all in scholarly discussion? Would it be better to find another term, or a set of them?" [7]

My answer is "yes"; it would be much better if we stopped using evolution and used "Darwinian change" to signify descent with modification under the influence of natural selection. If some other kind of process is under discussion, then other terms exist. Spencerian change could be used for an inevitable process leading to greater complexity and improvement. Lamarckian change could signify a process whereby change results from striving for improvement, and the further transmission of such improvement.

Making a clear distinction between Spencerian notions of change and Darwinian change is essential if evolutionary accounts of design change are to be treated seriously. These days, most historians reject historical "forces" as a meaningful concept, and many are unhappy with notions of progress. Historicism (forces of history) and Whig history (things get better over time) both have been discarded. Since Spencer's ideas include both "forces" and "things getting better," it is not surprising that Spencerian notions of evolution have been rejected. However, Darwinian evolution depends on natural selection, which is a filter not a "force" and does not claim that change must be progressive (though it might seem to be on occasion). As long as historians confuse evolution with Spencerian change, evolution is going to be rejected, as it has been by Adrian Forty. The Darwinian alternative has not been given a chance.

Another reason for rejecting Spencerian notions of progress through increasing complexity is that they just do not fit the facts. Many writers before Darwin, including his own grandfather, Erasmus Darwin, had notions of a progressive gradual change. Lamarck was so keen on progressive complexity that when it was pointed out that there were some new, simpler organisms, he was forced to suggest that they must be the product of spontaneous generation.

Darwin's natural selection is different; it is *not* essentially progressive: it is more in accord with what we observe in nature where there are many examples of things becoming less complex.

The remote ancestors of the horse, for example, had five toes which became three and then one. At some stages in the complex history of horse species, there were species which became smaller while others became larger. There was no simple linear development from a small dog-like creature to the modern horse. It has taken time for this fact to be appreciated by non-biologists. The fault for this lies in museum exhibits such as those that used the evolution of the horse as a visual illustration of evolution, giving the impression of progress in a particular direction.

In 1959, the Natural History Museum in London was illustrating evolution with, among other things, the horse progression. This exhibit had four skeletons, the Hyracotherium or Eohippus, which was about the height of a fox terrier, the Miohippus, which was about two feet high (shoulder height), the Pliocene horse which, was about four feet high, and the modern Equus. The feet changed gradually from having toes in the Eohippus to having hoofs in the Equus. Similarly, the teeth seemed to change gradually.

A slight hint that things were not quite as simple as suggested by the gradual progression of the skeletons was given in the words of a booklet accompanying the exhibit which claimed that the early skeletons came from Europe, but the "genus Equus first appeared about a million years ago in North America, whence it spread rapidly to every continent except Australia."[8]

The complicated history of horse evolution was sorted out by George Gaylord Simpson, the American paleontologist who, in 1949, could claim, "The record has demonstrated that evolution is not some overall cosmic influence that has been changing all living things in a regular way throughout the periods of the earth's history."[9]

Spencer, of course, was a firm believer in "some overall cosmic influence" which propelled not just the evolution of life, but included the evolution of the stars and the arts as well. This belief just does not fit the record.

Stephen J. Gould has shown why people have been confused about the apparent movement towards complexity.[10] His argument is that, if you start with single cell creatures in a space of possibilities, then there is much more room in the direction of complexity than in the direction of less complexity. Nonetheless, viruses which are simpler than single-cell creatures are among the most successful creatures around today.

What Darwin actually wrote was that, if complexity exists, there is only one way that it could have arisen—through a series of gradual changes with selection at each step—"If it could be demonstrated that any complex organ existed which could not possibly have been formed by numerous successive, slight modifications, my theory would absolutely break down."[11] This is not the same as saying that things must become more complex. It is not the same as saying that all change must be gradual. And it doesn't even say

8   "A Handbook on Evolution, to Accompany an Exhibition" (The British Museum [Natural History] 1959, 2nd enlarged edition).

9   G. G. Simpson, *The Meaning of Evolution* (New Haven, CT: Yale University Press, 1949).

10   Stephen Jay Gould, *Life's Grandeur* (London: Jonathan Cape, 1996) (Published in USA by Harmony, New York as *Full House*).

11   Charles Darwin, *The Origin of Species by Means of Natural Selection* (London: J. Murray, 1859 [6th edition, p 137]), 58 and 402.

that things have to change. On the contrary, Darwin was aware that, given stable conditions of life, things could stay the same for long periods of time. In his own words, "A number of species... might remain for a long period unchanged, whilst within the same period, several of these species by migrating into new countries and coming into competition with foreign associates might become modified."[11]

It follows that Spencerian evolution differs from Darwinian evolution in two major ways: the former has both a force for change and a direction, the latter has neither—or at least it has nothing comparable to a law of gravity. In biology, Darwinian change does have trends, pressures, and so on, but mainly within a limited time span (remembering that a "limited" time in biology may be thousands of years). Similarly, some writers refer to trajectories of technological change, but these are not like trajectories in physics; they are unpredictable over a long time scale. Many of the changes in both biology and technology seem to be the result of accidents. But if we neglect the possibility of the existence of some patterns of change, we end up with the minimalist stance that everything that happens is contingent on circumstances that are never repeated.

As stated by Douglas Adams (the author of *Hitchhikers Guide to the Galaxy*):

Anything that happens, happens,
anything that in happening causes something else to happen,
causes something else to happen,
and anything that in happening causes itself to happen again, happens again.[12]

Natural selection lies somewhere between the extremes of a progressive force and the absence of anything other than "if it happens it happens." There is, however another alternative—Lamarckian evolution—which has a direction (progress), but replaces a "force" of nature by striving. It is obviously comforting to some people to believe that: (a) the world is getting better, and (b), that their own efforts play a small part in this process. Such people would be at home with a Lamarckian theory of evolutionary change in design.

The Lamarckian Alternative

We have now reached the point where we can return to Ozcan's interesting question—what would Charles Darwin have made of cars and kettles—or rather kettles and bicycles, since cars had not been invented. His first steps might have been to realize the importance of ideas, and to decide that ideas about artifacts can be called design. It is just possible that he also might have thought that changes in design were Lamarckian. Towards the end of his real life, Darwin came very close to accepting the Lamarckian idea of inheritance of acquired characteristics. If he had thought that changes in kettles and bicycles were Lamarckian, he would have been supported by several

12 D. N. Adams, *The Salmon of Doubt* (London: Macmillan, 2002), 29.

modern writers. For example, Nobel Prize-winning biologist Peter Medawar, discussed the "evolution" of tools or instruments which:

> undergo a slow systematic secular change of a kind which it is perfectly possible to describe as an "evolution" ... provided of course one realises that it is the design of these instruments that undergoes the evolutionary change and not the instruments themselves, except in a quite unnecessarily figurative sense.[13a]

Elsewhere, Medawar claimed that this kind of evolution is Lamarckian and not Darwinian because—"It embodies a learning process." [13b] Medawar was emotionally in favor of Lamarck because he wanted to believe that striving and learning achieved some permanent improvement.

Lamarckian ideas can be summarized as:

1 Striving to meet a need leads to greater use.
2 Greater use leads to improvement.
3 Improvements can be passed on—inheritance of acquired characteristics.

Lamarckian change is more than the inheritance of acquired characteristics, the muscles of the blacksmith being the classic case. On its own, the ingredient of acquired characteristics does not work. As Helena Cronin points out, why just the muscles, why not the bad back and the burnt hands, and what about the blacksmith's daughters? [14] The answer to why just the muscles being passed on is the ingredient of striving, and people who are in favor of striving tend to wish that Lamarck was right.

Another reason for liking Lamarckian ideas is that anything is better than leaving things to "blind chance." This reason was appealing to many people including H. G. Cannon who, as a Lamarckist Professor of Zoology at Manchester University, made life difficult for zoology students when I was a chemistry student there. In the preface to his book, Cannon states, "If I can make it understood that evolution represents a continuous succession of amazingly efficient things that work, and not an incredible series of successful 'treble chances,' then I shall feel that I have been justified, for this I am certain is the only way we shall escape from the arid conditions of modern genetical theory." [15]

The idea that Darwinian change is just "chance" is wrong, and the idea that biological change could be Lamarckian has been convincingly demolished by Richard Dawkins, who states, "Lamarckism is not just something that might be; it actually couldn't be... the theory is in principle incapable of explaining the evolution of serious adaptive complexity not just on this earth but anywhere in the universe." [16]

Dawkins points out that not all acquired characteristics are "improvements." The thing that separates changes that are improve-

13a. P. B. and J. S. Medawar, *The Life Science,* Chapter 6 (London: Wildwood House, 1977), 52.

13b P. B. and J. S. Medawar, *Aristotle to Zoos: A Philosophical Dictionary of Biology* (Cambridge: Harvard University Press, 1983), 97. See also P. B. Medawar, "Technology and Evolution" (The Frank Nelson Doubleday Lectures, New York, 1973).

14 Helena Cronin, *The Ant and the Peacock: Altruism and Sexual Selection from Darwin to Today* (Cambridge: Cambridge University Press, 1991).

15 H. G. Cannon, *The Evolution of Living Things* (Mancester: Manchester University Press 1958), ix.

16 Richard Dawkins, *The Blind Watchmaker* (London: Longmans, 1986), 288.

ments from those that are not is a selective environment. (We have to remember that "environment" is not just the weather and stuff that "Greens" worry about. For a particular gene, all the other genes are part of its environment. It has to FIT—to Function In Time and Fit In Too.)

Discussing behavior, Dawkins said, "Suppose the skills acquired during life by animals could be translated into DNA and get passed on. They would be one jump ahead, and evolution would be speeded up." However, "This all presupposes that the changes in behaviour that we call learning are, indeed, improvements. Why should they necessarily be improvements?... there must be a Darwinian underpinning to ensure that acquired characteristics are advantageous."[16]

In other words, while evolution might happen somewhere in the universe in a manner which involves striving and the inheritance of acquired characteristics, such a system would not exhibit adaptation; it would not exhibit the appearance of design. The main reason for this is that there is no way of knowing what to strive for.

Striving has to be seen as a necessary but insufficient factor in Darwinian change. Any animal that inherited a lazy disposition would have reduced chances of passing on such a disposition (the human animal being an exception, of course). Animals have to spend their lives striving to keep up with the demands of the four Fs—feeding, fighting, fleeing, and the other F (in my view, the four Fs of the limbic nervous system need the addition of a fifth—fun). This is just a base line; they need a competitive edge if they are going to survive and replicate. The nature of the competitive edge is selected (not caused) by the animals' surroundings including other animals, sources of energy, and sources of danger.

So it is with human design. Ideas compete for resources, first within the head of an individual designer, then within an organization, and then in the selective world of purchasers and users. But surely human design is different: humans can imagine something that does not exist and organize resources to make it exist. This is the nature of striving, and Dawkins's objection to Lamarck in biology also applies to human design. The problem is that the best designer in the world has no way of knowing what the future will bring. Assumptions about what would make an improvement are notorious for coming up against unanticipated obstacles.

Changes in the environment can lead to the results of striving becoming redundant. What happened to the large muscles of the blacksmith when no one wanted blacksmiths anymore? Once, a faster airplane could be assumed to constitute an improvement. Then came the Concord, made possible only by massive expenditures by the French and UK governments. Similarly, the designers and engineers who developed the Hovercraft thought they were striving for an improved form of transport, aimed initially at the need for a transport system that could cover both land and water. However,

the helicopter filled that niche and the secondary aim of a "better" way of traveling over water was defeated by other advances in water transport such as the hydrofoil.

Six different firms who tried to make and sell the Hovercraft all had to give up the attempt. Even though all the costs of developing a working Hovercraft were paid for by the British Government, it was not possible to make a profit from the manufacture and sale of something that people did not want.[17]

In other words, the Lamarckian alternative which sounds like a description of human design—things getting better through the striving of individuals—in fact does not work. If we wish to discuss design evolution, we have to consider Darwinian natural selection.

Natural Selection Outside Biology

Although he did not specifically mention kettles and bicycles, we do not have to do much guessing to have a good idea what Darwin thought about change in non-biological systems. In his second great book, *The Descent of Man and Selection in Relation to Sex,* he speculated about the application of natural selection in areas outside of biology. For example, on language he stated, "The survival or preservation of certain favoured words in the struggle for existence is natural selection." Darwin quoted a writer in *Nature* in 1870 who wrote, "A struggle for life is constantly going on amongst the words and grammatical forms in each language. The better, the shorter, the easier forms are constantly gaining the upper hand, and they owe their success to their own inherent virtue." As Darwin pointed out, there is more to "success" than "inherent virtue"; language does not necessarily progress in the direction of being more virtuous. He suggested, "Mere novelty and fashion may be added for there is in the mind of man a strong love for slight changes in all things." [18]

Darwin was well aware of the importance of mind. He suggested that a sophisticated language requires a sophisticated mind, and the only way that could have happened was by what he called "correlation of parts," a term to describe how two different things changed slowly together so that they could keep in step. He had similar views on technical change or invention:

> If some one man in a tribe, more sagacious than the others, invented a new snare or weapon, or other means of attack or defense, the plainest self interest without the assistance of much reasoning power, would prompt the other members to imitate him and all would thus profit. The habitual practice of each new art must likewise in some slight degree strengthen the intellect.[18]

At first sight, the nature of the selection system within which ideas compete might be seen as being very different from the selection system in biology, but Darwin had two important theories which are relevant here. The first of these is unconscious selection. Because we

17 P. S. Johnson. "The Development of Hovercraft," *Three Banks Review* (December 1974).

18 Charles Darwin, *The Descent of Man and Selection in Relation to Sex* (London: John Murray, 1871 [2nd Edition, 1883]), 129 and 91.

have some control over the selection system, it might be thought that the evolution of kettles and bicycles was a form of artificial selection, like animals being bred by humans. However, Darwin was aware that even artificial selection did not proceed in a totally rational fashion. He gives the example of two flocks which started out as divisions of the same flock of Leicester sheep but, over fifty years, diverged from each other in an unpredictable manner to such an extent that they had "the appearance of being quite different varieties." He called this phenomenon "unconscious selection."[19]

Governments like to think that they make quite conscious decisions to support some things and discourage others, which of course they do but such decisions may have "unconscious" effects. The "rules" of the competition between design ideas can be altered deliberately by taxing some things and subsidizing others. Some things can be made illegal, while awards may be given for other kinds of things. The problem is that there is still the need for what Dawkins calls "a Darwinian underpinning" because governments do not really know what to support and what to discourage, and because of the unexpected effects of "unconscious selection." The British government has supported Hovercraft and hydrogen bombs. It supported larger families by offering child benefits. It has banned cannabis and working for the government after age sixty-five (apart from judges and prime ministers). When the contraceptive pill was introduced in the UK, medical treatment was free under the National Health Service, but prescriptions for the pill had to be paid for. Today, there is a charge for most prescriptions, but the pill is one of the exceptions; it is free.

As a society, we can use reason to attempt to make improvements, but there always is uncertainty about outcomes so we still are left with a Darwinian natural selection system underpinning our efforts. A good example of this can be found in England, where a government-funded cull of badgers was carried out to reduce the incidence of tuberculosis in cows that can catch TB from infected badgers. Badgers are social animals that live in small groups and do not travel very much as long as they have food and company. Attempting to kill the badgers destroyed the groups and left lone badgers roaming the countryside. This apparently led to a twenty-seven percent increase in bovine TB in areas where badgers had been shot, compared to control areas where no shooting had been allowed.[20]

Even when we are very sure that some change would be for the better, such change will still have the unexpected side effects of Darwin's unconscious selection.

Darwin called the second of his theories that concern the selection system "sexual selection":

The nests of humming birds and the playing passages of bower birds are tastefully ornamented with gaily colored objects; and this shows that they must receive some kind of pleasure from the sight of such things.[21]

19 Charles Darwin, *The Origin of Species by Means of Natural Selection,* (1859), 25.
20 "Badger Killing Led to Rise in TB," *The Guardian,* (November 5, 2003): 9.
21 Charles Darwin, *The Descent of Man and Selection in Relation to Sex* (1883), 92.

Darwin saw the main role of pleasing sights and sounds to be sexual attraction, and he was fascinated by the peacock's tail. Clearly, a tail which is large and heavy has no advantage in survival terms—it requires energy and it advertises its presence to any passing predator. Darwin's explanation was that basically the female peacocks had a preference for elaborate tails, and the evidence for this was that the peacock tails are at their peak during the mating season.

He called this phenomenon, "sexual selection." Another example was the Argus pheasant. Referring to the Argus pheasant, Darwin stated:

> He who thinks that the male was created as he now exists must admit that the great plumes, which prevent the wings from being used for flight and which are displayed during courtship and at no other time in a manner quite peculiar to this one species, were given to him as an ornament. If so, he must likewise admit that the female was created and endowed with the capacity of appreciating such ornaments. I differ only in the conviction that the male Argus pheasant acquired his beauty gradually, through the preference of the females during many generations.[22]

So I am sure that Darwin would have been happy to see kettles and bicycles in terms of the evolution of ideas, and that he would not have seen such a process as being particularly progressive. He would have found room for fashion, "a strong love for slight changes" and "unconscious" design. He would have drawn an analogy with sexual selection, and he also would have been happy with the notion of imitation as one way in which ideas are spread under the influence of "the plainest self interest without the assistance of much reasoning power."

So far I have tried to establish (1) that ideas of evolution that exist in the design literature are confused or pre-Darwinian and, should be consigned to the waste basket; (2) they should be replaced by a nonprogressive Darwinism; and (3) that the form of Darwinism that is needed to make sense of change in design is the evolution of ideas.

In the 1930s, biology achieved a synthesis of the ideas of Darwin with the ideas of genetics and the mutation of genes to produce neo-Darwinism. Genes provided an answer to the problem of replication. Mutation provided an answer to the problem of the source of new varieties without which natural selection comes to a halt.

A neo-Darwinian view of design change is natural selection plus memes, their competition, their modes of transfer, and their transformation; i.e., memetics.

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22   Ibid., 616.

Towards the Memetics of Design

Dawkins's memes which, in this context, are design ideas that can be replicated do not have to wait very long for replication to take place. They speed up the old genetic form of Darwinian change, but the evolution of design ideas is still Darwinian because ideas about what to strive for are in competition for scarce resources to turn them into manufactured realities. There are no basic principles telling us how one group of designed objects is superseded by another. The process essentially is unpredictable. There is no law of selection "to propel things in the direction of progress." Selection is blind because there is no way of knowing what happens next. Nonetheless, we keep trying. If we stop striving for improvement, we have stopped being human, but we should not be surprised if our efforts sometimes fail. Once this apparently gloomy view is absorbed, it can be put to work.

What might be called "Darwinian design under the influence of natural selection" was first used to make money by the German dyestuffs industry in the nineteenth century. Teams of skilled synthetic organic chemists were employed to make novel, colored chemical compounds. Since there was no way of knowing which of these would make useful dyes, the new compounds were tested in a dye house where most were found to be useless, but some were selected for further chemical modification in the hope of improving them. By 1910, it was calculated that ten thousand new compounds had to be tested to find one new commercial dye, but the profits from the one, successful dye were much greater than the cost of producing the ten thousand.

I find it reasonable to call such a process Darwinian, but Darwinian processes can have very surprising side effects. The demands of the German chemical industry for university trained organic synthesizers to make the new compounds led to the invention of a "junior doctorate"—the Ph.D.—which would take less time to achieve than the traditional higher doctorate, the D.Sc. The Ph.D. spread from Germany to the U.S., and then around the world so that today's potential academics in any subject have to obtain an academic qualification which was invented for the German chemical industry. I do not detect any sign of progress in this particular step in the evolution of education. The "meme" of a Ph.D. has been remarkably successful in propagating itself and, like the peacock's tail, it has prospered because it is "fancied" and not because it is "better."

However, there is a danger in replacing Spencer or Lamarck by memetics, and that is the replacing of one confused way of thinking with another. The achievements of memetics so far have not been impressive. Elsewhere, I have argued that, if memetics is to develop, it needs to do three things. The first is to move away from its concentration on imitation and epidemiology. The second is to realize that thinking of memes as "units" is not helpful. They are "patterns."

The third is to recognize that there are different types of memes with different methods of transmission. These are "recipemes," "selectemes," and "explanemes." [23]

Recipemes are transmittable ideas about how to do things—recipe ideas.

Selectemes are ideas about what sort of thing you want to do. They are involved in making decisions between alternatives. They provide motivation; they are values.

Any designer working for a client has a set of ideas about what the client wants. They also have ideas about the marketplace, about fashion, and about the sorts of designs that their peers approve of. These ideas are not worked out like a physics equation. They form a "pattern" in the mind, what Maria Abu-Risha calls a "pattern of need." I think that this is a pattern of selectemes.

At the same time, designers have other groups of ideas of things that are possible, ideas about how to make things—recipemes. These form a pattern of possibilities which are compared with the pattern of need until there is a "click"—a fit between the selectemes and the recipemes. Maria Abu-Risha calls this click "purposive pattern recognition" (PPR).[24] It is purposive because the designer knows what to do next.

The same concepts of selectemes and recipemes can be used when thinking about how design changes over long time periods. They are not restricted to an account of the here and now of a specific act of designing. In the same way, genes are used to describe what happens at the conception of an individual life, and they also are used to discuss how things change over millions of years. Both genes and memes are evolutionary replicators.

The third type of meme, the "explaneme," must be added because of the human propensity to ask "why?" As long as humans have had a language, they have told stories, and good stories get replicated. If someone discovers a new recipe, people will ask why it works as well as how it works. Explanemes are ideas that provide the basis for answering "why" questions. They range in sophistication from simple stories to complex mathematical concepts, but they have two things in common, they offer an explanation and they need a language to be transmitted. They differ in this from the other memes which sometimes can be transmitted by imitation without formal language.

Explanemes form an essential part of the discussion about Darwinian design change because of the claim that human rationality, science, and mathematical engineering makes modern design change different from the days of craft design when people did not know what they were doing (they still had stories though). An essential part of the claim that design change is Darwinian (and not Lamarckian) is the Dawkins "knockout" that all that rationality counts for little if we do not know what is going to be "better." In fact, our ideas of improvement are themselves subject to Darwinian

23 J. Langrish, "Different Types of Memes: Recipemes, Selectemes, and Explanemes," *Journal of Memetics* 3 (1999). (www.cpm.mmu.ac.uk/jom-emit/ 1999/vol3/langrish_jz.html)

24 Maria Abu-Risha, "Purposive Pattern Recognition," (Ph.D. thesis, De Montfort University, 1999).

change. Selectemes are in competition with other selectemes and, at different times and in different places, some are more successful at being replicated than others.

