Design's Own Knowledge
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Doxa: from the Greek, opinion, way of thinking. According to Parmenides, the world of *doxa* was the world of the opinions of mortals. When substituted by "what is" for what seems to be, or when mortals concur to manipulate things, or understand themselves, it becomes a falsehood or an error. Husserl held that all expressions are a doxic act in their full sense, i.e, a certainty, a belief.[1]

Introduction

The ancient Greeks divided thinking into two classes: one, the result of reflection, *episteme*; the other one, a result of daily living, *doxa*. Today, the limits between *doxa* and *episteme* have become more confusing and intricate, and less obvious. Pure sciences have developed into applied sciences, and knowledge has become habitual, usable, and practical. The ancient Greeks would be amazed to realize that *doxa*, daily-life thought or common sense, has become a science.

Scientific research, philosophizing, and thinking are activities unique to the human being. Solving questions and, principally, asking them—even when lacking an answer—is significant. The importance lies in inquiring and allowing time for reflection. By asking major and apparently simple questions, such as "Who am I?", or "What am I doing here?" to the most complex ones, such as the universe's own origin, we are encouraged to evoke through thinking everything that we are, everything we wish to be and achieve. This is the true significance of philosophy, the possibility we have to think about thinking, about ourselves, and even about why we think, create, and believe.

On the other hand, in science, we find an attempt to set apart subjective human condition, and to accumulate organized theoretical knowledge from our surrounding reality through the systematic and systemic processes of connecting concepts that will eventually lead to the construction of complex structural systems of models, projects, theories, and ideas. The historical development of human thought is closely related to scientific development. Western science already had been instituted four-hundred years ago as a formal structure, chiefly due to its use of the scientific method, which allowed, among other things, a generalized view of science as a rational, monomethodical, logical and positivist activity. Nonetheless, this conception of science has encountered severe stumbling blocks in recent years when dealing with reality. First,

1   Paul Foulquie, *Diccionario del lenguaje filosófico* (Barcelona: Editorial Labor, 1962), 42.

because of the reductionist and mechanicist nature of the theories proposed by this type of perspective.[2] And, second, because of the current awareness that the complexity of problems related to nature and humanity require several viewpoints, elicited from new tendencies and theories, such as the complexity theory, systems theory, self-organization theory, etc.[3] This essay will focus on the second aspect.

Unlike science, art involves a greater compromise to mirror social reality. *Techne*, as theoretical referent, already had been coined by the Greeks, to express their aesthetic sense of culture. Symbolic values that could be expressed by art were taken into account, and great historical synchrony was achieved in the quest for supreme artistic expressions, with strong institutional and ideological support. All artistic expressions, including architecture and crafts-manship, were encompassed in the Greek concept of *techne*. For instance, the construction of the Parthenon in the fifth century B.C., the main legacy of how Greek art was perceived at the time, represents, above all, a strong ideological sense of liberty and democracy. Some authors have even set forth a theory of idiosyncratic change that is evidenced in some of the bas-reliefs and sculptures found within the Parthenon, such as the self-portrait of Phidias and his protector, Pericles, on the shield held by the goddess Athena of Parthenos, or the portrait of Pericles by the sculptor Cresilas. These works appear to be a more visible testimony of a change in mentality from the religious to the ideological use of art. Since, in the ideological circumstances related to the Republic's Athenian hegemony, it was forbidden to create sculptures of human beings within temples, sculptural language to portray reality was born. This demonstrates that the evolutionary process of art expression is closely related to the social changes at that time, with institutional aid.[4] It is thus that art has been considered, since ancient times, an element of mythical and religious manifestation, as much as an instrument for social communication and the means to express the ideology or collective thinking of a certain era.

These philosophical, scientific, and artistic processes, common and inherent to human beings and their critical appreciation of nature and their surrounding elements since ancient times, lead us to inquire about design theorization. Many authors deem the use of the word "discipline" adequate to define design (just as in other domains of knowledge such as engineering, social sciences, technology, etc.). However, as a term, discipline does not compromise and eliminate the need to deal with the philosophical exercise concerning the existence of a theory, science, or philosophy of design. In the following paragraphs, I will attempt to define the main conceptual principles in this regard.