Returning to Forty

As stated above, Forty rejects both "great men" and evolution as explanations for changes in design. So what does he put in their place? The short answer is "ideas"—but what sort of ideas? Near the start of his book, he claims:

> Every product to be successful, must incorporate the ideas that will make it marketable, and the particular task of design is to bring about the conjunction between such ideas and the available means of production.[25]

Forty, of course, is aware that "the available means of production" are themselves designed and subject to change, but he does not like the idea that technological change "causes" design change. He calls this "the mechanical fallacy." [26]

As an example, Forty shows how the mechanization of sewing in the United States and in Victorian England was followed by a fashion for heavily trimmed dresses (i.e., lots of elaborate extra material sewn on to the basic dress). This additional sewing was achieved at little or no extra cost to the purchaser of the dress because the sewing machine could sew much more cheaply than had previously been the case.

Forty resists the conclusion that the sewing machine "caused" the fashion change by pointing out that sewing machines could have been used to reduce the hours worked by the machine operator or to pay the workers more. He concludes:

> Thus the ultimate cause of the fashion for heavily trimmed dresses was not now the sewing machine itself, but its use within a capitalist system of manufacture.[26]

Now, the concept of an "ultimate cause" is another idea from older theories of change. Darwinian change has few, if any, events that might be labeled "ultimate."

In a Darwinian system, the recipemes (e.g., sewing machine technology) have to FIT into an environment of selectemes which includes ideas of desirability held by those who put up the money for the technology, as well as ideas of desirability held by those who buy the products of the technology.

Forty and I, however, do agree on one thing, and that is the importance of changing ideas. To me, the history of design is the history of ideas—ideas about how to make things which I like to call recipemes, and ideas about what sort of things to make which I like to call selectemes. People make choices between competing ideas, and they sometimes use another kind of idea to justify their choice. Such explanatory justifications are my explanemes. All these

25 Adrian Forty, *Objects of Desire: Design and Society Since 1750,* 9.

26 Ibid., 51.

ideas and their interactions can be said to evolve. These ideas are the memes of design, and I would hope that a modern Darwin would agree that their evolution is a Darwinian process, involving competition for resources to ensure their survival but lacking long-term predictability for two reasons: first, the "rules" of the competition keep changing and, secondly, success in being replicated is subject to chance and whimsy. Spencerian progress is nowhere to be seen, and should be consigned to the waste basket of rejected explanemes.

What We Touch, Touches Us:
Materials, Affects, and Affordances
Tom H. Fisher

Introduction

To elucidate the "fine grain" of consumers' relationships with the material world, this article considers users' perceptions of plastics. For some writers, plastic signifies modern supremacy over nature; and for others, a fugitive and protean postmodernity. However, this article suggests that consumer perceptions of plastics are more physical and affective. While consumers sometimes *do* appreciate plastics' potential for technical mastery, there are very strong indications that this "theoretical" or "cultural" knowledge always is accompanied by knowledge of materials gained through direct physical interaction with them. This direct interaction, in turn, has affective consequences, which may be expressed in terms of a strong liking for or dislike of a material. At the extreme, it may be integrated into an individual's psyche in the form of sexual fetishism.

This article builds on social-historical studies of plastics, and studies in the sociology of technology and in the history of design. It draws on studies of consumption in sociology and anthropology, and on the work of psychologist James Jerome Gibson and others, to integrate these cultural, sensorial, and explorative aspects of our relationship to materials. Such an integrated view sheds light on our relationship to the materiality of new plastic objects, as well as identifying particular elements of our relationship to plastics during the life of objects that are implicated in their disposal.

Used Plastic

If someone who has had a computer for some time looks closely at the keyboard, they will see a craftily shaped collection of plastic components that approximately fit the requirements of their hands as they type. Some of the surfaces on the keyboard will be shinier than are others. Here, where the fingers touch most often, the subtle matte texture designed into the keys wears away, creating another set of surfaces defined by use, not design. This pattern is idiosyncratic—its presence relies on the user's presence, and it reflects the exact ways in which they have used their computer. On a keyboard used to type in English, the "E" key will be shinier than the others. A poor typist, like this writer, will see that the backspace key is shinier than the others, too.

It is perhaps of fleeting interest to remark that these two "conditioning factors," one cultural and one individual, produce patterns of wear on this plastic object. However, coincident with the creation of these wear patterns, another thing happens to computer keyboards as they are used—they collect dirt. The research that is reported here shows that, in combination with patterns of wear, the particular character of this dirt on a plastic surface is likely to be of more than fleeting interest to users, once they notice it.

Over the several years of a computer keyboard's useful life, this buildup of dirt can be quite extreme. It forms dark shadows around the areas that the ends of the typist's fingers have made shiny. In the most frequently used areas, it builds up into ridges that one can feel. It has the vague silver-gray sheen of mud on a winter evening, or the collar of a dirty white shirt. It is not dust—it won't blow or brush away. This dirt is firmly stuck to the plastic surfaces of the keys near to where we touch them. It is embedded in their texture and draws attention to it.

This research suggests that the consequences of reading such indexical signs of use [1] are highly significant to consumers' experience of plastic materials. The research has focused on plastic materials particularly, but the insight it provides may help us to understand the "fine grain" of our relationship to all objects.

Literature and Methods

Although some research in the social study of technology [2] has considered plastics, it has done so as an example of generic processes of technological development rather than to explore their meaning for users. However, its aspiration to account for the network of "actors" that constitute technologies [3] offers useful models for exploring multi-determined phenomena such as attitudes to plastics.

A broad social perspective on the history of plastics is particularly relevant to this subject. Meikle's *American Plastics* [4] is the most notable and compendious of such works. Other recent works on the subject by Clarke, Fenichell, Friedel, Rapping, and Schneider are more limited. [5] Earlier publications by Yarsley and Couzens, as well

1 In the terminology of Peircean semiotics, the pattern of wear and dirt are indexical signs of the use of a keyboard. Charles Sanders Peirce collected papers in Terence Hawkes, *Structuralism and Semiotics* (London: Methuen, 1977), 129.

2 Wiebe B. Bijker, *Of Bicycles, Bakelites, and Bulbs* (London: MIT Press,1995).

3 Michael Callon, "Society in the Making: The Study of Technology as a Tool for Sociological Analysis" in Wiebe B. Bijker, Thomas P. Hughes, and Trevor J. Pinch, eds., *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (London: MIT Press, 1995); and Bruno Latour, "The Berlin Key: Or How to Do Words with Things" in P. M. Graves-Brown, ed., *Matter Materiality and Modern Culture* (London: Routledge 2000), 10–21.

4 Jeffrey L. Meikle, *American Plastic: A Cultural History* (New Brunswick: Rutgers University Press,1995).

5 Alison J. Clarke, *Tupperware: The Promise of Plastic in 1950s America* (Washington, D.C.: Smithsonian Institution Press, 1999); Stephen Fenichell, *Plastic: The Making of a Synthetic Century* (New York: HarperBusiness, 1996); Elaine Rapping, "Tupperware and Women," *Radical America* 14:6 (1980); and Jane Schneider, "In and Out of Polyester," *Anthropology Today* 10:4 (1995): 2–10.

as by "Plastes," are "boosterising" in tone.[6] The former note, and the latter promote, plastics' identity as characteristically modern materials.

Over the last fifteen years, some writers have taken recent formulations and uses of plastic to be symptomatic of postmodern times. This literature takes its cue from the work of Jean Baudrillard, especially his *System of Objects*, and the work of postmodern philosophers such as Jean-Francois Lyotard.[7] Here the key authors are Ezio Manzini and Penny Sparke, although Meikle also reviews the relationship between these ideas and the recent history of plastics.[8]

Neither of these bodies of literature takes more than a glance at the object of study of this research because it is not possible to engage with the fine grain of users' relationships to materials using historical sources, or from reading meaning in objects. Some work in material culture studies does connect with the motives of this research, seeking to describe consumers' relationships to materials. Gay Hawkins uses plastic bags as a metaphoric marker in her discussion of the ethics of recycling and composting, and Gavin Lucas takes an archaeological approach to waste more generally in his discussion of the cultural categories that have determined our attitudes to the disposal of objects.[9]

Consumers' perceptions of and attitudes to materials are the subject of extensive commercial research, but only tantalizing glimpses of this are available in the public domain. An example is Noreaux's description of aspects of the research that the Peugeot company has carried out into the response of users to different materials, particularly plastics, in the context of cars.[10] The work on which this article is based has sought to some extent to recreate the spirit of this commercial research work using methods that allow access to consumers' attitudes. These included a Kelly's grid exercise, semi-structured interviews with twenty-one British consumers using a vignette technique and object prompts, and an e-mail survey of a globally distributed group of specialist users of plastics. It also involved observation and introspective reflection on the part of the author, such as that which starts this article.

Data

The data demonstrates that, in their evaluation of materials, British consumers are significantly influenced by the folk knowledge that exists about the plastics from which the accoutrements of contemporary life are frequently made. Some of the ideas about plastics that the participants expressed mirrored the ideas about plastics that have developed in Western culture in the process of their becoming ubiquitous, and which appear in the literature. However, the participants drew on another, experience-based "stratum" of knowledge, which also appears to some extent to generate folk knowledge about plastics.

6   V. E. Yarsley and E. G. Couzens, *Plastics* (Harmondsworth: Penguin Books, 1942) and "Plastes," *Plastics in Industry* (London: Chapman Hall, 1941).

7   Jean-Francois Lyotard, *The Postmodern Condition* (Manchester: MUP, 1984).

8   Ezio Manzini, "And of Plastics," *Domus* 666 (November 1985); Ezio Manzini, *The Material of Invention* (London: Design Council, 1989); and Ezio Manzini, "Objects and Their Skin" in Penny Sparke, ed., *The Plastics Age, from Modernity to Postmodernity* (London: Victoria and Albert Museum, 1990).

9   Gavin Lucas, "Disposability and Dispossession in the Twentieth Century," *Journal of Material Culture* 7:1 (2002): 5–22; and Gay Hawkins, "Plastic Bags: Living with Rubbish," *International Journal of Cultural Studies* 4:1 (2001): 5–23.

10 Jean-Emmanuel Noreaux and Sylvain Jeannin, "Sensory Aspects of Plastic Materials," *Proceedings of the Society of Plastics Engineers ANTEC Conference, San Francisco California* 3 (2002): 3682–3686; Society for the Plastics Industry, "Nonreturnables Face Legislative Ban in Madison, Wisconsin," *Plastics and the Environment* (April 3, 1970): 2–4; and Hagley Archive, accession 1929, Box 19. See also: MORI, The Reputation of the Plastics Industry in Great Britain Research Study conducted for the British Plastics Federation (London: MORI, 1983).

At the outset, it seemed that the distinctive contribution of this work would be to systematically review the discourses that have grown up around plastics, and to note how contemporary consumers deploy them in particular circumstances. Indeed, this has been one of the outcomes of the research. It is possible to identify moments when the participants employ three discursive "clusters" which refer to modernity/progress, authenticity/imitation, and health/hygiene. The subjects use these cultural concepts—these ideas about plastics—in combination with other more generalized concepts, which derive from taste formations and ideas about the characteristics of the different stages of life.

Taste

Here, for example, one of the participants in a group interview, a twenty-year-old female, speaks about when and where it would be appropriate to use plastic cutlery:

> ...people don't tend to want to eat off plastic too much cos it, it's got the feeling like (some people think) you might... feels a bit tacky or something, or just not designed for that sort of purpose cos it's not usually used, plastic....

She uses "tacky" to denote the transgression of taste standards implied by using a plastic object in that situation. Her use of this word is very significant for the discussion that follows, since it points from the cultural to another, physical, "stratum" of knowledge.

While this participant apparently used "tacky" to indicate "in bad taste," other participants used the same word to indicate the inadequacy of the mechanical qualities of the objects they discussed, physically manipulating them as they spoke. They interacted with them sensually, they touched them and explored them with their fingers, and they made reference to their characteristic sounds and smells.

The Senses

The usage of the word "tacky"[11] allows us to explore this sensorial dimension to judgments of instrumental fitness. A literal—physical—meaning of "tacky" is "sticky"—a surface coated with something to which other things will stick. If the surface is deliberately coated, say, with glue, the tackiness is useful and presumably welcome. Speaking about plastics, these interviewees used "tacky" exclusively as a negative term.

This negativity is telling. Physical tackiness is likely to be unwelcome and to elicit disgust in a civilized individual—a negative affect. The power to elicit disgust is common to a large number of different stimuli, many of which have in common the power to remind us of our animal nature, or of our "mushy insides" as Paul Rozin puts it.[12] Stickiness caused by sweat, blood, and other body fluids is a clear example of a potential disgust elicitor of this sort.

11 The etymology of "tacky" is quite complex. Collins (1979) suggests four definitions for "tacky" from two different roots:
1. A state of varnish and paint between wet and dry, which derives from "tack" to denote the property of stickiness in the same circumstances.
2. Shabby or shoddy
3. Ostentatious and vulgar
4. Eccentric or crazy (of a person).
Senses 2–4 derive from C19 dialect for an inferior horse. Senses 1–3 are applicable in the interviewees' use of the word.

12 Paul Rozin, "Food Is Fundamental, Fun, Frightening, and Far-Reaching," *Social Research* 66:1 (1999): 9–30.

In many formulations and uses, plastics seem to remind us of this bodily tackiness. The interviewees mentioned a characteristically "sticky" quality of plastics in objects as diverse as a synthetic teddy bear and plastic tool handles. Plastics seem to have a built-in potential to be associated with physically tacky experiences, and our experiences with this potential appears to mean that we associate plastics with a negative, possibly disgusting, sensorial experience which is invoked in the use of "tacky" in all its senses; cultural, structural, and sensorial.

This discussion is not just word play because this usage indicates the complexity of consumers' relationships to materials, and to the objects they comprise. Cultural and sensorial elements mix in this relationship. The interviews and other data contain many instances where cultural and sensorial aspects of plastics coexist.

Gibsonian Affordances—Exploration
J. J. Gibson's concept of the "affordance" offers a framework through which we can understand how these different registers of meaning can coexist in our perception of objects and their materials.[13] Gibson suggests that we do not perceive the function of things in the abstract by itemizing their particular qualities, but we perceive their "affordance"—what they particularly allow us to do. His idea is powerful for a number of reasons, not the least of which is because it is fundamentally *relational,* and therefore it helps to resolve the tension between the cultural and the physical in our interaction with objects.[14]

What a thing means to a user, and what it is useful for, is simultaneously a consequence of the expectations the user brings to the interaction with the thing and its objective, "invariant" properties. As Gibson puts it, an affordance cuts across the objective/subjective dichotomy. It is:

> ...not what we call a "subjective" quality of a thing. But neither is it what we call an "objective" property of a thing if, by that, we mean that a physical object has no reference to an animal.[15]

Although Gibson illustrates his ideas by references to our interactions with the given physical environment, the invariant qualities of man-made objects also constitute affordances. Therefore, his model also applies to manufactured artifacts.

Gibson is explicit about the need to see our world as a whole and to avoid false distinctions between the natural and the man-made:

> It is a mistake to separate the natural from the artificial [...] artifacts have to be manufactured from natural substances. It is also a mistake to separate the cultural environment from the natural environment, as if there were a world of

13   The same concept is used by Donald Norman in his *Psychology of Everyday Things* New York: Basic Books, 1988), although there it helps him to demonstrate users' relationship to aspects of products over which designers can exercise control. The instances of consumers perceiving the affordances of materials discussed here are beyond the control of designers.

14   James Jerome Gibson, "The Theory of Affordances" in Robert Shaw and John Bransford, eds., *Perceiving, Acting, and Knowing: Towards an Ecological Psychology* (London: John Wiley, 1977).

15   Gibson, 69–70.

mental products distinct from the world of material products. There is only one world, however diverse, and all animals live in it, although we human animals have altered it to suit ourselves.[16]

Costall elaborates on Gibson's point, stressing that this "humanized nature" includes artifacts, and that the world we inhabit is "already 'transformed by the activity of generations.'"

Gibson also makes it clear that we "were created by the world we live in"[17] and suggests that the mechanism by which this "creation" of ourselves takes place is the *sensual exploration* of the physical world that he sees as the basis of all human perception. He emphasizes that the act of perception is active and embodied, and that it positions the perceiver such that knowledge of the world is knowledge of the self. As he puts it:

...perception of the environment is inseparable from proprioception of one's own body—[...] egoreception and extoreception are reciprocal.[18]

This implies that we learn about ourselves through exploring the humanized nature that we inhabit, as well as learning about the affordances in our world through this "perceptual learning." What we can be is the result of our reciprocal relationship with our world.

This study contains striking evidence for the sensorial exploration of plastic materials early in life. A young woman spoke about her early exploration of, and fascination with, the expanded polystyrene packaging that she explored using her mouth. Asked what this was like, she itemized the qualities she discovered. It was:

Weird. Not—not that nice, you know, like I say it's that kind of squeakiness that it's got in your hand, but against your teeth it's not quite so nice, really. It sort of did make my teeth feel a bit funny....

From a Gibsonian perspective, this sort of physical exploration early in life furnishes us with our repertoire for understanding the physical qualities of objects and their materials. The interviewees demonstrated that this sensorial exploration of the material environment continues into adult life—they actively explored the objects they were given as prompts by tapping them and scraping their fingernails against them.

Because of the economic importance of innovation to capitalism, design continually presents us with new materials in new circumstances. It follows that we must explore the affordances of these materials if we are to make use of them, to understand them, and to fit them into our existing scheme. Contrary to the impression that Manzini gives, and which from the perspective of design it is

16   Gibson cited in Alan Costall, "Socializing Affordances," *Theory & Psychology,* 5: 4 (1995): 471.

17   Gibson, 71.

18   Gibson, 79.

tempting to believe, affordances cannot simply be "built into" or "read out of" artifacts, but are discovered by users through interaction with them.

As adults, we may do this in a different register of intensity—more discreetly, perhaps stroking and touching objects rather than mouthing them as we did as infants. Or we may do it more often in combination with explicit rationalization. As Heft puts it, analyzing Gibson's ideas in the light of Merleau Ponty's *Phenomenology of Perception,* as adults we explore the world with "cultured bodies" with which we play out en-cultured intentions.[19]

The group of "specialist" users of plastic referred to at the start of this article are individuals who get a sexual charge from plastic mackintoshes—in other words fetishists. They provided some specific and detailed descriptions of the physical properties of plastics as well as some insights into the relevance of these properties for their special interest. Although their perspective on plastics made their testimony appear rather different from that provided by the interviewees, Gibson's ideas about the sensual exploration of the physical world helps in its interpretation.

Although fetishists appreciate plastic surfaces in a non-mainstream context, they still do so through the exploration of the affordances of the materials, and since the "invariant" properties of the materials are identical in both settings, the physical characteristics that the fetishists describe may be relevant to the character of plastics in mainstream consumption.

Reviewing Gibson's work to bring out its social dimension, Alan Costall suggests that objects are "a 'crystallization' of human activities." They...

> invite and constrain us to use them in certain ways, even
> if this use does not correspond to their intended function.
> The affordances of artifacts are [...] a focus of enduring, and
> cumulative, social influence.[20]

Referring also to Gibson's assertion that "... affordances do not cause behavior, but constrain or control it,"[21] Costall stresses that the origin of an affordance therefore may be any salient aspect of the social situation in which an individual develops. So the affordance of an artifact—or material—means we use it to suit our physical and *psychic* needs, both because of its physical properties and because of the "heritage" that is associated with it. That heritage may be defined by a psychosocial entity such as plastic mackintosh fetishists, or by a geographical/cultural grouping—such as "Western consumers" or "UK teenagers."

Fetishists' Perception of Plastic's Objective Properties
The differences between fetishistic and everyday practices with plastics, therefore, is not a barrier to using the testimony of fetishists to contribute to our understanding of how plastics "work"

19 Harry Heft, "Affordances and the Body: An Intentional Analysis of Gibson's Ecological Approach to Visual Perception," *Journal for the Theory of Social Behaviour* 19:1 (1989): 1–29.
20 Costall, 471.
21 Gibson in Costall, 411.

in everyday consumption. It matters not that a fetishist's *use* of plastics is unusual. Because of the similarities in *structure* between the affordance of sexual gratification and plastic's more quotidian affordances, it is possible to use the fetishists' testimony about the qualities of plastics that are relevant to them to inform our understanding of the materials in mainstream settings.

For example, the fetishists used a particularly telling group of words to describe the surface quality of PVC.[22] Along with *"glossy,"* they used *"oily," "fatty," "buttery-smooth," "slick,"* and *"sticky."* All of these relate to bodily experiences with the material—they have a sensual dimension. "Sticky" describes the sensation of touching a very shiny, but quite soft and flexible, surface such as that of PVC. Shiny PVC fabric also does not slide across itself; it "sticks" to itself and it has a physically "tacky"quality under the fingers. To call a surface "oily," "buttery," and "fatty" relates it to a class of substances that have in common a sort of oozing stickiness, an unstable, indeterminate quality. Jean-Paul Sartre uses this type of substance to illustrate his discussion of the phenomenon of viscosity that he calls "the slimy."[23]

It was clear that, for some, the most enjoyable quality of plastic film when wearing it is precisely the sweaty stickiness that results from its imperviousness. One respondent said that he

> ...liked the heat, and if the garment doesn't admit much fresh air, liked the moisture and seeing them steam up.

Sweat and Stickiness: To a Sense of Dubious Margins

It is common to dislike the sweat that some plastics make evident and, by association, to dislike the plastic. However, as William Miller notes,[24] of all the oozing body substances, sweat is relatively low in the scale of disgust. So it is quite easy to imagine that with quite a small force of sexual gravity, disgust with sweat and the sticky, "tacky" plastics that produces it becomes delight.

In both the fetishistic and mainstream settings, the impermeability of plastics makes us aware of the margins of our bodies.[25] It destabilizes our sense of those margins with affective consequences, positive in one setting and negative in the other. There is something unstable and destabilizing about this tackiness which demonstrates to us an uncomfortable ambiguity in the margin between our body surface and the outside world by making us produce disorderly sweat.

This characteristically *plastic-y* stickiness is enjoyed by a fetishist, or dreaded by someone for whom cleanliness/hygiene is emotionally charged. In a design context, this "making an issue of our margins" can be positive—"high-touch" plastics for control surfaces; negative—sticky "tackiness"; or ironic—the gratuitous use of rubber in fashion. But all rely on the same objective properties of the materials.