The general structure of this article is directed at solving some fundamental questions. Before moving on, the reader is invited to analyze some of these questions:

2   For further discussion on the critique of Cartesian science, see Morris Berman, *The Reenchantment of the World* (Ithaca: Cornell University Press, 1981).

3   A brief description of these three theories and their scientific application is found in Edgar Morín, *Introducción al pensamiento complejo* (Barcelona: Editorial Gedisa, 1996), 39–84.

4   Support granted by social institutions to art also occurred in the Renaissance, according to a complete discussion in Mihaly Csikszentmihalyi, *Creativity* (New York: Harper Collins Publishers, 1996), 32–36.

1 Where is the place of the meta-structure of design?

2 Do design and its practice generate knowledge?

3 How may a model of design knowledge be structured?

4 Does design have a knowledge of its own?

5 Which are the basic categories of design knowledge?

6 Is design only knowledge?

The development of some of the answers will allow us to define the epistemological foundations of design and the possible methodological guidelines that may be relevant to broaden design's conceptual and academic limits.

1   Where Is the Place of the Meta-structure of Design?
The meta-structure of design is the global and holistic conceptualization of the actions of design in culture. Several studies and research works are found at this level, especially those by philosophers and anthropologists. These studies propose that the metaphysical viewpoint of design's global action lies in the foundations of current material production.

Ever since ancient times, human communities have attempted to impose reciprocal action on their surroundings, with the purpose of humanizing nature and creating their own environment for the activities to be developed within a community. Included among the many unavoidable material conditions that define the development of that society in time are geographical and natural conditions, and production means attained by the community and through population growth. This continuous process, called "social dynamics," [5] has resulted in two types of knowledge: the study of historical human activities and creations, and the study of social achievements and possibilities for the improvement of human life.

In general terms, this dynamic expression of society encompasses everything that is called "culture." As dynamic expression, culture incorporates two processes: the material process—which also is symbolic [6]—constituted by artifacts, tools, and environments produced by human beings, and the nonmaterial process, "an idealized cognitive system—a system of knowledge, beliefs, and values —that exists in the minds of members of society." [7] Nonetheless, both concepts are always interdependent; i.e., the presence of material culture relies on nonmaterial culture, and vice versa.

It is, therefore, necessary to locate design and the studies it may originate within the space-time framework of "material culture," i.e. the physical world and environment created by human beings and their social relationships associated with, in turn, the abstract and conceptual relationships that determine the generation of knowledge for the interpretation and externalization of the materiality of cultural products through their relationships with objects. Finally, the application of this acquired knowledge has, as its main objective, the improvement of the world; in the case of design, by

5   José A. Méndez, Santiago Zorrilla, and Fidel Monroy, *Dinámica social de las organizaciones*, 3rd ed. (Mexico: McGraw Hill, 1993), 9–10.

6   As evidenced in "cultural products as public utterances, ritual clothing, music, etiquette, dance, prohibitions, etc. All these productions have three main characteristics: their particular features, to a large extent, are unmotivated by immediate survival needs and often devoid of any practical purpose; they seemingly involve a capacity to 'reify' mental representations, so that certain communicative or memory effects can be achieved by producing material objects and observable events; and their features vary from one human group to another." Pascal Boyer, "Cultural Symbolism" in *The MIT Encyclopedia of Cognitive Science* Rob Wilson and Frank Keil, eds. http://mitpress.mit.edu/MITECS/ 1999.

7   Ronald Casson. "Cognitive Anthropology" in *The MIT Encyclopedia of Cognitive Science*.

balancing the relationships between society and industrial production governed by the rules derived from overwhelming technological developments.