22 The fetishist participants were referring to PVC as used in plastic mackintoshes, in which a quite soft formulation of the polymer tends to be given a high gloss.

23 John-Paul Sartre, *Being and Nothingness: An Essay on Phenomenological Ontology* (London: Methuen,1957), 1943.

24 William I. Miller, *The Anatomy of Disgust* (Cambridge, MA: Harvard University Press, 1997), 88.

25 In Gibson's terminology, this is an "invariant" in our environment.

An awareness of the margins of plastic materials themselves, as well as of our bodies, is evident in other interactions with plastic objects. Discussing food containers, one of the interview participants said that she would not use a "Tupperware" box to carry sandwiches without wrapping the sandwiches first, suggesting that:

the plastic would affect the taste of the sandwich for me.

For her, the surfaces of the box itself seemed to have ambiguous margins. Although it would be physically feasible to put sandwiches directly into the box, for her this would transgress the right ordering of materials in such a context. She implies there is something disorderly about the polyethylene of Tupperware when it comes into contact with food—some unknown component of the plastic could get into the sandwiches. This, by Mary Douglas's definition of dirt as "matter out of place," makes Tupperware unhygienic.[26]

The smell of plastic also can be an index of its disorderly margins. This was a positive feature for the plastic mackintosh fetishists who clearly enjoyed the chemical smell of new plastics. On the other hand, plastic-related smells seemed to denote the possibility of contamination for some of the interview participants. As one of them put it:

I think Tupperware tends to be a bit smelly. [...] I think it retains its smell after you take the stuff out.

Here, smell indicates the instability of the surface. That the surface would absorb smells was reason enough for this individual to avoid using it, smell serving as evidence of its ambiguity and its consequent untrustworthiness. Rozin and Nemeroff's work on fear of contagion reinforces the idea that smell is significant to consumers' relationship to the materials.[27] In their work on the natural magic principle of contagion-by-essences, they suggest that:

... odor [is] a special case of essence.... [It] shares many properties with essence and may be, at some level in development or cultural evolution, the origin of ideas of contagion.[28]

More often, however, consumers detect that a plastic object is potentially contaminating through visible evidence—it ceases to be pristine. A comment by another of the interview participants implies that the effect of substances on plastics as they depart from their pristine new state indicates their microscopic structure:

When you store things [...] in plastic containers sometimes, in the fridge, [...] plastic takes the color. You know, if you store something like tomatoes in a plastic container, you often see, particularly tomato soup, that's an awful thing.

26 Mary Douglas, *Purity and Danger: An Analysis of the Concepts of Pollution and Taboo* (London: Routledge, 1966).

27 Paul Rozin and Carol Nemeroff, "The Borders of the Self: Contamination Sensitivity and Potency of the Body Apertures and Other Body Parts," *Journal of Research in Personality* 29 (1995): 318–340. They note that we are particularly sensitive to the possibility of contagion via our bodily orifices, including the nose.

28 Paul Rozin and Carol Nemeroff, "The Laws of Sympathetic Magic: A Psychological Analysis of Similarity and Contagion" in J. W. Stigler, *Cultural Psychology* (Cambridge: CUP, 1990).

This participant learned that plastic surfaces can absorb "foreign" matter because dirt stains them and sticks to their textures—it can't be cleaned. The fact that the superb even surfaces of new plastic objects become visually tacky appears to coincide with them being potentially disgusting, which may lead to them being disposed of.

The Disposal of Degraded Plastic Objects
Although it is clear from this research that no-longer-pristine plastic objects can appear contaminating, further work would be needed to find out how this works in a range of situations. This study implies that this potential for contamination can relate to the human body and our sense of its margins, or to the chemical nature of the material. "Something" can leach out of the plastic, which is perhaps betrayed by the characteristic plastic smell that the interviewees reported.[29]

An obvious consequence of a negative reaction to plastic objects that are read as potentially contaminating is that they are reclassified as waste. This research has not concentrated on the moment of reclassification, but because others' feelings in principle are inaccessible to direct enquiry, introspection has been used to explore the disgust reaction mentioned above. This elucidated the relationship of the disgust emotion to properties of materials once they are reclassified as rubbish.[30]

This introspectively generated data compared the experience of wooden detritus and scraps of plastic materials found on a British beach. The remarkable qualities of the latter were starkly presented because they were not part of undifferentiated "waste," but were seen in isolation on the beach, in "nature":

> ...a pink bottle that perhaps once contained something for the bathroom, shampoo perhaps, is split along one edge and gapes and oozes at me when I squeeze it with my foot. I leave it where it is. [...] a piece of opaque white material that must have once been a container [...] is so battered it is no longer possible to tell what shape it originally was, or what it was for. It is reduced to a piece of almost nothing, folded in on itself, frayed along the edges, slightly yellowed. It is a piece of material, no longer an object ... it is disgusting.

Summary and Conclusions
This research has shown that materials in themselves are significant for consumers' reception of objects, and can be the focus of quite strong feelings.[31] Consumers relate particular ideas to plastics, which are implicated in their attitudes toward plastic objects. Factors that determine attitudes toward plastics appear to include the culturally derived ideas that a consumer brings to an encounter with a material, as well as the material's objective properties. The apparent opposition between these types of factors can be resolved using a

29 The long-standing debate about the safety of the plasticizers that leach out of PVC is evidence of concern about such contamination.

30 Lucas 2002 explores the categorization of objects in the process of disposal. He discusses the history of the idea of disposability and its interaction with concepts of hygiene and the design, and the use of spaces within the home from the perspective of archaeology.

31 The stress in this paper on plastics' potential as an elicitor of disgust than of other emotions is likely due to two factors. Disgust is particularly visible in the attenuated communication of an interview. Also, the interviews concentrated on the use of goods use after acquisition, and not on the moments up to their acquisition.

framework from Gibsonian ecological psychology. This suggests that it is the *relationship* between these factors that is made through an individual's exploration of the material world that determines what a particular object *is* in a particular situation for that individual—whether it "works" or not.

Considering degraded plastic objects helps us see beyond the peerless plastic surfaces of new and fashionable goods. Degraded objects demonstrate that to say that plastics are evaluated positively as the vehicles for the fulfillment of consumerist desire; or negatively, when they become waste, or as an aesthetic affront when we "wouldn't be seen dead" with them are over-simplifications. Similarly, instead of the wipe clean utopia of the modernists, or the postmodernists' dematerialized paraworld of Baudrillardian "atmospheres," consumers apparently perceive a dubious side to plastics as often as its peerless, glorious novelty. This dubious nature is evident in the disgust for degraded, evidently used, worn, no longer pristine plastic items that may invite their disposal. Plastic objects that start their lives delighting us begin, after a short time, to disgust us. With the passage of more time, a moment arrives when we must void such objects from our "spatial body."

Particular "invariant" properties of plastics seem to be significant in reactions to them. Plastics have a "fleshy" quality, shared by no other material—they can be "skin-like," and because of their mode of production they often are seamless. They are warm to the touch and "trauma" to their surfaces is evident, but irrevocable. Their objective properties help us to conquer some aspects of our human nature, and to defend ourselves from external nature. Plastics are part of a "humanized" nature with which consumers are familiar through constant sensual exploration of objects.

Plastics cease to be pristine, and become evidently worn, in a particular way. They do not patinate; they gather dirt rather than "charm," and then may elicit particularly strong feelings of disgust. When they are no longer an acceptable element in humanized nature, they perhaps are doubly *un*natural. They are not trustworthy because they seem to make an issue of the margins of our bodies, and the manner of their ageing draws our attention to their margins.

Whether as a result of this or not, consumers seem particularly sensitive to the characteristics of plastics' surfaces and to know that, while they generally are impermeable, their surface often is porous. Plastics, therefore, may be physically "tacky"—and engender fear they will pollute with invisible chemical components and absorb disorderly matter. This pollution seems to operate according to the principles of contagion and essence found in natural magic, principles that also allow plastics to be a vector for social or moral contagion.

As a result, moments when plastics elicit, or afford, disgust are also telling of their social significance, since this emotion marks both physical and social barriers. We generally wish to preserve our

physical selves from threats to our margins from foul substances and smells, and to preserve our sense of the integrity of the margins of our skin by avoiding the "slimy" substances that challenge it. Our knowledge of plastics' objective properties seems to contribute to negative feelings about them of this sort. The nature of the disgust emotion means that we locate ourselves socially and culturally through the taste judgments that it polices.

Our exploration of the affordances of the material world resolves the objective and cultural aspects of our relationship to materials. When these two dimensions cease to be adequately resolved, this is evident in disgust reactions. These disgust reactions, in turn, point up this mechanism of resolution, by which in normal use plastics provide us with useful and acceptable affordances.

A View from the Margin: Interior Design
Lucinda Kaukas Havenhand

1   It is important to note here that the same stereotypes assigned to women as interior designers are equally inscribed in stereotypes of gay men. The elision of the feminine, decoration, the interior, and the inferior was put firmly in place in the early modern movement not only by the anti-decorative invectives of Adolf Loos and Le Corbusier, but by a large societal discussion and concern about the issue referred to as "degeneration." At the turn of the century, legitimate scholars as well as pseudo-scientists from all fields theorized that the new conditions of modernity indicated that society was devolving or degenerating. The reason for this degeneration generally was recognized as the "feminization" of culture. In degeneration theory, the feminine represented the primitive, base, and erotic urges of society that had to be suppressed in order for society to evolve and progress rationally. All indications of the feminine, therefore, were perceived as inferior. The perception that gay men are "feminized" men links them automatically with the same inferiority assigned to both women and decoration. Like stereotypes of women and decoration, the stereotype of the gay man as decorator still is strongly inscribed in the public's perception and equally as undeconstructed. Since this article speaks mainly from my personal viewpoint and experiences as a woman, it will not deal specifically with issues of this stereotype, although it is equally important and relevant to this discussion. (See my article "Decoration as Modernism's Other: (Re)Reading the Texts of Early Modern Architecture and Design" in *Cultural and Artistic Upheavals in Modern Europe: 1848–1945* (Cummer Studies, Vol. 1, 1996) for a more complete discussion of the origins of these stereotypes).

About ten years ago, after nearly a decade of practice as an interior designer, I returned to school to work on a Ph.D. in interdisciplinary humanities. In my first semester, I was, perhaps, a bit over zealous and enrolled in a philosophy course whose subject was Hegel, Marx, and Nietzsche. I was intellectually rusty after being away from school for so long, and this class was very difficult. New jargon and concepts had sprung up since my last academic experience, and I found that I was hanging on the professor's every word just so I could understand. But I studied hard, read diligently, and I was doing well. I was required to do a presentation in class, so I met with the professor just to be sure I was on the right track. In that meeting, we quickly got into an extremely stimulating discussion of Nietzsche's critique of metaphysics, which was my topic. It was one of those animated discussions that every grad student and professor long for. I was elated that I was able to hold my own in the discussion, and perhaps because I could, the instructor paused in our conversation to ask about my background. In my description of myself, I mentioned that I was an interior designer and from that moment everything changed. My professor abruptly ended our previous conversation, and started asking for my advice about decorating her living room. Although I tried to get the conversation back on its previous track, I could not. Somewhat discouraged, I decided to leave and our interview ended, not with closing remarks on Nietzsche or my presentation, but with my professor commenting: "I have always admired you girls like my mother and sister who have the knack for picking colors." [1]

Considering my instructor was both a woman and a feminist, I was incredulous that this conversation had taken such a turn. I had encountered many people in the past with preconceived ideas about me because of my identity as an interior designer, but I had never seen it shift so remarkably right in front of my eyes. The ability of the label "interior designer" to do that indicated to me that something very powerful was in play. The fact that my professor, who seemingly was sensitive to issues of sexism, could not recognize the same embedded in her own statement made me realize just how strong and obscured this power was.

As a graduate student and later as a professor teaching interior design, I have long attempted to understand this phenomenon. From an investigation that is situated in both my personal experience

as well as my academic research, it is clear to me that the mechanisms of the power of this label are part of a larger discourse that assigns both interior design and the feminine the position of "other." Interior design is perceived as feminine, superficial, and mimetic as compared to a male, rational, and original architecture. Although the subtext is not said out loud, it still is clear: interior design is inferior to architecture. In spite of the many postmodern/poststructuralist reassessments during the past thirty years, the duality that places architecture as the dominant term in a binary opposition with interior design remains largely undeconstructed.

While "otherness," marginality, and femininity have formed the central focus of many recent critiques, the field of interior design has neither fully recognized nor examined its marginal position. This is not to say that it is not aware of it. Interior designers do understand that they have a problematic and often misunderstood identity, although they have worked diligently over the past fifty years to identity and legitimize their field. In the 1930s and '40s, these activities were centered on differentiating interior design from interior decoration through the creation of educational programs and criteria for competency and knowledge. Later, professional organizations such as the American Society of Interior Designers (ASID), the Foundation for Interior Design Education and Research (FIDER), and the National Council for Interior Design Qualification (NCIDQ) were formed to oversee the development and maintenance of these criteria both in education and practice. These groups crafted legal definitions of interior design and constructed a unified body of knowledge that included its own history and theory. A professional internship program (IDEP) was put in place in 1993, and an ongoing effort to create licensing and titling acts that identify qualified interior designers to the public continues.

While these efforts helped to legitimize interior design as an academic and professional discipline, they have done little to dislodge its supplemental position to architecture. In spite of its many efforts to clarify its definition, the public perception of interior design still remains largely askew. Television shows such as *Designing Women, Will and Grace,* and now *While You Were Out, Trading Places* and HGTV perpetuate the image of a feminized, self-expressive, decorative, and superficial kind of interior design, while the myth of a heroic male architecture, as presented in Ayn Rand's *Fountainhead*, is continually reinforced in movies and even TV shows such as *Seinfeld*.[2] The boundary between architecture and interior design remains in place, held there by a persistent idea of difference between the two fields: male vs. female, structure vs. decoration, and superior vs. inferior. Ironically, at a time when interior design has become more like architecture because of its consistent emulation of its practice and education, the field of architecture seems even more intent on keeping this idea of difference in place. Lobbying efforts by the American Institute of Architects and the National Council of

2   I refer here to the episodes in which the character George refers to himself as an architect to impress women.

Architectural Registration Board to prevent further interior design licensing and titling acts, regardless of what it also may be, serve this purpose. In addition, interior design's efforts to establish and legitimize itself seem to have done little to promote dialogue and exchange between the two fields. An atmosphere of opposition and exclusion exists, particularly in academia. In a recent call for papers by the Association of Collegiate Schools of Architecture, for example, participants from other disciplines were encouraged to submit for their annual conference entitled *Re-calibrating Centers and Margins.* Urban planning, real estate development, the fine arts, and industrial design were listed as related fields and topics. Interior design was not mentioned. The "other" was not invited to participate.

This essay suggests that it is interior design's strategies for legitimacy that have contributed to this marginalization, and prevent it from understanding and establishing a distinct, nonsupplemental identity. In efforts made to define, establish, and recognize the field of interior design, little mention has been made of the issue of gender. Whereas other fields such as home economics and nursing have dealt head on with the inherent gender biases of their professions, interior design has not. The gender implications attached to interior design, which in turn are largely responsible for its inherent assignations of inferiority, have been treated like "the crazy aunt in the attic" and have been purposely overlooked. By ignoring this important aspect of its perceived identity, interior design has not been able to acquire the proper self-consciousness needed to solve its identity problem. As its recent history demonstrates, efforts to control its own identification by creating definitions, bodies of knowledge, and professional rules and organizations do little to counteract interior design's perceived inferiority to architecture. This will not take place until the issues of gender and marginality are recognized, considered, and deconstructed. The link between interior design and the feminine has to be acknowledged.

In a new strategy for interior design that considers its assignation as feminine, the history and theories of feminism could become particularly useful. From this viewpoint, it is easy to see that interior design's current theoretical approach to identity politics can be recognized as echoing the strategies of first-wave feminism. In their fight to attain equality and suffrage, early feminists questioned the idea of difference as a constructor of inequality between men and women. Since, at the time, difference was being used to legitimize the unequal treatment of women, they attempted to repudiate it so that women could assume their rightful place in society. Demonstrating how women were equal to men and could do similar work was a large part of early feminist practice. Inherent in this strategy was an underlying assertion of androgyny; a push not just to ignore gender, but also to absent it from discussions of equality.

Making the case that interior design is equal to architecture has been a large part of its legitimization strategy. Interior design, in both education and practice, has emulated architecture as the basis for its studio education, qualifying exams, and internship programs. Architectural history and theory have been integrated as part of its own. Demonstrating how interior design education is comparable to architectural education also has been part of its licensing and titling efforts. Buie Harwood, a leader in interior design education, for example, outlined in her 1991 article, "Comparing Standards in Interior Design and Architecture to Assess Similarities and Differences" in the *Journal of Interior Design* how interior design's education and practice parallels that of architecture. Using a chart that compares the different aspects of each, she argues point by point how interior design and architectural education are similar.

Like the early feminist stances, these kinds of arguments also assume a kind of androgyny. Gender is purposely not discussed. While demonstrating that interior design education and practice have appropriate rigor, they make little headway in undermining its supplemental position, since they do not break the elision of the feminine and interior design.

In feminism, critics of the strategies of the first wave were able to identify the inherent weakness in these kinds of strategies. These feminists recognized that, in trying to assert that women were "as good as" men, they were only asking to be continually compared to them. In a critique that perhaps began with Simone de Beauvoir, the idea of attaining equality for women by emulating the characteristics of male privilege was reconsidered. Feminists recognized that assuming an androgynous position was difficult in a system that was controlled by patriarchal ideology. Since such a system privileged male superiority as the normative condition, not discussing issues of gender only silently acknowledged the norm as the ideal. The feminine within this system still is assumed to be inferior. As the theorist, Madan Sarup points out, "The feminine always finds itself defined as deficiency, imitation, or lack" in Western culture.[3] Feminists have concluded that redefining the feminine within this patriarchal system is problematic since, as the feminist poet Audre Lourde stated so succinctly, "The master's tools will never dismantle the master's house."[4]

Therefore, as long as interior design tries to gain legitimacy by comparing itself to and emulating architecture, it inadvertently supports the system that ensures its supplemental position. This strategy not only acknowledges the superiority of architecture and its position as the norm, but dooms interior design to always being less than, and not equal to, architecture. The tendency for academic programs and professionals in interior design to call what they do "interior architecture" is a popular strategy for trying to correct the inherent perceived inferiority of interior design. But this method supports the system that created the problem, and does little to

3   Madan Sarup, *An Introductory Guide to Post-Structuralism and Postmodernism* (Athens, GA: University of Georgia Press, 1993), 119.

4   Audre Lorde, "The Master's Tools Will Never Dismantle the Master's House," *Audre Lorde Compendium* (London: Pandora Press, 1993).

dislodge the connection of the interior with the supplemental. Renaming interior design interior architecture becomes a futile game of "passing." This strategy, like that of the early feminists, also assumes a kind of androgyny, and therefore the inherent link between the feminine and interior design remains unbroken and continues to be confined to its supplemental position. In most cases, interior design seems neither to be aware of nor moving in a direction to correct this quandary.

Feminists, however, have given the matter greater consideration. A second wave of feminism since the 1970s has proposed the idea of celebrating difference instead of trying to eliminate it as a solution for legitimization. Christine DiStefano, a feminist scholar who refers to this tendency as "antirationalism" explains:

> Antirationalism comes face to face with the denigration of feminized nature within rationalism, and attempts to revalorize the feminine in the light of this denigration. Significantly, the terms of this valorization are the terms of the excluded and denigrated "other." Antirationalism celebrates the designated and feminized irrational, involving a strong notion of difference against gender-neutral pretensions of a rationalist culture that opposes itself to nature, the body, natural contingency, and intuition. This project sees itself as a disloyal opposition, and envisions a social order that would better accommodate women in their feminized difference rather than as imperfect copies of the everyman.[5]

Feminists supporting this position argue that, since the definition of the feminine has been controlled by a male patriarchal system, there has been a distortion and devaluation of feminine characteristics. They call for a reconsideration of the so-called "natural" inferiority of these. This second wave of feminism discards the pursuit of androgyny and the reduction of gender difference, and advocates for both identification and celebration of female characteristics. Although this position has raised the criticism of being "essentialist" (assuming all women are the same, and that a general category called "woman" is definable),[6] it provides a provocative starting point for new theories of gender and marginalization; a starting point that could be both interesting and useful for interior design.

As part of this reconsideration of the feminine, Donna Haraway and others have contributed to the development of a concept called "feminist standpoint theory." In standpoint theory, the gendered nature of the construction of knowledge is recognized, but the assignation of inferior attributes with the feminine is reversed. Feminine knowledge and characteristics are valorized, not as a mere inversion of the binary opposition, but as a starting point for a new understanding of knowledge. Haraway, a scientist, has suggested that:

5 Christine di Stefano, "Dilemmas of Difference: Feminism, Modernity, and Postmodernism" in *Feminism and Postmodernism* (London: Routledge, 1990), 67.

6 See Linda Allcoff, "Cultural Feminism Versus Post-Structuralism: The Idenitty Crisis in Feminist Theory," *Signs: Journal of Women in Culture and Society* 13:3 (1988) for a good discussion of this issue.

The gender-specific and differentiated perspective of women is advanced as a preferable grounding place for inquiry—preferable because the experience and perspective of women as the excluded and exploited other is judged to be more inclusive and critically coherent.[7]

Haraway suggests that women, because of their marginality, have a kind of epistemic privilege. She continues:

The standpoints of the subjugated are not "innocent" positions. On the contrary, they are preferred because, in principle, they are least likely to allow denial of the critical and interpretive core of all knowledge ... "subjugated" standpoints are preferred because they seem to promise more adequate, sustained, objective, transforming accounts of the world.[8]

Haraway also advocates that these marginal viewpoints could be particularly valuable in today's society:

We are also bound to seek perspective from those points of view ... that promise something quite extraordinary, that is, knowledge potent for constructing worlds less organized by axes of domination.[9]

The potential of this special viewpoint of the marginalized is a topic that frequently has been discussed in recent contemporary theory. The feminist bell hooks, for example, has recognized the position of marginality as the "space of radical openness" and "a site of creativity and power," as well as a "site of resistance" in her writings.[10] The filmmaker Trin T. Minh-ha refers to the position of the margin as "our sites of survival" that "become our fighting grounds." [11] Mary McLeod, an architectural critic, points out in her article, "Everyday and 'Other' Spaces" that the field of architecture has readily acknowledged this special position of marginality. She says that one of the primary preoccupations of contemporary architectural theory has been the concept of "otherness." Architects such as Peter Eisenmann and Bernard Tschumi, for example, have attempted to deconstruct the historical notion of architecture by elevating terms such as "demateriality," "nothingness," "dislocation," and "absence," the binary opposites or "others" of the traditional terms of architecture, in their work.

McLeod criticizes these architectural explorations of marginality, however, because they are being carried out by male architects whose position and architecture are not marginalized. She claims that these architects are "colonizing" the position of "other," and therefore are limited in their vision by their inauthentic marginal position. McLeod suggests that the subject position of women and of the everyday present more legitimate marginal viewpoints, and therefore more potential for truly new discoveries in architecture.

7   Donna Haraway, ed., *Simians, Cyborgs, and Women: The Reinvention of Nature,* (London: Free Association Books, 1991), 74.

8   Donna Haraway, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," *Feminist Studies* 14:3 (Fall 1988): 583.

9   Ibid., 585.

10   bell hooks, "Choosing the Margin as a Space of Radical Openness" in *Gender Space Architecture* (London: Routledge, 2000), 203.

11   Trin T. Minh-ha, "Cotton and Iron" in *Out There: Maginalization and Contemporary Cultures* (New York: The New Museum of Contemporary Art, 1990), 330.

Herein lies the importance for interior design. If interior design is a truly authentic marginal position, rooted in its perceived femininity, then interior design possesses the potential of having this special viewpoint of the marginalized; a viewpoint that in, Haraway's words, "promise more adequate, sustained, objective, transforming accounts of the world." [12] Interior design can only explore this potential, however, when it discontinues its practice of emulating architecture, and fully acknowledges and explores its characteristic femininity and "otherness." Recognizing and celebrating its marginal position, therefore, would not only afford interior design a way of developing a unique and distinct non-supplemental identity apart from architecture, but also the potential for providing a different and special kind of perspective for re-envisioning the built world. To quote Haraway again, "...a knowledge potent for constructing worlds less organized by axes of domination." [13]

What then would an interior design that elevated and celebrated its marginal "feminine" characteristics be like? Feminist architect Karen Franck perhaps gives us a idea in her essay, "A Feminist Approach to Architecture: Acknowledging Women's Ways of Knowing." [14] The idea of a "women's way of knowing" emerged in this second wave of feminism as part of its acknowledgement and identification of specific feminine characteristics. This theory posits that, since men and women have different experiences of the world, they "know," and analyze that world differently. As Franck explains: "We construct what we know, and these constructions are deeply influenced by our early experiences and by the nature of our underlying relationship to the world." [15] Many feminists have speculated on how women experience the world differently. Nancy Chodorow, for example, using the premises of psychoanalytical object-relation theory, posits that children develop gender identity at an early age by being able to identify with or differentiate themselves from their primary caregiver. Since, in most cases, the primary caregiver is the mother, women develop relationships of attachment to self-identity since they are the same gender as their mothers, while the men's process is one of differentiation since they are not. Emotion and subjectivity, characteristics of attachment, therefore, become important aspects of a woman's way of looking at the world, since they are essential parts of making connections. Reason and objectivity, both methods of differentiation, are characteristics of a masculine view. Nancy Hartsock, another feminist theorist, reinforces this idea, as Franck explains:

> The masculinity that boys must achieve is an ideal not directly experienced in the home and family, but reached only by escaping into the masculine world of public life .... In contrast, the female sense of self is achieved within the context of the home and family, and hence embraces and values everyday life and experience. [16]

12 Haraway, 584.

13 Ibid., 585.

14 Karen A. Franck, "A Feminist Approach to Architecture: Acknowledging Women's Ways of Knowing" in Ellen Berkeley, ed., *Architecture: Place for Women* (Washington, DC: Smithsonian Institution Press, 1989) and reprinted in *Gender Space Architecture* (London: Routledge, 2000).

15 Ibid., 295.

16 Ibid., 296.

Like Haraway, these feminists propose the recognition and elevation of women's ways of knowing not merely to reverse their supplemental position, but to integrate this way of looking at the world as an acceptable and important framework for research and analysis. In her article, Franck identifies what she sees as the characteristics of these women's ways of knowing, and how they may be used in designing built spaces.

The first quality she notes is the "desire for connectedness and inclusion," which is achieved by "the recognition of an underlying connectedness to others, to objects of knowledge, and to the world and a sensitivity to the connectedness of categories."[17] She theorizes here, like Hartsock and Chodorow that, since male self-identity is developed through distance and abstraction, the tendency to think in terms of dualisms and oppositional characteristics is more pronounced in men's thinking. Since female self-identity is developed through identification and connection to everyday experience, she speculates that women have a tendency to overlook dichotomies and recognize connections rather than differences. The boundaries between categories such as public/private, work/home, and male/female tend to be broken down in women's ways of knowing. Design processes undertaken in this feminist perspective are likely to blur role distinctions between designer and client, and designer and user; make closer spatial or visual connections between spaces; integrate diverse kinds of spaces; and combine both subjective and objective information.

The second quality Franck recognizes is an "ethics of care" and "value of everyday life" in women's ways of knowing. Attention to the issues of the everyday life has been a consistent characteristic of design reforms undertaken by women throughout history. She points out the work of social and urban reformers such as Catherine Bauer, Edith Elmer Wood, Jane Jacobs, and Clare Cooper who have emphasized the importance of daily-lived experiences. She also points out how women designers such as Lili Reich and Eileen Gray have created spaces and furniture that were direct responses to everyday needs. Eileen Gray's design of color sheets, for example, can be seen as an acknowledgement of the use of an unmade bed as the site of everyday, informal activities including reading and eating.

Franck also proposes that, in making design decisions, women would be more motivated by a female "ethic of care" rather than by a male "ethic of justice." She cites here the feminist, Carol Gilligan, author of *In a Different Voice: Psychological Theory and Women's Development,* who proposes that there is a difference in how men and women make decisions:

> Women and girls draw upon a "reflective understanding of care" requiring that no one be hurt and that one respond to the need of others, whereas men and boys are concerned that everyone be treated fairly.[18]

17   Ibid., 297.
18   Ibid., 296.

Designing according to a women's way of knowing therefore would pay more attention to the individual and the subjective needs of the users, and less to applying standards across the board.

The acceptance of subjectivity and feelings as a strategy of women's way of knowing also is recognized. Franck says that personal experience and knowledge become sources of information for design in women's ways of knowing. Attitudes and emotions, usually downplayed in a rationalist approach to design such as mothering, personal expressiveness, affection, intimacy, and attachment would be considered valuable.

The desire for complexity and flexibility is another characteristic Franck identifies as part of women's way of knowing. Complexity and ambiguity are considered desirable in this context because they undermine hierarchical control and invite user participation. Considering multiple uses for spaces and objects, and an awareness of the need for change, flexibility, and transformation also are part of this aspect of women's way of knowing.

When I first read Franck's categorization of women's ways of knowing, I was taken aback not because the information was new, but because it was so familiar. From my experience as both an educator and interior designer, I recognized all these characteristics as part of what interior design does. Interior designers focus on the intimate movements, needs, and emotional concerns of the users of interior space, as individuals and in connection with others. Good interior design creates a kind of "second skin" or prosthetic that facilitates or reflects not only the functional needs of its "wearer," but their emotional, personal, and spiritual needs as well. Interior design is concerned with the more intimate needs of its user, i.e., the intimate needs of our own interiority. Since the interior has long been assigned as the realm of the feminine, recognizing the feminine nature of interior design only more fully recognizes and celebrates the idea of interior. In a new strategy of interior design that celebrates its marginal feminine position, and therefore a wider, more complete, and more robust view of interiority, issues such as materiality, sensuousness, decoration, nurturing, self expression, desire, and mothering which have been de-emphasized in a male, rationalist, architectural framework would be brought to the foreground.

The question must be asked though whether this is possible in a professional and academic world that still privileges the historical superiority of the characteristics of male and the rational. French feminists including Luce Irigaray, Julia Kristeva, and Hélène Cixious have theorized that this is difficult if not impossible. These feminists have concluded that only from speaking outside of the controlling system, which is male, can true feminine perspective be understood and defined. Since language has been recognized as the major constructor of inequality between the sexes, they have proposed that women need to develop their own language. They have promoted a

different kind of writing for women that values the first person over the third, allows personal expression, and often is nonlinear and fragmented. This writing, which they see as subversive and "related to the body,"[19] they believe challenges patriarchal order and undermines the stability of binary oppositions, therefore making a place for feminine subjectivity.

What would a unique language of interiors that reflected its marginal and feminine characteristics look like, sound like, and feel like? Although most of the work in interior design now tends to emulate male, rationalist, architectural practice, a few examples can be cited that give a hint of what such an approach might be like. Perhaps one of the easiest and most straightforward ways of developing a new language for interior design would be in its drawing and presentation techniques. The "God's eye view" of the architectural perspective and axonometric could be discarded in interior design in favor of drawings that allow only the true and accurate viewpoint of its occupant. The view from the interior would be superior to the view from the exterior in this new language. The resulting scale and intimacy of these drawings would reflect a stronger and more direct relationship to the body and its place within the depicted space. New computer programs that allow more accurate interior views from a multiplicity of perspectives, as well as virtual walkthroughs, could be a powerful tool for this new mode of representation. Presentations that emphasize the sensuality and bodily impact of the interior materials also could be part of this new language. The collage techniques of both Ray Eames and Florence Knoll in which samples of the actual materials and colors of the space were used to construct plan, elevation, and 3-D views could be reintroduced as part of this new interior design practice.

Most important, design education and studio practice would have to be evaluated and reconstructed. The nature, scale, and types of projects considered as important for interior design also might have to be reconsidered. Carla Corroto, a feminist scholar and interior design and architectural educator who is an advocate for reform of architectural studio culture, is one of the few pioneers who are working with new parameters in design studios that incorporate "women's way of knowing" into design pedagogy. In Corroto's classes, students earn grades not only by completing the assigned class projects, but also by being "cooperative learners." Students are evaluated by their co-students after each project with regard to how their studio mate(s) supported them. Students can improve their grades by being recognizably supportive of their co-students. Corroto's system undermines the traditional competitiveness and hierarchies of the design studio, and encourages Carol Gilligan's "ethic of care" and "nurturing" atmosphere, while teaching students to co-author projects and be inclusive in a larger range of ideas and mutlivocal perspectives. Her studios promote an integration of an

19   Sarup, 109.

appreciation of caring for others, and the development of intimacy through sharing, as part of the design process. Her approach could readily be utilized in training for this new paradigm for interior design.

Would efforts such as these help deconstruct the binary opposition that holds interior design in its supplemental position, and challenge the architectural status quo as the norm? Could they be used to clearly establish the difference between interior design and architecture, and celebrate and promote that difference so that interior design has a unique and non-supplemental identity? These speculations are all food for future thought, and this examination of an overlay of feminist theory onto interior design purposefully hints that it could provide some interesting answers to these questions.

At present, however, interior design is at a crossroads. Interior design must decide whether it wants to become architecture or continue to try to maintain a distinct identity of its own. As the rising tide of budget cutbacks and reorganizations push more interior design education programs and offices into the realm and control of architecture, or put them out of business all together, certain questions need to be asked now. Does interior design have an identity outside of architecture? Is it a distinct field that offers something different to architecture? Is interior design a valuable category of the design disciplines that needs to be preserved?

What this analysis has hoped to establish is the idea that interior design does have a unique and valuable position in the design world. Elevating the theoretical position of the feminine in interior design and acknowledging its marginality, which in bell hook's words can be a "site of creativity and power," may provide a starting place for change, innovation, and the successful establishment of an autonomous and distinct identity for it. In this light, instead of being seen as a subcategory or inferior supplement to architecture, interior design can be seen as having the potential for being a truly transgressive, creative, and transforming activity with a unique role to play in design practice and education.

Designing the Morality of Consumption: "Chamber of Horrors" at the Museum of Ornamental Art, 1852–53
Suga Yasuko

Introduction

In Britain, where all sumptuary laws were abolished as early as 1604 (the earliest in the world), the "taste" of everyday things became an issue of great importance by the mid-nineteenth century, enough to give birth to a national institution solely dedicated to the matter. This was the Museum of Ornamental Art, now the Victoria and Albert Museum, whose primary aim was to "improve the public's taste." The term "taste" was introduced to Britain from France in the eighteenth century, and was discussed mainly within intellectual, aristocratic, or professional circles. Edmund Burke argued "On Taste" in the preface to his *Philosophical Enquiry into the Origin of Our Ideas of the Sublime and Beautiful* (1756); and the title of Thomas Chippendale's book, *Gentleman and Cabinet-Maker's Director: Being a Large Collection of the Most Elegant and Useful Designs of Household Furniture, in the Most Fashionable Taste* (1754), was clearly suggestive of its audience. In the following century, however, after Britain had experienced the industrial revolution, "taste" was placed in a much wider context. A.W. Pugin associated taste, society, and morality in his *Contrasts: Or, A Parallel Between the Noble Edifices of the Fourteenth and Fifteenth Centuries and Similar Buildings of the Present Day, Shewing the Present Decay of Taste* (1836). Works such as *The Hand-Book of Taste: Or, How to Observe Works of Art, especially Cartoons, Pictures, and Statues* (1843) by Fabius and periodicals including *The Artist and Amateur's Magazine: A Work Devoted to the Interests of the Arts of Design and the Cultivation of Taste*, to which William Etty and John Ruskin contributed, intended for a nonprofessional and middle-class reader, appeared soon after. So far, the focal subjects of these how-to publications were architecture, painting, sculpture, literature, and music, which, in general, were either appreciated in public or possessed by a luxuried few.

Towards the middle of the century, a different trend emerged. Taste in consumption was discussed for a nonprofessional, more general audience that would spend money on home decoration. Domestic objects became as serious a subject as any work of art, as represented by Charles Eastlake's *Hints on Household Taste in*

Furniture (1868), which sold extremely well in Britain and the United States. This growing interest in everyday objects can be attributed to the Great Exhibition of 1851. As Thomas Richards argued, "Until the Exhibition the commodity had not for a moment occupied center stage in English public life; during and after the Exhibition the commodity became and remained the still center of the turning earth, the focal point of all gazing and the end point of all pilgrimages."[1] However, while this "palace of consumption"[2] certainly provided a good opportunity to discuss the commodity to an unprecedented extent, it would take further confirmation by a mechanism other than a one-time-only exhibition for this new commodity culture to have a lasting impact. That honor would fall to the Museum of Ornamental Art.

One gallery in the Museum, "Examples of False Principles in the Decoration," showed examples of "bad taste" for the purpose of illuminating the public. This gallery played a crucial role in defining the contemporary discourse on taste, and consequently on consumption. Generally known as the "Chamber of Horrors," the gallery in question was arguably the first attempt to control the consumption of commodities not by any written law, but through display and discourse on the morality of consumption. Museum histories often refer to this gallery in a side story. However, although small and short-lived, it was significant in a way more than the Great Exhibition, marking the turning point in the discussion of taste from a production view to a consumption-oriented view.

This article focuses on this controversial gallery representing "bad taste" for the purpose of understanding the formation of moral discourses of taste and consumption in the Victorian period.

Production-Oriented Discourse on Taste
It is well known that Britain entered the Victorian Period with a feeling of inferiority towards Germany and France in the field of design due to the increase of German and French exports. After its appointment in 1835, the Select Committee on Arts and Manufactures "problematicized" the lack of design education, as well as issues such as the wallpaper tax and the regulation of patents. "Taste" was one of the most important issues. When Charles Robert Cockerell, the architect of the Bank of England and an associate of the Royal Academy, was called to give evidence before the Committee, he deplored the "indifference shown by Government on a subject...which is of paramount commercial and national importance in a manufacturing country where the cultivation of taste only is wanting to give us superiority over the world."[3]

The impact of the Select Committee on the discourse of taste and consumption can be detected in magazines including *The Penny Magazine* published by the Society of Diffusion of Useful Knowledge. Aimed at improving the working class from the middle-class point of view, this publication occasionally had articles on everyday objects

1   Thomas Richards, *The Commodity Culture of Victorian England* (Verso, 1991), 18.

2   Tim Barringer, "The South Kensington Museum and the Mid-Victorian Moment," in *Victorian: The Style of Empire* (The Decorative Arts Institute, 1996), 26.

3   Evidence given by Charles Robert Cockerell on Aug. 28, 1835 in "Report from Select Committee on Arts and Manufactures" (1835).

such as cutlery and furniture. In the first issue, "On the Choice of a Labouring Man's Dwelling" told the reader to "begin humbly." [4] After the Committee published its results, consumption was clearly encouraged: "If rooms are to be papered at all, why should they not be ornamented with tasteful, elegant, and suitable patterns, instead of what is tawdry and ugly?" [5] Here, discourse was not based on the pleasure of consumption, but on taste as a stimulus for possible employment. "Improvement of Taste in the Decoration of Houses" stated that taste would secure more work positions: "A wide field for productive employment might be opened, if the taste of the people of Great Britain were so generally improved, as to require that the decoration of houses and the adaptation of household furniture, should be pursued on scientific principle." [6] *The Penny Magazine* stated that good taste would do both manufacturers and workers good, demonstrating that the middle-class view on taste at this point emphasized its link with production.

It was Henry Cole and his circle who would lead the discourse of taste in a more consciously consumption-oriented direction. Cole accomplished this by introducing a "moral" quality into design. A civil servant who reorganized the Public Record Office and introduced the "Penny Post" system, Cole won a silver prize at the Royal Society of Arts exhibition in 1846 and was mentioned by Prince Albert (the patron of the Society). Cole and his circle devoted themselves to the development of industry and art, the major outcome of which was the Great Exhibition of 1851. He also established Felix Summerly's Art Manufactures in 1847, began challenging the School of Design (est. 1837—a concrete outcome of the Select Committee), and criticized the inefficiency of the design education system. In 1849, Cole began publishing the *Journal of Design and Manufactures,* which contained design theories written by artists, painter, designers, and members of the Royal Academy including Richard Redgrave, William Dyce, and others who designed for Felix Summerly's Art Manufactures.

The biggest problem in the system was, according to Cole, the absence of "principles" in design, and the first issue of the *Journal* emphasized the importance of design theory. It was important "to present to the designer treatises developing sound principles of ornamental art, and to keep him thoroughly informed of all that is likely to be useful and instructive to him in his profession"; thus "the manufacturer and student of design will find throughout our pages something like a systematic attempt to establish recognized principles." [7] Visualization was key to this process, and the first issue duly included no less than forty-four textile samples and more than two hundred illustrations.

The *Journal* included extensive discussion of both the "right" and "wrong" designs, where the "wrong" examples often came from the School of Design students. The titles of articles in the *Journal* also demonstrate the editor and writers' tendency to dogmatize design
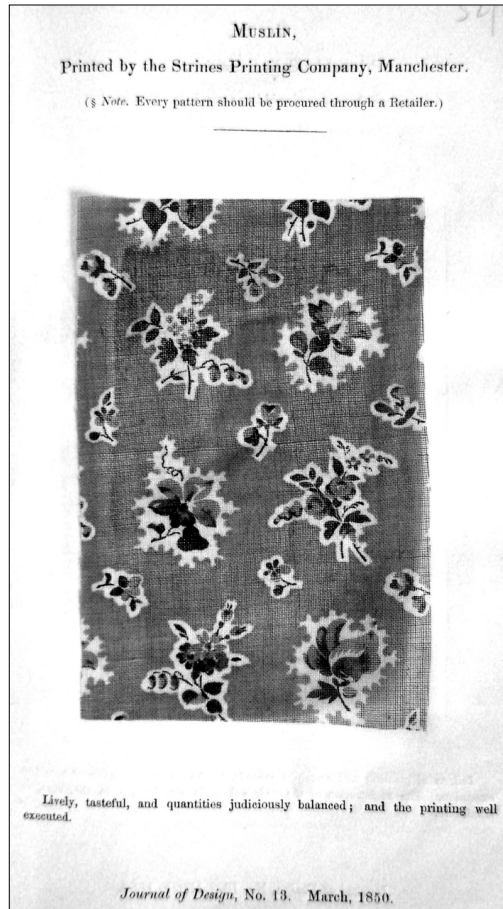
4   *Penny Magazine* 1 (April 7, 1832): 16.
5   *Penny Magazine* 5 (Dec. 10, 1836): 484.
6   Ibid.
7   *Journal of Design and Manufactures* (hereafter *Journal*) I:1 (1849): 3.

MUSLIN,

Printed by the Strines Printing Company, Manchester.

(§ *Note.* Every pattern should be procured through a Retailer.)

Lively, tasteful, and quantities judiciously balanced; and the printing well executed.

Journal of Design, No. 13. March, 1850.

theory; while the first issue contained only "reviews" of patterns. Words such as "hints" appeared in the second issue. By the fourth issue, the writers of the *Journal* had begun to make judgments on "good" or "bad" taste. The titles of articles such as "Iron-work and Its Principles of Treatment," "Right Taste for Carpet, Wallpaper, Glass Products," "Canons of Taste in Carpets, Paper-Hangings, and Glass," and "The Use and Abuse of 'Parian'" demonstrated the Cole circle's endeavors to define the "right" taste. Geometric patterns were considered to be "good," and naturalistic designs and excessive decorations were unwelcome, even though naturalistic flower patterns were the most commercially successful in this period.

The *Journal* was noteworthy for connecting design with judgments of taste and morality. A. W. Pugin's *True Principles of Christian or Pointed Architecture* (1841), had shown that nineteenth-century Christian architecture employed structure and decoration to express the true values of Christianity. Pugin went on to apply this religious judgment to judgments of taste. Cole was inspired by Pugin, with whom he worked on the Exhibition, and followed his discourse albeit without the religious aspect.[8] When a member of The Great Exhibition team commented: "I think experience shows that

8   See Clive Wainwright, "Principles True and False: Pugin and the Foundation of the Museum of Manufactures," *Burlington Magazine* CXXXVI:1095 (June 1994): 357–364.
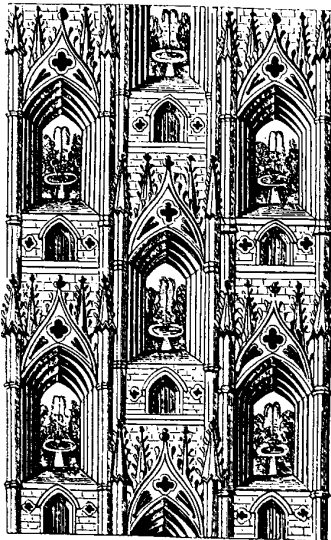
Pattern of Modern Gothic Paper.

Figure 2
Wallpaper pattern showing defective principles but "a great favourite with hotel and tavern keepers" (Pugin, *True Principles,* 29)

doctors in taste differ as much as doctors in medicine," Cole replied: "I think to act upon the principle of 'every one to his taste,' would be as mischievous as 'every one to his morals'; and I think there are principles in taste which all eminent artists are agreed upon in all parts of the world." [9] The *Journal* reiterated the thesis that the artistic value of design denotes its moral value:

> Whilst the commercial value of ornamental design now comes home practically to the perception of tens of thousands—to manufacturers, artists, and designers; to artisans and dealers in decorative manufactures; the moral influence of ornamental art extends to millions...And surely the stale proverb of a thousand years standing, that art softens rough natures, need hardly be quoted in proof of its moral benefits.[10]

Another editorial opined:

> Design has a twofold relation, having, in the first place, a strict reference to utility in the thing designed; and, secondly, to the beautifying or ornamenting that utility. The word design, however, with the many has become identified rather with its secondary than with its whole signification—with ornament, as apart from, and often even as opposed to, utility...These errors, by vitiating the taste of the public, react upon the artist, until both have arrived at such a state of diseased judgment, that the simplicity of truth and propriety would hardly be endured, however well presented; and the many have come to love gaudy extravagance in lieu of simple, earnest, ornamental art.[11]

Authors such as Joseph Addison, Lord Shaftesbury, and Francis Hatchenson had associated morality with taste from the eighteenth century, and this discourse still was strong in the following century. By using the language of "true" and "false" when discussing design, Cole's framework of "truthful" taste as the proper choice against "hideous" manufactures worked well to persuade a Victorian middle class deeply concerned with "respectability." The original utilitarian intention to increase the sale of British goods by attractive design; an intention prominently apparent in the Select Committee's conclusions; was somewhat covered by the evangelical, moral discourse.

Cole emphasized the importance of the consumer in design reform: "Improvement in design depends not only on the right intelligence of manufacturers and designers, but quite as much, or even more, on that of the public;"and "If the public are unable to appreciate excellence, surely we cannot call on the manufacturer to produce it at a sacrifice."[12] Six months after its first publication, the *Journal* was being published on monthly basis. Its editors began to pay full attention to the "average" consumer, and introduced selected successful examples of decorative products "considered

9   Alan S. Cole, *Fifty Years of Public Work of Sir Henry Cole, K.C.B. Accounted for in His Deeds, Speeches, and Writings* I and II (London: George Bell and Sons, 1884), 286.
10 *Journal* I:1 (1849): 1.
11 *Journal* I:2 (1849): 56.
12 *Journal* II:7 (1849): 1.

with reference to the use of them by the consumer" and to "direct means of interesting the general public practically in design." [13] They desired "to exhibit and criticize not so much the best and most costly productions, and therefore exclusive patterns, but the *fair average* character of our manufactures, not neglecting the *very cheapest.*" [14] Ironically, the reader of the magazine was never "average," but rather restricted mainly to retailers and those in the design professions. The magazine's dynamic idea of attaching textile samples with prices was well received, but the practice also limited the publication run practically and financially. As the *Art Journal* pointed out, it was expensive: "It has not been successful; its circulation has been small, and not remunerative" and "could not have taken place at all if the circulation of the *Journal* had been extensive." [15] However, the attempt to visualize taste judgments to promote taste socially gave impetus to the next big project: a large-scale public exhibition.

Thus came the world's first Great Exhibition of 1851, displaying one-hundred thousand objects from more than thirty-two countries (half of the products were British-made), which revealed the aesthetic inferiority of British products and supplied a good opportunity to discuss "taste" openly. In *Art Journal,* R. N. Wornum wrote a twenty-two-page essay on "[The] Exhibition as a lesson in taste." Wornum's main argument was that people needed education to improve their taste, and if the criteria for good taste were exhibited in public space, the public would learn better taste through the exhibited objects. In the beginning of his article, Wornum quoted Edmund Burke, arguing that bad taste derived from a lack of design theory and education. He discussed improvement in design would bring "not only a direct success but also the whole social progress" with many foreign objects concurrently displayed with the British ones, thus providing an opportunity for comparison. The Great Exhibition, he believed, was "of all things the best calculated to advance our National Taste." [16]

There were two obvious roadblocks to the Exhibition as a site encouraging the improvement of taste: its temporality and the exhibits' mixed nature. *Mechanics' Magazine* editors had expressed their suspicion that "The few objects intrinsically good will be smothered by what are intrinsically bad," and that "public taste will be blinded to truth and perverted to false good." [17] Wornum also recognized this problem in his essay. In order to improve the public taste, Britain needed a permanent exhibition space to display selected objects. An institution such as a museum was the most suitable venue for this, since museums and galleries were considered ideal for all classes to share knowledge. Britain had only a few museums at the beginning of the nineteenth century, but the number of the museums gradually increased to around forty in 1845, when the Museum Act was issued. During the Exhibition, Cole already had suggested to the Department of Trade that selected well-designed objects should be moved to the collection of the School of Design. Cole, Redgrave,

13 *Journal* II:1 (1849): 5.

14 *Journal* I:1 (1849): 5

15 *Art Journal* (1852): 99.

16 Ralph Wornum, "The Exhibition as a Lesson in Taste," *Art Journal* (1851): I, VII, XXII, V–VI.
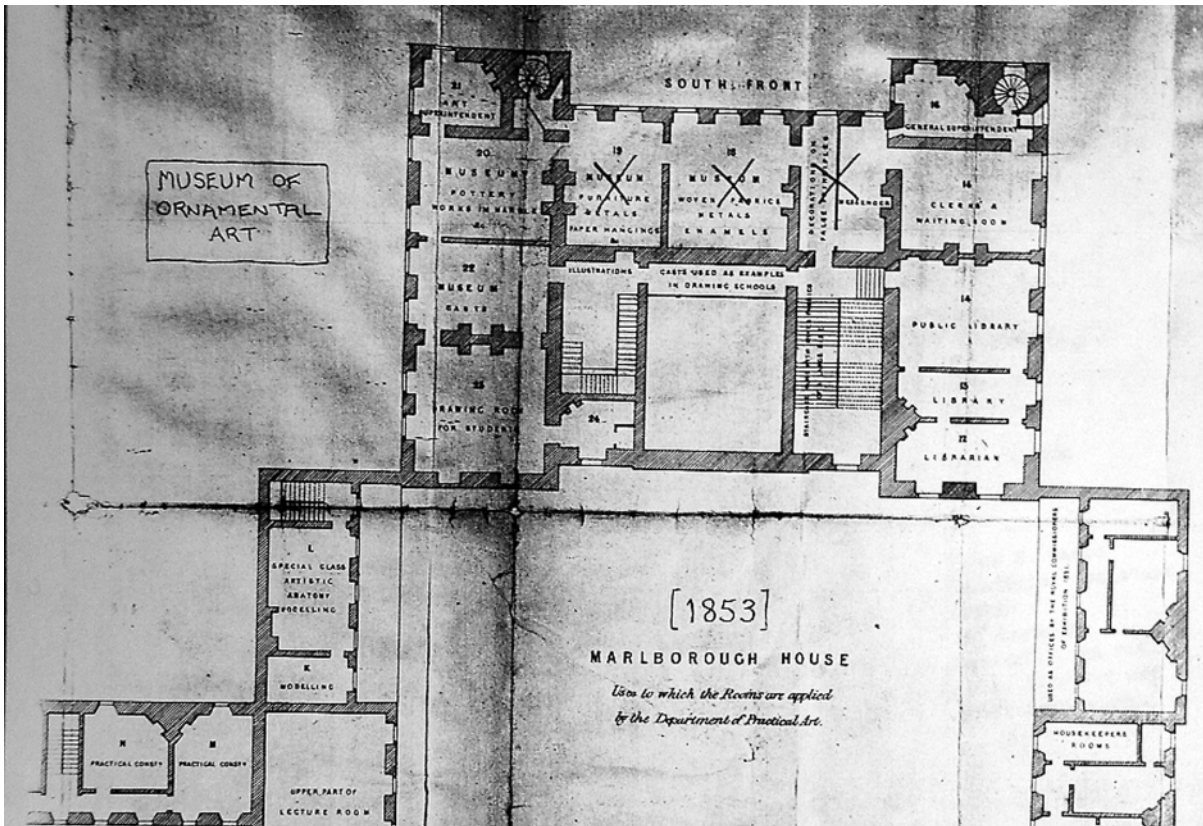
17 *Mechanics' Magazine* 1396 (1850): 370–1.

Pugin, and Owen Jones selected the objects. In January 1852, the new Department of Practical Art (Department of Science and Art from 1853) started, with Cole as director. The Department's aims were:

> 1st, General Elementary Instruction in Art, as a branch of national education among all classes of the community, with the view of laying the foundation for correct judgment, both in the consumer and the producer of manufactures; 2nd, Advanced Instruction in Art; and lastly, the Application of the Principles of Technical Art to the improvement of manufactures, together with the establishment of Museums, by which all classes might be induced to investigate those common principles of taste which may be traced in the works of excellence of all ages.[18]

Queen Victoria and Prince Albert gave Cole permission to use Marlborough House of Pall Mall. They refurbished on the top floor to the house the School of Design's collection—objects from the Great Exhibition estimated to be worth around five thousand pounds, including the royal ceramic collection. The Museum of Ornamental Art thus was established as a result of Cole's doing "twice the work of anyone else." [19] He ceased publication of the *Journal* in February 1852. In May, Owen Jones gave four lectures on "The True and False Principles of Design." The audience for these lectures averaged 116

18 "First Report of the Department of Practical Art" (London, 1853): 2.

19 Henry Cole Diary, July 20, 1852 (typed manuscript, National Art library).

people in the morning, and 211 in the evening; attendance figures which exceeded audiences at lectures that year. The museum was open to the public for seventeen days in May and June, and after the summer, it reopened permanently, offering unlimited admission to students, and free admission to the public on Mondays and Tuesdays. Despite the fact that the British Museum closed galleries because gas lights would damage the objects on display, and the National Gallery regulated opening hours against the "unreliable" working class, the Museum of Ornamental Art was the first museum opened until the early evening "to ascertain practically what hours are most convenient to the working classes."[20] According to the first report the Department of Practical Art issued in 1853, the museum had an average of 800 visitors on days it was open to the public, and seventy on student days.[21] It attracted 6,359 visitors between February 27, 1852 and January 6, 1853, and sold 18,706 catalogs, thus reaching a much broader audience than had the *Journal*.[22]

The Illustrated London News reported that the museum was a "new-born school of taste."[23] Indeed it was, for all visitors had to physically pass through the "Examples of False Principles in Decoration" gallery (its name and the content obviously echoing Pugin's book *True Principles*), or so-called "Chamber of Horrors," before entering the main galleries of treasures. There were eighty-seven objects specifically selected to represent "bad taste." Visitors were encouraged to observe these objects with the guidance of the catalogue, which described every single detail of falsehood in the exhibits, and depicted why these were "false." The *Journal*'s emphasis on simplicity, geometry, and truth to material was firmly stamped in the catalogue of the museum. It said:

> There has arisen a new species of ornament of the most objectionable kind, which it is desirable at once to deprecate on account of its complete departure from just taste and true principles. This may be called the "natural" or merely imitative style, and it is seen in its worst development in some of the articles of form.[24]

Articles such as "Landscapes and pictures are almost always out of place in pottery," and "Brilliancy of surface and transparency should ever be preserved with the greatest care in all right treatment of glass," added to the emphasis. Generally, three-dimensional naturalistic patterns on two-dimensional surfaces received the most criticism. A carpet (Catalogue No. 1) was judged as "bad taste" for its "Direct imitation of nature; flowers out of scale; architectural ornament in imitation relief; inharmonious colouring," and imitation of ribbons upon fabrics were repeatedly criticized. Wallpaper (No. 27) with "Perspective representation of a railway station, frequently repeated and falsifying the perspective" was determined to be "false." A jelly glass (No. 64) represented that "the natural outline of the glass when blown destroyed by the surfaces being cut." A

20 However, there were no difficulties in opening the museum to the working class. *The Observer* reported that the people neatly queued. They did not at all damage objects estimated at thousands of pounds, and that all of the visitors were satisfied with the display and contents at the museum. (*The Observer*, January 9, 1853).

21 "First Report of the Department of Practical Art" (London, 1853): 44.

22 Henry Cole, *The Functions of the Science and Art Department* (London: Chapman and Hall, 1857), 24.

23 *The Illustrated London News* (September 11, 1852): 195.

24 *A Catalogue of the Museum of Ornamental Art, at Marlborough House, Pall Mall, for the Use of Students and Manufacturers, and the Public* (London, 1853), 13.

Figure 4 (above left)
Object no.16 (V&A Museum)
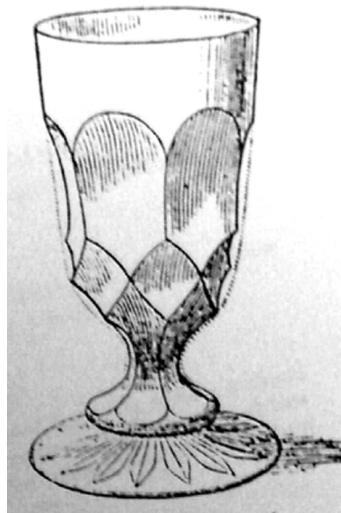
Figure 5 (above right)
Object no. 27 (V&A Museum)
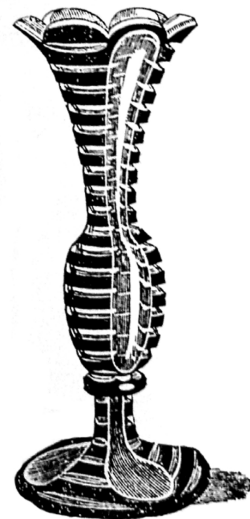

Figure 6 (right)
Object no. 64 (V&A Museum)

Figure 7 (far right)
Object no. 69 (V&A Museum)

glass vase (No. 69) also was assessed as having its "general outline entirely destroyed by the vertical cuttings." The commentary on a jug (No. 76) sounds very curious: "The general form totally disregarded; it is a rude imitation, in blue earthenware, of the trunk of a tree, on which are applied figures, vine leaves, and grapes, all out of scale with one another; this jug has been one of the most popular ever manufactured." A gas burner (No. 83), made in Birmingham, one of "those inexhaustible mines of bad taste" according to Pugin,[25] also was very popular in society, but it was "entirely indefensible in principle."

Reactions to the "Horrors"

The "Chamber of Horrors" affected both consumers and producers, although in different ways. Consumers were taken aback. Some people completely misunderstood the message, due to the paradox of an art museum displaying objects of "bad taste," and admired the "false principles" as creditable examples. Some who managed to

25   The other city was Sheffield. A.W.N. Pugin, *True Principles of Pointed or Christian Architecture* (London, 1854): 28.

Figure 8
Object no. 83 (V&A Museum)

understand the message correctly faced an identity crisis. First, they were upset to find that they had been living surrounded by what was labeled "bad taste." The gallery immediately was caricatured in Dickens's weekly magazine, *Household Words.* The plot, about a middle-class gentleman who was happy until he visited the gallery, was set exactly as Cole had envisaged. The crisis began once Mr. Crumpet had "acquired some 'Correct Principles of Taste.'" He realized that he had been living in what the exhibit called a "reproduction of nature." When he went into the gallery with the catalogue, he was "ashamed of the pattern of my own trousers, for I saw a piece of them hung up there as a horror." After his return from the museum of ordeal, he "saw it all; when I went home I found that I had been living among horrors up to that hour. The paper in my parlour contains four kinds of bird of paradise, besides bridges and pagodas." At a friend's house, he suffered from the "imitation of nature" present in the wallpaper's perspective pattern, and flowers and fruits in the pattern of a carpet. He almost fainted when he found a naturalistic drawing on the bottom of a teacup: "Butter-fly-inside my cup! Horr-horr-horr-horr-i-ble!" His friend took him home in a cab. He sympathetically told him that design certainly needed "true principles," but such abstract ideas would not become common until the next generation. If things went too far, it meant no good.[26]

Another kind of confusion arose when consumers attempted to understand the concept behind the display. A gentleman wrote to *The Observer*:

> A party of young ladies entering here saw a small handkerchief, with the motto, "Honesty is the best policy." Immediately over it were the words, "False principles," referring to the picture on the handkerchief. "Oh!" cried one of them, "if honesty is the best policy is false principles, we must take care of our pockets here." Most of the visitors were confounded by this ominous label of false principles. Even those who recognized the truth of the objections (writes our correspondent) could not understand why a rose, for instance, so beautifully copied, could be false; and, we believe, for the first time in their lives they began to think about art and its meanings.[27]

As the above examples show, the gallery was much appreciated but its overly serious approach towards "bad taste" was a butt of many jokes. Still, one consistent message was certainly felt: the consumer was strongly made aware that s/he was expected to "choose" correctly. The gallery took advantage of this psychology of consumption. The production side naturally was extremely unhappy with the "Chamber of Horrors," especially those whose own products were displayed in it. In 1853, thick pamphlets consisted of three volumes entitled, *A Mild Remonstrance against the Taste-Censorship at Marlborough House in Reference to Manufacturing Ornamentation*

26 Henry Morley, "A House Full of Horrors," *Household Words* VI (December 4, 1852): 265–270.
27 *The Observer* (January 9, 1853).

and Decorative Design (to Manufacturers, Decorators, Designers, Public Generalle) came out. The anonymous writer called himself "Argus," after the mythical monster with multiple eyes. Each pamphlet cost six pence, but manufacturers were able to buy a hundred copies for four shillings when they circulated them free to their clients and suppliers.

The contents were provocative. The author condemned the practice of calling British design "bad taste" compared to that of France, Italy, and China: "What right have they to have different tastes, different habits, and different modes of thought, to Englishmen?"[28] Argus blamed the Museum of Ornamental Art for wasting the nation's tax money, and pointed out the paradoxes in the catalogue's "principles." The pamphlet criticized the Museum for its acquisition of foreign cabinets, described at the Great Exhibition as "Notwithstanding the defects in the upper part of this piece of furniture, where there is a great mixture of styles; and the bad carving of the figures in the lower part, this was one of the finest works of its kind in the Exhibition, and cannot be too strongly recommended" for four-hundred pounds. The author urged the museum to explain: "In the first place, with such defects in style, and so bad in workmanship, why was it purchased? In the next place, notwithstanding these defects from top to bottom, why is it one of the very first things we meet with as illustrative of "True Principles"? or rather, why is it not, all costly as it is, in your Chamber of Horrors'?" Also, if "Simplicity is one of the first constituents of Beauty", why then did you buy the elaborately-ornamented Snuff-box? Why the elaborately ornamented Knife-handle, price £200? Why, in short, did you purchase all the other elaborately ornamented articles which make a Wardour Street Curiosity-shop of your museum?" He maintained that the "Chamber of Horrors" was a challenge to the laissez-faire spirit in industry and "an act of imbecile and wanton injustice." He pointed out that only one-twentieth of the museum's objects followed the true principles, and suggested that "the sooner you withdraw your Principle, or shut up your Museum, the better."[29]

Argus's remonstrance was rhetorically constructed. In the first volume, the tone was humanitarian. He called Redgrave, Jones, and Cole a "Triumvirate of Taste" that believed in the existence of "Canons of Taste." In the second volume, he criticized the censorship of taste as "an encroachment on our liberties" and "tyranny."[30] He strongly stated that "You can no more change the Religion of a nation by a coup d'état, than you can reform the Taste of a nation by simply willing it in solemn conclave at Marlborough House."[31] He opposed the regulation of taste by referring to human freedom and democratic rights, rather than commercial intentions. The economic function of design was covered with the word "taste" tinted with morality, as Cole often had done. In the third volume, he finally mentioned business, but again using Cole's "true" and "false" rhetoric itself to confront his group. Manufacturers needed to apply

28   Argus (pseudonym), "A Mild Remonstrance Against the Taste-Censorship at Marlborough House in Reference to Manufacturing Ornamentation and Decorative Design," Part I (London, 1853): 3.

29   Argus, ibid., Part I: 25–7.

30   Argus, ibid., Part II: 33.

31   Argus, ibid., Part II: 11–3.

complex rather than simple decoration in order to sell products with added values, and what sold was "true" to them.

In fact, the "Chamber of Horrors" was severely damaging to certain trades. A manufacturer who mainly used "flowery patterns" and the "direct imitation of nature" complained that "My whole stock— my machinery—my capital,—my all—is jeopardized by the interference, in the name of the Government, of these censors" as the result of their products being displayed in the 'Chamber of Horrors.'"[32] Finally, manufacturers' similar complaints reached Parliament, and the gallery was closed in the spring of 1853.

One must note that this was not the end of the taste bureaucracy, but rather the beginning of its long-lasting influence. Cole himself seemed to be satisfied with the excitement it caused. When the Crystal Palace was moved to Sydenham, he suggested that organizers create another "Chamber of Horrors" there. He also reflected proudly on this event in *What Is Art Culture?* (1877): "You may recollect that, in 1853, there was a 'chamber of horrors' in Kensington Museum, which consisted of a collection of samples of decorations of the most costly kind, which had no principles of decorations about them. That chamber produced a startling effect; it was talked about even in Parliament." He continued that "The productions of our best manufacturers are now much more consistent with standards of good taste than formerly," and, therefore, he maintained, "Such a chamber of horrors could not be produced now."[33] His belief in the canon of taste was never shaken.

The influence of the gallery certainly was felt in the manufacturing world. *The Builder* noticed at the Paris Exposition Universelle (1855) that "In the present exhibition we miss the atrocious natural imitations of fruit, flowers, and landscapes once so popular among all classes; and in place of them, sober, conventional treatments of foliage, exhibiting considerable skill in design and arrangement."[34] At the Great Exhibition of 1862, as the government set more clear regulations for its collection, or because manufacturers began to take taste concerns more seriously, the numbers of objects in "imitation of nature" was observed to be less than at the Great Exhibition. Modes of consumption must have been influenced, too, for in the 1860s, many living rooms were refurbished with two-dimensional pattern designs, reflecting the lessons shown by the exhibit at the "Chamber."[35]

The argument regarding good and bad, or true and false, design was penetrating society in various ways, most directly through advice literature. Christopher Dresser's *Principle of Decorative Design* (1873), a manual for practical designers, was largely based on the same discourse. As for manuals for the consumer, Eastlake's *Hints on Household Taste* aimed to "encourage a discrimination between good and bad design in those articles of daily use." Eastlake also stressed that judging a commodity's quality was part of moral housewives' duties, emphasizing the link between femininity and

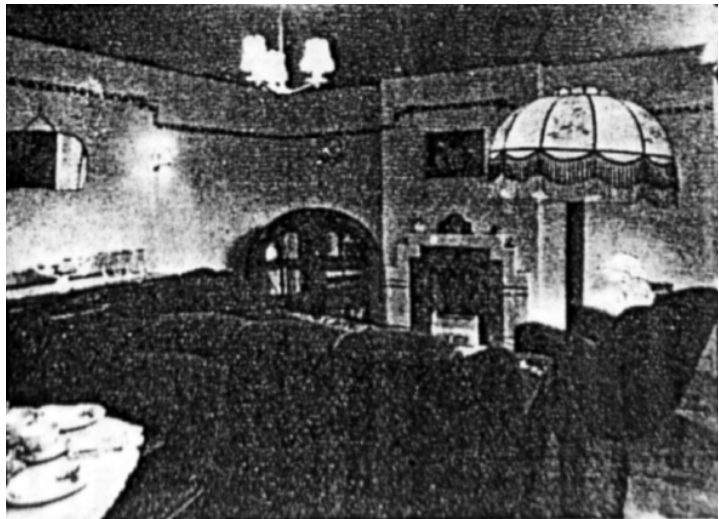32 *Morning Advertiser* (February 25, 1853).

33 Henry Cole, *What Is Art Culture?* (London, 1877), 6.

34 *The Builder* (1855)

35 Barbara Morris, *The Inspiration of Design* (London, 1986), 21.

Figure 9
Two rooms at the "Register Your Choice"
Exhibition (Mass-Observation Bulletin, No. 49,
March/June, 1953)

consumption. Eastlake, who saw the "Chamber of Horrors" as a way
"to illustrate the progress of bad taste in this century,"[36] reiterated
the arguments found in its catalogue: "It is an established principle
in the theory of design that decorative art is degraded when it passes
into a direct imitation of natural objects."[37]

Taste and morality became inseparable in the Victorian dis-
course of consumption. In 1864, John Ruskin was more straightfor-
ward: "...good taste is essentially a moral quality... Taste is not only a
part and index of morality;— it is the only morality."[38] To choose cor-
rectly and tastefully was of great significance, and the consumer had
to follow the taste bureaucrats. Echoes of the "Chamber of Horrors"
can be found in later design reform movements. In the first half of
the next century, when modernism emphasized geometric forms
even more than Cole could ever have imagined, moral discourse in
taste again was very strong. Modernism was first thought to be "im-
moral." As Sir Laurence Weaver lamented, "A great many excellent

36   Charles Eastlake, *Hints on Household
      Taste* (London, 1868), 15, 67–8.
37   Ibid., 161.
38   John Ruskin, *The Crown of Wild Olive*
      (1864).

people, good husbands and fathers, who think that any art which proclaims itself to be modern must be Bolshevist; that if you do not want to be Georgian or Queen Anne, you must be immoral; that modernism in art is a thing which has to be stamped on firmly."[39] In turn, modernists claimed that modernism was true and moral. The Design and Industries Association (est. 1915) was a prominent example. The Association, conscious of leading and formulating the modern taste, visualized what they thought as "bad taste" in 1928 at the *Daily Mail*'s "Ideal Home Exhibition" by preparing a new "Chamber of Horrors." In 1953, a century after the Chamber closed, the Association organized the "Register Your Choice" Exhibition at Charing Cross Station, with two rooms furnished in different tastes (one modern, the other conservative). A governmental organization, the Council of Industrial Design, also favored comparative exhibitions of "good" and "bad" design exhibited for comparison at the "Britain Can Make It" Exhibition (1946). Thus, the framework for the politics of taste constructed by Cole, whom Argus had sarcastically called "man of design," survived until the dawn of post-modernism finally negated any unified criteria for good design.

Conclusion

Design means order, method, and plan: the antonym of disorder. And a museum was, and remains today, epistemologically a space in which the world is ordered in a certain system. Considering the significance of principles for pacifying society as expressed in Matthew Arnold's *Culture and Anarchy* (1869), anything associated with disorder was in a way a "horror" to the Victorian mind. Adding nuances of morality to taste and design helped to manipulate and regulate public opinion and standardize taste, especially when this was visualized at a national museum.

In 1959, Kenneth Clark, then Director of the National Gallery, published a pamphlet entitled, *What Is Good Taste?* In the pamphlet, written in the transitional period from modern to post-modern, he did not give a definitive answer to the question, but he made an interesting comment:

> I'm not saying that machinery is the enemy of taste necessarily; but it changes the basis of taste from making to choosing.[40]

In a society of mass production supported by mechanization, what mattered for taste was not making or production, but choosing or consumption. Thus, society was led toward a more consumption-conscious axis. The "Chamber of Horrors" symbolized the new conditions for taste, and *forced* the change on Victorian society. A new consciousness was rooted into the consumer.

39   Sir Laurence Weaver, "Art in Industry and Salesmanship" (lecture pamphlet, February 5, 1929): 14–15.

40   Sir Kenneth Clark, *What Is Good Taste?* (Associated Television Limited, 1959).

Contract Research in Design
Anthony Crabbe

Contract research is a commercial research service undertaken for commissioning clients. This activity may pose difficult questions for researchers in the design area, since a commercial service may appear capable of producing little more than jobbing practice. The present paper considers case studies of work carried out by the Design Contract Research Unit at Nottingham Trent University in light of various theoretical positions on research. The aim of the discussion is to better clarify the controversial relationship of commercial design practice to what is now coming to be recognized as design research.

Research and Practice

In the UK, there is political pressure on academic communities to reach a consensus about the nature and value of research in their chosen disciplines, most obviously evidenced in the introduction of national Research Assessment Exercises. Politicians and civil servants seem increasingly drawn to the idea of fixing an apparently tangible value on the quality of public activity by creating new funding equations. An audit like the RAE is a useful means of demonstrating their diligence and the accountability of their fund management. However, success in such an exercise is not the beginning or end of funding support for design research. Design is an element of industrial culture, and some of the most impressive research campuses to be found are those belonging to giant industrial corporations, such as Microsoft and Nestlé. Armies of researchers also inhabit those campuses, and it would be a serious misunderstanding by those of us less well accommodated in universities to believe that somehow our industrial colleagues are working one level below us, tied as they are to the directions of greedy masters. Consider that such masters may provide academics with patronage additional to that given by politicians and bureaucrats, whose motives (such as maintenance of personal office) are not obviously purer.

Some may argue that the outcomes of commercial research and development evidence "applied" research, which seems by implication to be a rung down the ladder from "pure" research. A less specious distinction to make is that between research with a predetermined goal, and research without the same (which often is called "fundamental" research in the sciences). An example of the former would be to find a way of preventing a carbon filament that becomes incandescent when an electrical current passes through it, from burning up after a few seconds. This was a major research project that

led to the invention of the first durable electric light bulb by Edison, using a largely empirical trial-and-error method.

Investigating what happens when an electrical current is passed through strands of different materials would be an example of fundamental research. In hindsight, this may seem like a necessary precursor for inventing a light bulb but, in foresight, it does not appear to be a research program guaranteed to add even to the theoretical understanding of electromagnetic behavior. It is invidious to value one approach more highly than another. Both exist in design research, yet goal-led research evidently is the more dominant form because research programs can be very expensive, and so market forces in both the public and private sectors favor the goal-led form in design. Indeed, it is hard to imagine that design researchers could learn much of value from practice-based activity unless there were commercial manufacturers and developers available to collaborate in essential realization processes such as tooling, fabrication, and distribution. It is largely due to this consideration that my own unit has been led into accepting goals set by clients, rather than us, and why the term "contract" prefixes our research activity.

With regard to the notion of practice in relation to research, Nigel Cross is persuasive in insisting that practice itself does not constitute a significant research activity because, in a community, others may feel that if they cannot gain access through public reports to the methods behind the outcome, they cannot easily assess their value or further applicability.[1] In the case of craft production, many crafts people probably would go to considerable lengths not to disclose their methods to others. The success of such an approach, both in defending innovation as well as adding value or mystique to the products, is well evidenced by the successful transition of famous Renaissance figures such as Leonardo da Vinci from the status of craftsman to artist. Parallels can be found in contemporary design, where the status of designers such as Armani and Starck indicates that, even in an industrial culture, mystique still plays an important role in the value systems of consumers and the profit margins of marketers.

More commonly in industrial cultures, we have mechanisms for protecting personal innovation by actually disclosing outcomes in formal public ways. Patents and copyrights are the most obvious examples, and both are recognized as satisfactory research outcomes by UK research assessment exercises. Patents, by definition, must be: (1) new ideas, not previously publicly disclosed, (2) involve an inventive step such that, "when compared with what already is known, it would not be obvious to someone with a good knowledge and experience of the subject," and (3) "be capable of industrial application."[2] In this respect, "industry," in its broadest sense, is meant as anything distinct from purely intellectual or aesthetic activity. Under such definition, natural discoveries, scientific theories, mathematical methods, and aesthetic creations are excluded from patent protection.

1   N. Cross, 1999, "Design Research: A Disciplined Conversation," *Design Issues* 15:2, (1999): 5–10.

2   UK Patent Office, www.patent.gov.uk (2002).

On the other hand, the specific form of an aesthetic creation, such as the exact words of a text or the patterns and shapes of a designed object, can be protected under copyright or a design patent.

Patent definitions are then most instructive in telling us about the forms of knowledge that are pertinent to the definition of design research. Design practice primarily concerns the creation of apparatus, devices, processes, or methods of operation that are capable of industrial application. While it is by no means necessary that the outcomes of design practice are in any way inventive, many of them may be claimed to take a specific form that is novel and can be disclosed and protected. The ordinary patent involves creating products, methods, or processes that can be described in such a way as to enable others to reproduce and apply the inventive steps. The design patent involves creating a specific arrangement of symbols, shapes, lines, or patterns that so differs from precursors that just describing it in patent form prevents others from trying to reproduce the arrangement without permission. Of the two kinds of disclosure, the ordinary patent makes it far easier for others to gain insight into the particular research and creative processes giving rise to the outcome. Designers, like other professionals, may then wish to comment publicly through means such as conference or publication on the kinds of approaches and insights underlying particular design outcomes. This constitutes a third form of contribution to public knowledge that is not patentable, but is recognized as a vital part of the research culture of any discipline.

Research and Knowledge

As to the relationship between research and knowledge, the dictionary definitions of research include "collecting information about a subject" in a way that is "careful or diligent." This diligent way also may involve a more complex "investigation and experimentation aimed at the discovery and interpretation of new facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws." [3]

An attribute of research in general that is embedded in the official guidelines of organizations such as the UK RAE is that it "contributes to knowledge." In this sort of description, knowledge seems to be principally the public kind, and accordingly, a contribution may be seen as something that is new, or different enough, to add to a public "bank" of knowledge. For patents, there is a highly developed and complex method that allows professional examiners to determine the extent to which knowledge claims may be deemed new additions. Unfortunately, for forms of knowledge "excluded" from patenting, such as intellectual discoveries and theories, it is far less clear-cut how they come to be accepted as additions. The primary mechanism is that of peer review by academics, publishers, and media editors.

3   Britannica Webster's, Encyclopaedia Britannica Online (www.britannica.com, 2002).

As a relatively young and emergent discipline, design introduces problematic issues of its own. There seems to be consensus that design is very much an interdisciplinary activity, attracting inward a variety of research paradigms from longer established academic disciplines.[4] There also seems to be some agreement even between those with differing views of design research, such as Charles Owen[5] and Ezio Manzini,[6] that it is right and proper for all the different specialists gathered under the design umbrella to develop new research paradigms.

Among the new paradigms entering design, is post-structuralism, or "the new criticism,"[7] which challenges traditional knowledge hierarchies. Although most evidenced in what used to be called literary criticism, the new approach is derived from the work of cross-disciplinary mentors including psychoanalyst Jacques Lacan and philosopher Jacques Derrida. Derrida argues that no form of knowledge is "centered," and that there is no unique "logos" or knowledge structure that is truer than any other.[8] In fact, Derrida's main point here already has been expressed by other philosophers, as different as Karl Popper and Richard Rorty. Popper has argued that knowledge comprises a network of theories, in which even the firmest beliefs appear to be provisional; subject to the discovery of a better theory.[9]

Rorty attacks the "foundational" view of knowledge, by which philosophers traditionally have assumed a privileged view of knowledge in general, which portrays different forms of knowledge building up from a hard base layer of the cognitive kind to progressively softer layers of the hermeneutic kind.[10] Popper seems to be one of these traditional philosophers, arguing that objective knowledge such as "The Earth orbits the Sun," holds a special place because the veracity of such propositions does not appear to depend on subjective choice. Objectivity is clearly an important feature of the way knowledge is viewed in the hard sciences, and may help to explain why even great creations such as relativity theory are more usually described as "discoveries." As recognized in the earlier discussion of patenting, design activity may involve some form of new discovery that can be tested in a way that provides reproducible results. However, design also encompasses forms of creative output which can be recognized, described, and evaluated; but only in the form of a critical activity that appeals to a sharing of personal experiences and aesthetic codes.

It is unlikely that many in design would want to claim that critical arguments impose the same sense of necessity on the understanding as do objective findings about, say, the physical performance of designed objects. Accordingly, by its very nature, design seems divided between views of knowledge that differ according to the kind of activity undertaken and questions posed. Designers frequently are called upon to tackle different problems, which involve different forms of knowledge and, thus, methodology. For

4   V. Margolin, "Design Research and Its Challenges," *Design Journal* 15:2 (1999): 14–19.

5   C. Owen, "Design Research: Building the Knowledge Base," *Design/Research Conference* paper (London: Royal College of Art, 1994).

6   E. Manzini, "Design Research for a Sustainable Environment," *Design/Research Conference* paper (London: Royal College of Art, 1994).

7   A. Seago and A. Dunne, "New Methodologies in Art and Design Research: The Object as Discourse," *Design Issues* 15:2 (1999): 11–17.

8   J. Derrida, *Margins of Philosophy* (Brighton: Harvester 1982).

9   K. Popper, *Objective Knowledge: An Evolutionary Approach* (Oxford: Oxford University Press 1972), 71-81.

10 R. Rorty, *Philosophy and the Mirror of Nature* (Oxford: Blackwell, 1980), 313-22.

instance, the writing of this paper involves critical discourse, which appeals to subjective experience, leaving the arguments open to a spectrum of personal interpretations. Although some of the product design work I am about to discuss is not open to the same level of subjective interpretation, it either performs to an international standard, makes valid patent claims, or it does not—and these issues can be resolved by reproducible testing and examination. Such work is not even typical of much product design, which concerns restyling familiar objects, an activity that could be the subject of a design patent, but not an ordinary one. Differing research methodologies are bound to underlie such different tasks, and people working on three such projects are bound to adjust their goals, knowledge claims, and research methods, without ceasing to be engaged in some form of worthwhile design research.

However, caution should be exercised in the selection of research methodologies and paradigms, as evidenced by the example of some of the new criticism. Consider the "Theory of the Gaze," which came from Laura Mulvey's 1975 article "Visual Pleasure and Narrative Cinema."[11] This has been a very influential, critical stance on film narrative, based on an entirely uncritical acceptance of Freud's theory of scopophilia, which although probably new to most in visual studies at the time, already was regarded as outmoded and unreliable by many in psychology.[12] When introducing ideas and methods from contingent disciplines, it is more advisable to select methodologies from them that seem appropriate for particular tasks. Through informed adaptation to specific requirements in design, existing methodologies may even be revised or expanded to become generally useful in design research. For instance, asking if a design is patentable is a useful way of assessing the degree to which people from all disciplines may consider it innovative, but not of regrading it critically.

Returning to the value of patents as indicators of worthwhile research activity, if numbers demonstrate anything, our colleagues in the corporate sector are making a far more prolific contribution to the field of product innovation than ourselves. However, to recognize this is not to exclude academic researchers from the field. There are many small-to-medium enterprises (SMEs) that cannot afford to maintain their own research and development units. To such organizations, universities can offer what in today's parlance is called "knowledge transfer."

In many countries, this transfer can be supported by state funding initiatives. We have been supported by European Regional Development Funding, with a directive to provide a subsidized knowledge transfer service to SMEs. This imposes the condition that we should not be competing for work with local design agencies. Academics have the benefit of being part of a much larger expert community, whose presence greatly increases the range of methods, techniques, and resources we can bring to bear in planning a goal-led

11   L. Mulvey, "Visual Pleasure and Narrative Cinema," *Screen,* XV1:3 (1975).

12   J. Eysenck and G.D. Wilson, *The Experimental Study of Freudian Theories* (London: Methuen, 1973), 1–13.

research program. Few private design agencies could or would want to compete with these resources, so this makes it easier for us to identify the kind of projects in which we want to get involved. Our rule of thumb is that we say "sorry" to any company asking us to "Design one of those," but welcome collaboration with anyone asking us "Do you think it would be possible to design something that...?" or "Are we going the right way about designing this?" A good demonstration of this principle is a case study of our collaboration with a small, but successful plastics company in our catchment area.

Case Study: Design for Rotational Molding

Europalite Ltd. molds plastic products such as road cones and grit bins by rotational methods. A rotationally molded form essentially is a single plastic surface bounding a closed volume—a hollow sphere is a basic example. On the other hand, an open form like a bowl is not typical, but could be made by cutting a rotationally molded sphere in half. The process also allows more complex shapes, such as a form pierced through by a hole—"genus 1" in mathematical language—as well as genus 2, 3, and so on; provided the walls of the holes are all orientated on the same axis and do not "return" into the body of the basic form. While the method is less flexible than other molding processes in allowing a variety of geometries, plastic offers more opportunities for constructing complex forms than similar processes such as clay slip casting. The vast majority of molds are split into two parts, which are filled with finely ground plastic, sealed, and then rotated biaxially in a large oven that causes the polymer to melt and attach to the wall surfaces inside the mold, which later may be split open to release the finished product. The two great advantages of rotational molding are that it can produce large products, and the mold tools are cheap to fabricate or cast, typically costing between ten and twenty-five percent of the price of much smaller injection tools. It is a relatively simple process, often associated with large utilitarian products of relatively low production quality, and large tolerances of accuracy.
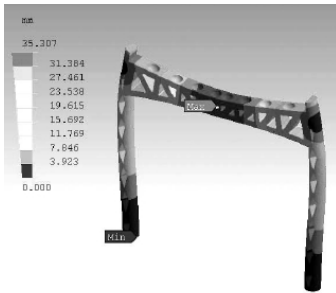
The managing director contacted us because he thought the process was capable of far more than his industry has demonstrated thus far. Early in our association, he suggested to that we investigate the possibility of designing an adjustable builder's trestle to compete with the tubular steel variety that are fabricated to meet stringent British Standards in safely supporting a working load of 650 kg (BS 1139:4:1982). His cheerful justification of why he should want to attempt such a project was, "Because I make things in plastic." While this had scared away design agencies, it proved irresistible bait to people who enjoy getting their students to build improbably strong bridges out of drinking straws. It was a project through which we felt we could learn, and this made it seem an ideal form of knowledge transfer.

For this project, we purchased a basic Finite Element Analysis (FEA) computer software program, *Design Space,* not only to assist the design process, but also to evaluate an application which, in principle, should be usable by product designers and not just trained engineers. Having generated a number of concept designs (figure 1), some were input into *Design Space,* which grudgingly started to give answers to the engineering questions (figure 2). It was not until the project was almost completed that we discovered we had been asking the program to do more than it was designed to, analyzing hollow forms rather than solids. We cross-checked the FEA solutions by taking small segments of a given part and calculating the answers manually. Then we fabricated a prototype steel tool using the final design selected.

In this case, we discovered that the loading simulations were within twelve percent of the real values found in the final design. We concluded from this that the latest FEA applications could be viable tools for product designers without formal engineering training. Despite our reservations about the eventual commercial viability of the trestle, we sought throughout the project to exploit the inherent advantages of a molded trestle by limiting the components to four forms that could be inexpensively molded with few fabrication steps thereafter, and assembled from a flat pack by the user. We were able to contract the standards testing in-house to our engineering laboratories. The dissemination of what we had learned was accomplished in part through the filing of a patent.

Another vital part of our mutual learning was an investigation into whether it was possible to increase the strength of the polyethylene polymer we were using, perhaps by glass fiber

reinforcement. This investigation demonstrates the value of patent literature to design researchers, since we found two patents from the 1980s which showed the polymer suppliers to be wrong in their assertion that rotationally molded plastics could not be successfully glass reinforced. When we tried to replicate the methods disclosed in the patents, the results showed the fiber tended to migrate into the inside of the product walls and was poorly packed, which made the strength of the compound less than expected in comparison to other molding methods. Proceeding in a way more reminiscent of Edison's empirical approach to the light bulb than of contemporary polymer engineers, we guessed that the problem lay in the glass strand dimensions. So we obtained samples of several nonstandard strand types to compound in a variety of different test batches. We were fortunate in achieving the desired result of a greatly strengthened product within a few hours of molding.

The next task was to further improve the strength of the glass-to-polymer bond by finding a more appropriate chemical coupling agent than those described in the patents. Despite superb support and advice from Akzo Nobel and Hoechst, we encountered far greater difficulty in these tests. The eventual solution again was derived from a leap of designer's intuition, rather than formal analysis. We felt an instinctive discomfort in suggesting that the workforce made up the molding compound with a rather hazardous liquid chemical. This led to a search for a powder-based form, which we could not find, but we did come across a similar product used in rheology rather than coupling, that had a fine chalk powder of similar grain size to the polymer. Again, we used empirical methods to find the correct concentration, and the strengthening effect was so tangible we scarcely needed laboratory testing to tell us which measure and mixing method gave us the best coupling. The results of this work are to be disclosed in another patent application.

The final example concerns a project more within our range of expertise, which arose from the company's success in persuading us that there was untapped potential in rotational molding. The problems to be overcome had more to do with the standards of toolmaking than of product design. The tolerances of steel-fabricated mold tools are at least 2mm over 1m, and wall thickness can vary up to twenty percent. In theory, an aluminum tool cast from a wooden model, or pattern, can be made accurate to fractions of a millimeter, but then the patterns are hand-built from the design drawings and therefore prone to larger errors. In the trestle, we had to connect opposing walls in the hollow form to create a true structure, rather than a void enclosed by unconnected walls. We did this by dimpling key areas of the walls to create "kiss points" inside the form as the product molded (figure 3). The unconventional dimple forms we created did not endear us to the toolmakers, whose notions of engineering tolerance did not endear them to us. If we could find a more

accurate way of generating the patterns, we felt we could overcome the limitations of the process to liberate its potential.

The molding ovens can be as large as four meters in diameter, which means smaller products can be tooled as "parasites" that are just fixed into any space not filled by a larger product being molded. Given tooling costs of as little as £2,000 to £3,000 for a product the size of a flashlight, the parasites can act as prototype generators which, if successful, can be duplicated so that arrays of these small products can be molded ten or twenty at a time at a fraction of the cost of an injection-molding tool manufacturing them at a comparable rate. So rather than trying to apply rotational molding to products never made before in plastic, we were seeking to advance rotational molding into a more competitive form of making plastic products. A good vehicle for this idea turned out to be a "hard hat," a product always injection molded, with a typical tooling cost of £80,000 to £100,000. Since a hard hat essentially is a shell supported by an adjustable webbing cradle, we set out to see if it were possible to turn the underside of a rotationally molded hat into a webbing, and find an alternative method of adjusting the headband to fit all sizes of head (figure 4).

The design solutions seemed relatively simple. The adjustable back of a baseball cap shows how a broad range of hat size adjustments could be made by attaching a belt-type strap to two small lugs on the rim. The webbing could be created by cutting the shapes of the holes in the webbing from a low thermal-conducting material, and then fixing these cut-outs on the relevant surfaces of the mold tool so that no plastic would form on them. However, the real problem was how to ensure the accuracy of tooling that was essential
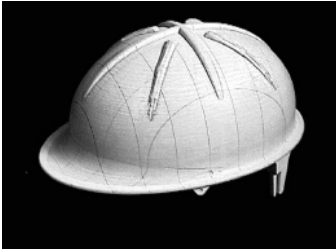
Figure 5
Rapid prototype model of hard hat in laminated paper.

from a structural point of view as well as an aesthetic one, because this was an apparel item. Construction workers appear to have a greater consciousness of their appearance than may be imagined. Evidence comes in the form of the novelty *Stetson* hard hat, which apparently is a major seller in the U.S. heartlands. The fact that our hat has ribs which form a Union Jack is completely fortuitous, a result of our mainly structural approach to the task. Nevertheless, we were perfectly happy to exploit this accident and have only half-jokingly suggested that the client might consider marketing it in the UK as the "Jack Hat."

As to making an acceptably accurate model, we turned to our colleagues at Nottingham University to help us rapid prototype an extremely accurate solid model direct from our original CAD files. For this relatively small product, it was economically acceptable to use the LOM (laminated object manufacture) process. This produces the "wood" model by scanning the CAD model in paper-thin horizontal slices, and then laser-cutting the slice from a sheet of paper, running a glue-impregnated roller over the slice and then repeating the procedure to generate the complete model (figure 5). Plaster patterns were taken from the model, from which the aluminum mold tool parts could be sand-cast. The tool casting is taking place at the time of this writing, so the results are not yet fully known. However, we are confident that our approach is the way forward to realizing the larger objective of introducing rapid, accurate toolmaking right from the designer's CAD files in order to facilitate a new generation of products that conform both to consumer expectation and to the necessary regulatory standards for public health and safety.

Conclusion

As to the lessons that can be learned from the practice of contract research in design, the following seem instructive. Unlike art or craft activity, professional design generates plans that are seldom realizable by the designer, and require the application of technologies and resources largely controlled by third-party commercial enterprises. Those seeking to develop a consensual view of design research should not overlook the real relationship of design with commerce. Commercial imperatives clearly impact on designers' research approaches as well as their practice. It may appear from the case studies that goal-led research for commercial clients encourages less inhibited methodology, because the primary goal is research that produces a tangible commercial effect. Yet while ends very much justify means in contract research, they do not necessarily handicap good design research. The design researcher need not have all the expertise required by the project, good project management skills are more appropriate, and key among these is the ability to recognize what expertise and methodologies need to be introduced from outside the discipline. This suggests that breadth of knowledge is an important characteristic of both design researcher and practi-

tioner, and further implies that depth of specialist knowledge may not count as much as in other disciplines. We have found that the effect on clients of working with academic researchers is to liberate their risk-taking and playfulness, which are vital ingredients both for creativity and formulating interesting research questions. Play involves a considerable element of trial and error, an approach that may have become rather unrespectable in formal scientific research, but is very much a part of the designer's working method—especially since product design involves speculative activities such as criticism, which appears to play little or no role in the practice of "hard" science. Some of the research methods described in our case study might appear too informal to purely academic researchers. We defend the methods on the basis that the contracted goals were achieved, allowing new products to be realized and their designs appropriately reported and disseminated, for instance, through patent applications. These reflections may suggest that a shared understanding of design research is as well assisted by retrospective examination of practice as by prospective theoretical debate.

Rethinking Design Policy in the Third World
Sulfikar Amir

Introduction

The unfortunate social and economic conditions of Third World[1] societies have instigated designers and design scholars to pay attention to the needs of this two-thirds of the world population. The "ideology" of design as problem solving drives designers and design scholars to think about how design can contribute to helping Third World societies. The 1970s witnessed the emergence of this awareness. Victor Papanek, in his classic *Design for the Real World,* called for designers' attention to the predicament of these societies. As an industrial designer, Papanek believed that "design has become the most powerful tool with which man [and woman] shapes his [and her] tools and environments (and, by extension, society and himself)." Furthermore, Papanek asserted that "design must become an innovative, highly creative, cross-disciplinary tool responsive to the true needs of men [and women]."[2] Papanek's notion of design for the Third World was quite novel at a time when most designers in industrial, developed countries were concentrating on serving profit-oriented industrial corporations, celebrating high mass consumption society.

Following Papanek's challenge, the International Council of Societies of Industrial Design (ICSID) organized the *"Design for Need"* conference in April 1976. Held at the Royal College of Art, the conference represented the international design community's general awareness of design's responsibility in contemporary society, examining the social contribution of design at both the philosophical and practical levels. Gui Bonsiepe, a Brazilian design thinker, provocatively brought up the issue of design in Third World countries in a broader sense. Bonsiepe's point of view, however, was quite different from that of Papanek. While Papanek proposed the idea of design for the Third World from the materiality of design, Bonsiepe construed the issue of Third World design from the political and economic relations between the First and the Third World, or in Bonsiepe's terms using a Marxist-oriented dependency framework, central and peripheral countries. Bonsiepe scrutinized the inequalities in the distribution of wealth caused by a system of unequal exchange or "value transfer" from peripheral to central economies. He proposed a model of design transfer that would rely on an industrialization policy "that promotes a self-centered or autonomous economy, as

against an outer-directed, dependent economy." Bonsiepe argued that this policy would enable design to "contribute to the satisfaction of local needs perfectly with local material and locally developed technology." [3]

Over two decades after Papanek and Bonsiepe first conveyed their ideas of design for Third World societies, the social and economic conditions of these societies have not changed much if one compares them today with thirty years ago. It seems that the paradigm of design as problem solving for Third World societies remains utopian, for these societies still are submerged in many social and economic dilemmas such as poverty, lack of adequate shelter, poor health facilities, lack of education, malnutrition, and so forth. The idea of design for the Third World advocated by either Papanek or Bonsiepe did not really work because they lacked political dimensions in their implementation. Therefore, this article seeks to offer a new perspective to implement the idea of design as a solution for Third World societies by looking at the interweaving of design and politics.

Political Economy of Design

As Jacques Giard [4] points out, design does not, and cannot, exist in a contextual vacuum. Design always is connected to a broader context that includes political systems, economic models, and cultural milieus. In a similar vein, Edward Woodhouse and Jason Patton [5] assert that political, cultural, economic, and environmental factors always are embedded in design, thus producing far-reaching implications. Hence, a more comprehensive formulation of the concept of design for the Third World should begin from an understanding of the complex interrelationship between design and social, cultural, and political factors. From this standpoint, I want to extend the conception of design from "proximate designers" to "design by society." According to Woodhouse and Patton, proximate designers are professional designers "who work at the drawing board, exercising the finest level of control over the details of design," while design by society is an awareness that "myriad persons participate in the design process with varying degrees of immediacy." The design by society framework enables us to view design in a broader perspective, and to construct a new direction for coping with the problem of Third World societies.

To comprehend how design evolves from an individual activity of proximate designers into an "object" of politics, we should understand the political economy of design. This begins from the notion of design as a process of creating artifacts that have economic value. In the aggregate, the economic value of design produces a considerable impact on economic systems. Although design usually is taken for granted in economic theories, several studies have shown the significance of design for economic growth. [6] This economic significance brings design into the political arena in which design is

3   Gui Bonsiepe, "Precariousness and Ambiguity: Industrial Design in Dependent Countries" in Julian Bicknell and Liz McQuiston, eds., *Design for Need: The Social Contribution of Design* (Oxford: Pergamon Press, 1977), 13–19.

4   Jacques Giard, "Canadian Design and the National Agenda: Toward the Year 2005," *Design Management Journal* 7:3 (1996): 28.

5   E.J. Woodhouse and J. Patton, "Design by Society: Science and Technology Studies in the Social Shaping of Design," *Design Issues* **20:3** (Summer 2004): 1–12.

6   Studies of the relationship between design and economic competitiveness are to be found in: O. Davidson Ughanwa and Michael J. Baker, *The Role of Design in International Competitiveness* (London: Routledge, 1989); Robin Roy and Steven Potter, *Design and the Economy* (UK: Design Council, 1990); and Vivin Walsh, et al., *Winning by Design: Technology, Product Design, and International Competitiveness* (Oxford: Basil Blackwell, 1992).

situated as a public policy object. In a broad sense, public policy is construed as the pursuit of particular purposes, where the government as the holder of public authority decides the policy objectives and the way to achieve them. Hence, design policy is a form of the government's political and economic intervention into public sectors to influence the development of design in society.

There are two good reasons for discussing design policy in Third World countries. First, Third World governments recently have shown an increasing awareness of design. The establishment of design centers and institutes, and the growing number of design schools with the government's support in Third World countries, indicates this trend. Second, the endeavors to bolster design activities in Third World countries are motivated by the idea that design is a strategic tool for business and commerce,[7] and thus important for economic growth. How this design policy orientation becomes a "mainstream" model in Third World countries, and whether this design policy model is adequate to encounter the problems of Third World societies, are two questions addressed here. Throughout this paper, I will examine whether the "mainstream" model of design policy has a felicitous rationale, given the current dilemmas of Third World societies. Furthermore, I shall propose a model of design policy that situates people as the main concern of the policy by incorporating democratic, participatory approaches in the determination of design policy outcomes.

Design Policy in the Third World

The discourse of design policy in the Third World arises from today's global economic situation, which imposes a double bind on Third World countries. On one side is the substantial size of the Third World's foreign debt to First World financial institutions. This is a very serious problem that Third World countries face, because it not only severely burdens their economies but also shapes the Third World's economic dependency on the First World. Looking at how foreign debt has trapped Third World countries in a vicious circle, Arturo Escobar[8] analyzes the emergence and consolidation of the discourse and strategy of development in the early post-World War II period as a result of the problematization of poverty. Using Foucauldian frameworks, Escobar scrutinizes the utilization of allegedly "neutral" and "universal" knowledge, particularly development economics, in "rescuing" the Third World. Through this knowledge, a type of development was promoted which conformed to the ideas and expectation of what First World countries judged to be a normal course of evolution and progress. Furthermore, Escobar points to the basic set of elements and relations that hold together the discourse of development, and define its hegemonic worldview. This increasingly permeates and transforms the economic, social, and cultural fabric of the Third World, and creates its perpetual dependency on the First World.

7   Christopher Lorenz, *The Design Dimension: The New Competitive Weapon for Product Strategy and Global Marketing* (Oxford: Basil Blackwell, 1990).

8   For the discussion of the discourse of development and the emergence of development economics, see Chapter 2 and 3 of Arturo Escobar, *"Encountering Development: The Making and the Unmaking of the Third World"* (Princeton: Princeton University Press, 1995).

To reduce foreign debt and its burdensome implications, Third World countries have been trying to increase the export value of industrial products for international markets. This is an economic solution that can be pursued by them, yet is not easily attainable. Third World countries have to face the reality of an economic globalization in which international trade is becoming more and more rigorous. This is the other side of the double bind. Although promising a free market system, as David Korten[9] asserts, the global economy in fact primarily serves the benefit of powerful corporations and financial institutions of the First World.

Nevertheless, globalization with all its economic, political, social, and cultural implications already is here and, as Thomas Friedman[10] suggests, embracing it is the only rational attitude to take. Thus, to dissolve the double bind, Third World countries are compelled to increase their industrial product competitiveness. This is the entry point of design policy in the Third World. The unequivocal advantages of design for the economy, as shown in the case of Japan[11] and South Korea,[12] have inspired Third World governments to give considerable attention to design policy. Today, industrial-oriented design policy in the form of design promotion centers, design institutes, and the like is growing in a number of countries.[13] For example, the Malaysian government established the Malaysia Design Council in 1993 to determine the best use of design by Malaysian industry. The Indonesian government created the Indonesian Design Center in 1995 with assistance from the Japan International Cooperation Agency and the Japan Design Foundation.[14] In the Philippines, the Product Development and Design Center of the Philippines was created by the government to promote industrial design as a tool for improving the quality and competitiveness of Philippine products. The Thai government has created the Office of Product Development & Design for Export. In India, design policy is implemented through the establishment of the National Institute of Design, which puts an emphasis on educating designers and serving industry. In Colombia, there exists *Artesanías de Colombia,* while in Cuba there is an *Oficina Nacional de Diseño Industrial* (National Office of Industrial Design). In Mexico, the government created the Mexico Design Promotion Center, whose tasks are similar to those of design institutions elsewhere. In Brazil, the Brazilian Design Center has done an excellent job of fulfilling industry's needs in the industrial area of Sao Paulo. In South Africa, there is a similar institution, the SABS Design Institute, which fosters the economic and technological development of that country.

Due to the diversity of economic and political systems, there are distinctions among these countries in terms of how design policy is implemented. Yet one can still squeeze out similarities among these measures that encompass the factors of policy orientation, policy subject, and policy agency. First, as already discussed, economic interests characterize the orientation of design policy in

9   David Korten, *When Corporations Rule the World* (Bloomfield: Kumarian Press, 1995).

10 Thomas Friedman, *The Lexus and the Olive Tree: Understanding Globalization* (New York: Anchor Books. 2000).

11 See John Heskett, *Toothpicks and Logos: Design in Everyday Life* (Oxford: Oxford University Press, 2002): 184–186.

12 See Kyun-Wong Chung "Strategies for Promoting Korean Design Excellence," *Design Issues* 14:2 (1998): 3–15.

13 Design institutions presented here are based on the data obtained from the Website of the International Council of Societies of Industrial Design (ICSID) <www.icsid.org>.

14 More information on design policy in Indonesia can be found in my article "Industrial Design in Indonesia: Education, Industry, and Policy," *Design Issues* 18:1 (2002): 36–48.

Third World countries, which treats design as a strategic tool for industrial competitiveness. Second, since design policy is aimed at improving industrial competitiveness, it is very obvious that the subjects of the policy are industrial corporations. The important feature of design policy is to encourage those corporations to utilize design more intensively in product development and innovation processes. Third, even though some models of design policy emerge from the initiatives of non-governmental groups,[15] the role of government in design policy undoubtedly is central and vital because the government conceives and approves design policy decisions, and provides financial support.

Human-Centered Design Policy

Undoubtedly, design policy in Third World countries is an advantageous trend for design communities. It indicates the government's awareness of design's potential, giving design an important position equal to other fields such as science, technology, and economics. Yet it should be noted that a discrepancy emerges between this industrial-oriented design policy and the social and economic realities of a large number of people in the Third World. While design policy appears to be serving industry's needs to increase its competitiveness in the international market, it overlooks local people in terms of alleviating poverty and fulfilling their basic needs. Design policy focuses heavily on questions of how to utilize design more intensively in industrial production, yet it neglects questions such as: What is the strategy to empower laypersons through design so they can build their economic life more independently? How does design play its social and cultural role in a situation in which Third World societies are marginalized? How can designers be made more socially and culturally conscious of local people's needs?

Questioning industrial-oriented design policy is ethically important if we take seriously Richard Buchanan's reminder of the ontological meaning of design for human dignity and human rights:

> Design is not merely an adornment of cultural life, but one of the practical disciplines of responsible action for bringing the high values of a country or a culture into concrete reality...[D]esign is the way we create all of the artifacts and communications that serve human beings, striving to meet their needs and desires, and facilitating the exchange of information and ideas that is essential for civil and political life. Furthermore, design is the way we plan and create actions, services, and all of the other humanly shaped processes of public and private life. These are the interactions and transactions that constitute the social and economic fabric of a country. Finally, design is the way we plan and create the complex wholes that provide a frame-

15 Some models of design policy initiated by non-governmental groups are discussed in two special issues on design policy in *Design Management Journal*: (1) "Design and National Policy: Assessing Government's Options in Design Management" 4:3 (Summer 1993) and (2) "Design and the National Agenda" 7:3 (Summer 1996).

work for human culture—the human systems and subsystems that work either in congress or in conflict with nature to support human fulfillment.[16]

Buchanan insinuates our pragmatic attitudes of exploiting design, and invites us to ponder the dimension in which design should be treated in its relation to society. This means reminding ourselves that design is for people. It is from this perspective that we need to rethink design policy in Third World countries, which has been heavily focused on competitive economic purposes.

If industrial-oriented design policy is not adequate to answer the problems of Third World societies, then what kind of policy is to be conceived? This article, however, is not intended to answer the question by giving prescriptive concepts. Rather, it calls for awareness that design policy should be aimed at society not solely at of industrial corporations. Therefore, following Buchanan's notion of the foundation of human-centered design,[17] I propose a human-centered design policy that takes into account the transformation of the orientation, the users, and the initiator of design policy.

In its intrinsic meaning, policy is a sort of design that involves analytical as well as creative processes in solving social problems. In this instance, constructing a human-centered design policy might start from Langdon Winner's illuminating concept of political ergonomics. This is developed as a discourse in which politics and design are interwoven by understanding the selective forces that influence the shape of artifacts, as well as their role in shaping human affairs. Winner applies the concept of ergonomics to the science of politics that shapes the policymaking process.

> The study of political ergonomics ... is a logical outcome of the critical study of technology and politics that has been brewing in much of twentieth-century thought. Many criticisms about the relation of technology and social life are actually a commentary about an unhappy fit between the two. If different forms or design of technology are suited to the qualitatively different forms of social and political existence, then the science of politics must include an ergonomics able to specify a suitable fit between the body of politics and its instruments.[18]

Political ergonomics offers us the notion of the structures that embody a political system. Like a designed artifact formed by purposeful structures, Winner explains that a political system is constituted by structures that establish coherent patterns of enablement and constraints within a given medium or set of related media. While the enablers strongly encourage certain outcomes, the constraints build a wall obstructing others. Thus, political ergonomics seeks to arrange a composition of these structures so as to fit the social and cultural realities of a society.

16 Richard Buchanan, "Human Dignity and Human Rights: Thoughts on the Principles of Human-centered Design," *Design Issues* 17:3 (2001): 35–39.

17 Ibid., 37. Criticizing the reduction of human-centered design to matters of sheer usability, Buchanan redefines human-centered design as a fundamental affirmation of human dignity.

18 Langdon Winner, "Political Ergonomics" in Richard Buchanan and Victor Margolin, eds., *Discovering Design: Explorations in Design Studies* (Chicago: The University of Chicago Press, 1995): 163.

The notion of structures can be used in transforming an industrially oriented design policy into a human-centered one. Thoroughly analyzing the former, we are able to find that this sort of policy is surrounded by structures enabling industrial interests to influence the nature of design policy, while building constraints that hinder local people from putting their needs, desires, and interests into the policy. Therefore, the implication of political ergonomics in implementing a human-centered design policy is the creation of a fairer political setting of design policy that allows lay people to influence orientation. Certainly, this requires the willingness of the government as well as the design community (designers and design scholars) involved in design policy to include local people's needs, desires, and interests in national design agendas.

The institutionalization of human-centered design policy can be characterized by three principles, which replace those of the "mainstream" mode of design policy. First, a human-centered design policy is directly oriented toward people's needs and interests. Within this orientation, design is treated as a social and cultural tool for creating a better life for Third World societies in accordance with their social and cultural infrastructures. Second, the targeted-users of human-centered design policy, as expressed in its name, are people. Here, the function of design is not limited to producing physical artifacts, but is extended to enhancing sociality and improving equity in Third World societies. And third, although the role of government in human-centered design policy remains important, the participation of many stakeholders such as design practitioners and academicians, and local communities, plays a pivotal role in influencing design policy outcomes. This participatory model of design policy politically empowers design to be utilized more effectively in dissolving the predicaments of Third World societies.

Conclusion

I want to emphasize that the social and economic problems of Third World societies cannot be solved solely through the materiality of design, such as creating low-cost products using local material, charity design, and the like. What underlies the problem is a structural condition that needs to be solved through a structural solution. This is the reason why the discussion of design policy is relevant because it involves political factors in its implementation.

We have seen that design policies in Third World countries are mostly aimed at increasing the competitiveness of industrial products. This sort of design policy, however, overlooks the unfortunate social and economic conditions of Third World societies. Thus, the concept of human-centered design policy is proposed to revive the ontological meaning of design for the betterment of society. This model of design policy centers on people's social and cultural realms by incorporating participatory approaches in determining design policy outcomes.

Two immediate questions arise in response to this proposal. First, the whole argument conveyed throughout this article that criticizes the industrial-oriented design policy seems to undermine the precariousness of foreign debt that most Third World countries face. Indeed, foreign debt is a very crucial problem, but the effort to cope with it has commanded too much attention, while the actual needs of Third World societies have been neglected. Focusing design policy on people's needs and interests is much more crucial, because people have the right to live in better conditions than they do now. Second, the idea of incorporating democratic principles into design policy through participatory approaches is not easy, given the fact that democracy in many Third World countries is rarely practiced.[19] Yet this does not mean that the concept proposed here is impossible. What is needed is the openness of designers, design scholars, and policymakers in Third World countries to democratic ideas and practices. This could be hard work for them, but making design more socially, economically, and culturally useful for Third World societies through human-centered design policy is worth the effort.

19 For more discussion on this topic, see Howard Handelman, *Democracy and Its Limits: Lessons from Asia, Latin America, and the Middle East* (Notre Dame, IN: University of Notre Dame Press, 1993).

Design Enquiry: Tacit Knowledge and Invention in Science
Chris Rust

For some years, there has been discussion and speculation on the subject of "design enquiry," and a number of people, for example Richard Buchanan[1] and Clive Dilnot,[2] have looked for forms of enquiry appropriate to, or fruitful for, design as an academic and professional discipline. From a different perspective, Ranulph Glanville[3] has suggested that the relationship between design and science might be redefined to acknowledge similarities of method that are disguised by forms of narrative employed by scientists. However, most contributions to these debates deal with generalizations, so I would like to propose some specific ways in which designers can explore and develop the concepts and practices of design enquiry.

In particular, I would like to discuss a kind of enquiry in which designers can play a role in forming and pursuing questions that arise in the natural sciences, and I will suggest that this role might be extended into some other fields. In doing so, I will make reference to the subject of tacit knowledge, a concept which was formalized by Michael Polanyi in his consideration of the philosophy of science fifty years ago, and which has attracted continuing interest,[4] but also some shallow interpretation since then.

I believe that Polanyi has a great deal to offer the design community, perhaps more in some respects than the widely cited work of Donald Schön, who dealt with general questions of practice relevant to many disciplines, while Polanyi addressed the relationship between enquiry and creativity in a very direct way.

In the natural sciences, enquiry is concerned with uncovering or discovering that which exists. "Invention" is not considered to be a feature of scientific enquiry and perhaps is not compatible with the dispassionate relationship with knowledge that scientists traditionally have claimed. Design, by contrast, claims invention (and personal ownership of it) as a central principle, so it is difficult at first to see where the two traditions can overlap. In this paper, I will set out some ways in which they can cooperate and, in doing so, support the distinct goals of both.

Polanyi—Illumination and the Tacit Dimension
A central problem of science is how to recognize and define worthwhile subjects for investigation. For one thing, we may be faced with myriad opportunities and no means to decide which are going to be

1   Richard Buchanan, "The Study of Design: Doctoral Education and Research in a New Field of Enquiry," *Doctoral Education in Design Conference,* Ohio 1998.
2   Clive Dilnot, "The Science of Uncertainty: The Potential Contribution of Design to Knowledge," *Doctoral Education in Design Conference,* Ohio 1998.
3   Ranulph Glanville, "Researching Design and Designing Research," *Design Issues* 15:2 (Summer 1999): 80–91.
4   Polanyi's 1958 book, *Personal Knowledge,* was reprinted most recently in 1998 and 2002.

fruitful. On the other hand, our environment may limit our ability to recognize scientific problems and possibilities, especially the ones that could lead to significant changes in our understanding.

To illustrate this second problem, philosophers have speculated on the science and culture of imaginary worlds which have fundamentally different and more restricted conditions than ours. If you and your environment consist of gases with no solid objects to reflect on, then you may not be able to conceive of geometry as we know it. If you lived in a one- or two-dimensional world, you would have a very different set of concepts from us and, no doubt, people living in a five-dimensional world would see us as conceptually impoverished in much the same way.

Artists also engage with these issues, often in stimulating and accessible forms. For example, science fiction writers explore imaginary worlds which shape their civilizations in ways that may inform us about our own experience. Brian Aldiss [5] described a world in which each season lasted for many lifetimes, including a harsh winter which few people and institutions survived, effectively cutting people off from their history and most of the knowledge acquired during the previous summer. This fictional device provided a fresh perspective for the examination of individuals and societies confronted with difficult circumstances.

These abstracted questions have their parallels in everyday life and more mundane enquiries. Michael Polanyi [6] describes the "logical gap" between existing knowledge and any significant discovery or innovation. No matter how thorough our factual knowledge of the situation which we inhabit, the pursuit of logical reasoning or iterative development of existing concepts would not, on its own, allow us to cross this gap. There also must be some kind of leap of "illumination" by which the scientist imagines a new concept and proposes it as a worthwhile subject for investigation. As Polanyi says:

> Illumination... is the plunge by which we gain a foothold in another shore of reality. On such plunges, the scientist has to stake, bit by bit, his entire professional life.[7]

If the gap between our existing situation and the new world which we wish to inhabit is made wider by our inability to conceive of what that world is like, then, I suggest, that is where designers can help.

Polanyi was concerned with what he called the "tacit dimension" in our knowledge. In particular, he wished to give proper value to the process of recognizing, and making a commitment to, ideas or hypotheses, which may result from a rich understanding and knowledge, but cannot be explained by explicit reasoning, in order to carry out the enquiry that will lead to them being more widely understood and accepted.

I have used the term "accepted" rather than "proved" (itself shorthand for Karl Popper's concept of a falsifiable hypothesis

5 Brian Aldiss, *Helliconia Spring* (London: Jonathan Cape, 1982).
6 Michael Polanyi, *Personal Knowledge: Towards a Post-Critical Philosophy* (London: Routledge, 1958).
7 Polanyi, *Personal Knowledge,* 123.

that has proved so far to be reliable) because Polanyi held that all scientific knowledge is a question of "passionate belief" rather than dispassionate proof, requiring us to take account of the methods, competence, judgment, and integrity of scientists, and the knowledge and principles that we already hold, before we accept the knowledge which they offer us. This seems much more reasonable today, when more people appreciate the limitations of science, than fifty years ago, when Polanyi was developing his ideas.

So where does designing come into all this? Through working with designers and scientists, and observing other such collaborations, I have come to the conclusion, a "passionate belief" if you like, that the ability of designers to imagine new scenarios, and to create a practical environment for us to experience them by producing experimental artifacts, is a valuable aid for scientists who want to identify ideas that merit investigation. Going further, it is possible that, in some cases, the actual enquiry and its possible outcomes may be defined by a scenario designed to enable it.

Polanyi made a valuable contribution by asserting the importance of the "illumination" which guides scientific enquiry, suggesting that it could be more significant than the subsequent process of investigation. It is conventional, in reporting scientific findings, to emphasize the rigorous process of "proof," and pay very little attention to the genesis of the enquiry. I would like to suggest that the undervalued "creative" dimension of scientific enquiry needs to be emphasized, and that designers, through their practical contributions, can be instrumental in drawing attention to this.

Designing New Worlds

So far, I have referred to the natural sciences, and that is the main area of opportunity that I wish to consider. However, many of the ideas which inform these thoughts have arisen from interactions between design and the social sciences, which have led to new ways of designing and a new role for the designer.

In a well-known example, Pelle Ehn and Morten Kyng[8] described work on the design of computer systems where the designers had to overcome two important problems. First, they needed to draw on the knowledge and experience of people whose work would be supported by the new system, and second, they did not have effective ways of prototyping design ideas which depended on new technologies not yet readily available or affordable (in the 1980s) or easily understood by their audience.

In response to this problem, Ehn and Kyng adopted a technique, which they described as the "cardboard computer," using very simple paper and cardboard representations of the different parts of the system. For example, a matchbox represented a mouse, a cardboard box was a laser printer, and a piece of paper taped to the wall was a computer screen.

8 Pelle Ehn and Morten Kyng, "Cardboard Computers: Mocking-it-up or Hands-on the Future" in J. Greenbaum and M. Kyng, eds., *Design at Work: Cooperative Design of Computer Systems* (Hillsdale, NJ: Lawrence Erlbaum, 1991), 169–195. Similar techniques now are used in a number of fields, and the terms "paper prototype" or "low-fidelity prototype" often are used to describe them.

Although this might appear to be a crude approach driven by cost and expediency, it had some significant advantages over more sophisticated prototyping. As well as being extremely fast to set up and modify, it allowed the participants in the exercise to recognize that judgment was being suspended—they were engaged in an imaginative play activity in which they did not have to concern themselves with technical or organizational limitations, just explore the possibilities and problems of the ideas represented in the cardboard system. In addition, anybody could modify the cardboard system. If they felt that the laser printer should be in a different position, they just picked it up and moved it. If they thought the information on the computer screen should be shown differently, they could change it themselves or draw a new screen on a fresh piece of paper.

This allowed the participants to play a very full and uninhibited role in the development process, a fact that was underscored by later experiences with real prototypes that could only be modified by computer experts, reducing the other participants to passive observers who would easily lose interest. The most important value of the cardboard computer process was the way it allowed participants to enter into an imaginary world (which they would not have been able to envision by other means), explore it, and, most important, manipulate it to further their exploration.

This process unlocked the participants' tacit knowledge gained through years of practical experience. They acted out both the scenarios of their existing work and the new scenarios of the future workplace to build up a rich picture of how the new system might work. Arguably, the "knowledge" which thus was mobilized was inaccessible by other methods and, most important, it only became "explicit" in the sense that it was embodied in the design and procedures of the new system.

The idea that people's tacit knowledge somehow can be extracted and made explicit in the form of rules for all to employ is expressed often in the field of knowledge management but, in my view, it is fundamentally misguided. Each of us has a tacit understanding which allows us to respond to different situations differently but, in general, appropriately. It is possible to harness that understanding in activities that provide us with design ideas and principles, or with other insights helpful to our investigation, but these will be new explicit knowledge. The original tacit knowledge held by individuals is unique to them, a product of their whole experience, and not a direct source of generalizable knowledge.

Symbolic Languages and Rich Representations

If designers are to play a constructive role in multidisciplinary enquiry, we need to understand what will be different and helpful in their contribution. One feature of a design-based enquiry is that it can generate artifacts, another is that designers are skilled in organizing and representing artifacts. This may not appear central to the

idea of scientific enquiry, but it might become very significant if we consider the role that systems of representation have played in the development of thought.

The invention of symbolic languages allowed reasoning of a far greater scope than was possible before, and it can be argued that it was only language that allowed us to transcend our relatives, such as chimpanzees, that are intelligent and inventive but unable to manipulate ideas with the kind of complexity that characterizes human thought.

How we think, and the kinds of knowledge that we can develop, depend heavily on the symbolic languages available to us. Scientists and others may invent or adapt notations or vocabulary to facilitate their thinking, and there is a constant tension between the requirements of specialist thought and those of comprehension by a wider audience.

Early forms of text were pictographic, and grew from literal pictures, but today we use simplified abstract characters. Polanyi [9] suggested that, to be useful, a language needs a relatively small set of symbols which can be used flexibly to represent complex ideas. He called this the "poverty principle." Symbols or words which each represent single complex ideas create an unwieldy language that is much harder to learn. We need to work within a vocabulary of manageable size.

So it can be argued that the historical move from one-off literal pictorial representations to the generalized alphabets that we take for granted today is essential for the development of knowledge. However, it may be profitable to consider how different forms of representation, including complex, very specific artifacts, can support our efforts to employ tacit knowledge in our enquiries, whether we are seeking to engage our own tacit processes or those of our audience. This tension between simplified generic symbols and complex specific representations reflects the relationship between atomistic methods, which have been so successful in advancing scientific knowledge, and the holistic outlook needed for successful design.

To illustrate this, I would like to give an example from research that included the experimental use of creative design practice, and resulted in the accumulation of artifacts that had been produced or employed in the research. As well as being evidence of the process, such a collection also can act as a visual notebook of the research, readable by those who have been involved in it.

Efforts were made to exploit this resource, initially by simply laying out all of the research material in one space to facilitate a review of the project.[10] It was apparent that the collection of drawings and three-dimensional objects provided a record of the research in which all aspects of the work could be seen and encompassed in a holistic fashion by the researchers.

9   Polanyi, *Personal Knowledge,* 77–82.
10 This work was described in detail by Chris Rust and Adrian Wilson in "A Visual Thesis? Techniques for Reporting Practice-Led Research," *Proceedings of the 4th European Academy of Design Conference,* Aveiro, Portugal, April 2000, 68–72.

The connections between the many different aspects of the research and the great variety of narratives embedded in it could all be traced without losing the overall picture. Subsequently, it was possible to construct a large number of simpler composite images, each collecting together material relevant to an aspect of the work, and providing a basis from which that part of the research narrative could be constructed.[11]

This activity was similar to Ehn's and Kyng's "Cardboard Computer" in that it provided an environment in which the researchers could reflect on their work in a comprehensive way, and employ tacit as well as explicit knowledge to identify and trace ideas, connections, and experiences from its history. The artifact record was quite different from written notebooks, which do not provide a complete picture "at a glance," and require their owners to maintain a complex mental picture (not accessible to collaborators) of their work if they are to navigate and exploit their records.

Polanyi used the term "indwelling" to describe the process whereby a person engages in a task that develops and employs tacit knowledge. For example, experienced car drivers may attend explicitly to the route that they want to follow, but pay very little attention to the car that they are driving or its controls. They dwell in the familiar task of driving, and rely on their tacit knowledge to take care of it for much of the time. Take them out of the car, and they may be unable to describe with any precision how it was driven in a given situation.

The provision of a rich set of images or artifacts, as described in the example above, provides an environment in which individuals can dwell in their work and employ their tacit knowledge. The reason that I have pursued this train of thought is to suggest that, while Polanyi probably is correct to say that simple languages with abstract, general-purpose symbols are necessary for the development of knowledge, there still is a place for rich, complex, literal representation. The authors of early cave paintings may have understood something about the role of indwelling that has been lost in our almost universal adoption of text as our primary recording medium.

There is a further, celebrated example of an investigation which was advanced by the use of designerly methods and rich representations. The story of Watson's and Crick's solution to the puzzle of the DNA molecule is well known, as are the images of the three-dimensional model that they used to think through the problem of how this very complex molecule might be constructed. The basic principle that the molecule might have a helical form was identified by Rosalind Franklin using photographic techniques to examine the molecule, but the way that form was constructed and interlinked, and the crucial idea that the molecule was a pair of identical helixes that could divide to form two new molecules, was

11 Graham Whiteley, "An Articulated Skeletal Analogy of the Human Upper-Limb" (Ph.D. thesis, Sheffield Hallam University, UK, 2000).

worked out by Watson and Crick, whose method was based on the construction of analogous models of sheet metal and cardboard.

Watson describes how they adopted the methods demonstrated by their rival in the DNA race, Linus Pauling:

> The key to Linus's success was his reliance on the simple laws of chemistry... the essential trick was to ask which atoms like to sit next to each other. In place of pencil and paper, the main working tools were a set of molecular models superficially resembling the toys of preschool children. We could thus see no reason why we should not solve DNA in the same way. All we had to do was construct a set of molecular models and begin to play.[12]

Given the three-dimensional complexity of their problem, it was only by constructing and, arguably, dwelling in their model that Watson and Crick could make the mental connections needed to complete the puzzle. Watson's own account of the enterprise makes it clear that there was a tension between the philosophy of Rosalind Franklin, who believed that thorough analytical work would yield the secret of DNA and focused all her efforts on photographic analysis methods, and the approach of Watson and Crick, who believed, with Linus Pauling, that DNA was a geometric problem best understood by three-dimensional modeling. In fact, both approaches were needed, as the Nobel Prize Committee demonstrated by making their award jointly to Watson, Crick, and Franklin's colleague, Maurice Wilkins.[13] It was Watson's opinion that Wilkins's team at London University might have been the first to solve the DNA puzzle if Franklin had not been so firmly against using physical models which, in her eyes, lacked proper scientific rigor.[14]

Investigative Designing

To give some examples of how these ideas can work, I would like to describe some recent cases of designers working in collaboration with scientists. Peter Walters[15] and his colleagues describe work concerned with understanding ways to discriminate between the different tube connections used to deliver medication to hospital patients. This was a problem which was of grave concern because mistakes in connecting tubes can kill or seriously injure people.

This can be thought of as a problem of cognition, and most people involved assumed that psychologists would tackle it. When a design team was proposed as part of the research effort, it was difficult for many of the participants to understand why designers were needed at this early, theory-building stage. The designers developed a series of prototype connectors that explored the problem of tactile and visual differentiation, and provided the research team with something to test on human subjects. The design process allowed some early "quick and dirty" evaluation of possible strategies, as well as more rigorous testing of the more promising options. As a

12 J. D. Watson, *The Double Helix* (New York: Signet, 1969), 38. (First published by Athenium in 1968).

13 Rosalind Franklin had died by then, and Nobel prizes are not awarded posthumously.

14 In *The Double Helix,* Watson described Franklin's hostility to the technique of modelmaking (p. 51). It is clear that Watson was worried when Maurice Wilkins borrowed the Cambridge molds for making molecular models, and relieved when he discovered that the molds had not been used by Wilkins's team. It took several years for Wilkins to confirm the Watson and Crick description using analytical methods, adding to the evidence that the modeling approach was the key to the discovery, even though other methods were needed to support and confirm it.

15 My description here is based on frequent conversations with the researchers, who are based in Sheffield, as well as the published reports. The project is described by Peter Walters, Paul Chamberlain, and Mike Press in "In Touch—An Investigation of the Benefits of Tactile Cues in Safety-Critical Product Applications," Proceedings of 5th European Academy of Design Conference, University of Barcelona, 28–30 April 2003.

result, not only did the research provide strong direction for an international program seeking to develop standards in this area, but it also led to recognition of the need for (and strategies for developing) a more wide-ranging understanding of how tactile discrimination can operate in different circumstances.

In a second example, the Information Design group at the University of Idaho[16] is working on methods for representing scientific data. This started as a professional practice teaching program providing new career paths for graphic design graduates but, in exploring the issues with scientists, it appears that there may be benefits that go beyond the immediate communication problem (in itself a difficult concept for scientists, who imagine that the designers are offering help to glamorize their PowerPoint slides).

For example, one discussion of possible approaches to representing data in a medical research project led directly to the researcher identifying significant patterns in the data which led, in turn, to a proposal for clinical applications of the research. It is particularly interesting that the designer's contribution in that case was limited to discussing how to communicate data, and this new perspective was sufficient to change how the scientist perceived the data. Clearly, the scientist had the data and the knowledge (tacit and explicit) to carry the research forward, but the designer's ability to work with and reframe representations provided a valuable catalyst.

Gary Gowans and Jim Campbell of Dundee University are multimedia designers who were invited to take part in a project concerned with reminiscence therapy for Alzheimer's disease sufferers,[17] collaborating with academic colleagues in the departments of Psychology and Applied Computing.

They were able to introduce both a number of imaginative ideas for ways to apply the underlying theories, as well as a design approach based on a good understanding of usability. While the success of the project depends on the specialist knowledge and research methods of all of the partners, it is difficult to imagine the project making such significant progress without the involvement of designers able to envision and prototype realistic multimedia resources that reflect both the scientific understanding behind the project and the wider agendas of the different "stakeholders" in the project.

In their published discussion of the project, the designers draw attention to the importance of recognizing the expertise of their collaborators, and also of overcoming designers' natural tendency to assert their individual roles rather than value teamwork. Arguably, one advantage of this sort of collaboration is that it allows individual designers to make a significant creative contribution while also recognizing that teamwork is important in the bigger picture of the research.

16 The group includes Frank Cronk, Jill Dacey, and Colleen Taugher. The work was described by Professor Cronk in a talk at the 2002 Information Design Conference at Reading University, UK. Subsequently, the specific issues referred to here, along with the text of this paper, were discussed in an e-mail "conversation" with Professor Cronk.

17 G. Gowans, J. Campbell, A. Astell, M. Ellis, N. Alm, and R. Dye, "Designing CIRCA: A Multimedia Conversation Aid for Reminiscence Intervention in Dementia Care Environments," *Proceedings of 5th European Academy of Design Conference,* University of Barcelona, 28–30 April 2003.

For my final example, as a process of investigating possible analogies for the joints of the human arm, Graham Whiteley[18] designed and produced a model arm including mechanical joints that provided a very close match to the movement of the original joints of the body, despite being constructed quite differently. In evaluating the results, the prosthesis design research group at Sheffield Hallam University invited a number of experts, such as surgeons and osteopaths, to manipulate the resulting skeletal arm, and found that they were able to recognize subtle features of the model very quickly, identifying how it matched and differed from the original. The model arm allowed them to mobilize their tacit knowledge of anatomy, gained from many years of regularly manipulating people's limbs.

This was significant in two ways. First, the tacit knowledge complemented the relatively unreliable quantitative data available (measuring skeletal movement is a difficult art, so most published data is suspect and provides limited information), and second, the process stimulated a number of ideas and observations by the participants. An elbow surgeon commented that the design indicated ways to improve the design of replacement elbow joints, an osteopath pointed out that there were subtle damping effects due to soft tissue surrounding normal joints, that were absent in the Sheffield arm, and a clinical engineer proposed a development of the research to provide an additional dimension to surgical simulations.

These examples show how a designer's ability to embody ideas and knowledge in artifacts can give us access to tacit knowledge, and can stimulate people to employ their tacit knowledge to form new ideas. Sometimes, as in the analogous arm, designers are engaged in developing new knowledge on their own account, in other cases, their role may be to table propositions or hypotheses in accessible forms that can stimulate people to further evaluate and develop the ideas.

The main aim of this paper has been to develop ideas about investigative designing, and to indicate ways that designing can be complementary to other research practices. The forms of research described here indicate one of the most interesting features of designing—it takes place in almost every context, and can contribute to understanding and our experience in almost every context. While it may be legitimate for "design researchers" to consider the special arenas and activities peculiar to designing, for designers themselves, there is a much wider world of knowledge and experience that they can engage with and influence, and this is as true of research as it is of the more usual forms of creative practice.

There are two barriers to this. The first is in the designer's self-image. If designers imagine that research and the creation of knowledge is a matter for others, then they always will find themselves in a subsidiary role (or no role at all) in research. To overcome

18 This project took place in Sheffield between 1997 and 2001. The work was proposed and carried out by Graham Whiteley in the Art and Design Research Centre of Sheffield Hallam University, and supervised by Adrian Wilson of the University of Sheffield Medical Physics Department and myself. Fuller details may be found in Whiteley and in Rust and Wilson.

this takes not only self-confidence, but also a proper appreciation of, and respect for, the knowledge and methods of scientists.

The second problem is the perceptions of possible collaborators, who may not recognize the contribution that designers might make. Here I can only recommend that designers seek collaborators who have open minds, but it also will be necessary to be subversive, to find opportunities to demonstrate what can be achieved, and to expect to invest some effort in doing that before partners start to understand the possibilities. Luckily, designers have ways to demonstrate their contribution that do not require rational argument or a formal definition of their role in a project. If an energetic and able designer can find any role at all in a research environment, they can quickly develop that role by creating and deploying artifacts that affect the work in hand, and demonstrate the designer's ability to make a difference.