Since the 1950s, design has mediated, promoted, catalyzed, and regulated the diverse conflicts that have emerged between society and industry. How has this been achieved? First, by its projectal activity of "humanizing environments." [8] In second place, by its reflexive and research activity, upholding a position on diverse conflicts while embarking on a proposal for design ethics—consequently, the ethics for human material activity. All of these studies and reflections are part of what we call the conceptual meta-structure of design.

2   Do Design and its Activities Generate Knowledge?

When viewed from the outside, from its relationship to cultural processes, we acquire a perspective of design that is part of its macrocosm. In contrast, if the trajectory is changed, we may find design's own study objectives within the conceptual microcosm of design. To this end, it is necessary to analyze whether there is a field of knowledge which is the product of design activities, and whether, parallel to the generation of new knowledge, we may discover research elements inherent to design—all of them indispensable for the definition of a theory of design.

The study object of many sciences, among them the physical and natural sciences, encompasses everything that is, in turn, their field of action whereas design, as its has been interpreted and particularly taught, reveals some differences. Ever since Bauhaus's theoretical foundation, design has been defined as a "mixture" [9] of art and craftsmanship (*techné*)[10] with technology conditioned by study of the human being, especially human factors, made by some sciences. These essential elements have become, in turn, study objects in design as a career, with some modifications with regard to how much has been devoted to one or the other, or to the approach used in each school.

Nevertheless, art, technology, and human factors are essential knowledge that all designers must acquire. Considering the relevance of these conceptual domains, they have to be contrasted with the *praxis* of design.[11] In design's current theoretical division, there is a radical split between study object and field of action, because the former encompasses isolated subject matters such as shape, function, technology, and social sciences, while the projectal development of ideas and products is included in its field of action.

When analyzing the university studies of designers, the main theoretical problem we encounter is the lack of a general conceptualization related to design *praxis,* leading to disconnection and the absence of a theory formulated through design proper. According to Dewey, in selecting a study domain "subject matter is then regarded as something complete in itself; it is just something to be learned or

8   Since the 1850s, with Henry Cole and William Morris, and, at the beginning of the 20th century, with Peter Behrens, Walter Gropius and their Bauhaus team. The problem of humanizing environments, including spaces and industrial objects, is and will be the fundamental problem in a theory of design. This conception of design is highly socialist—the prevailing ideology of the time—as evidenced in the cited authors' works. See William Morris, "Art and Society" in *Architecture, Industry, and Wealth: Collected Papers* (New York: Garland Publishers, 1978) and Walter Gropius, *The Bauhaus Manifesto.*

9   From a philosophical perspective, the term "mixture" describes a chemical combination, while questioning whether elements are really combined in as much as they preserve their own characteristics and individuality.

10   For the ancient Greeks, there was no difference between art and artisanship; both were considered equally. See Herbert Read, *Art & Industry* (London: Faber and Faber, 1956), 24.

11   *Praxis* is, by definition, opposed to theory. Greeks determined the *praxical* character of all actions, transactions, and human affairs. Nevertheless, Aristotle distinguished three classes of knowledge: theoretical knowledge, *praxical* knowledge, and poietic knowledge. The object of the first class is knowledge; the object of the second one is wisdom with respect to moral action (politics), and the third has productive action as its object. See J. Ferrater, *Diccionario de Filosofía* Vol. 2. (Buenos Aires: Editorial Sudamericana, 1971).

known, either by the voluntary application of mind to it or through the impressions it makes on mind." [12] Therefore it becomes necessary to determine which elements may result in the designer's desirable willingness to intellectually and emotionally solve design problems that also may be consistent for all design problems encountered, "identical with all the objects, ideas, and principles which enter as resources or obstacles into the continuous intentional pursuit of a course of action." [13]

The study object of design should include all the decisive elements to master the "art of conceiving and planning products." [14] Attaining this projective quality will allow designers to solve different design problems, regardless of their diversity and complexity. Projective ability may, in turn, be developed by understanding the projective complexity and objectual complexity required to create a social context, because, "isolation of subject matter from a social context is the chief obstruction in current practice to securing a general training of mind." [15] For these elements to become study objects in design, we first need to generate specific knowledge and, secondly, to develop education and didactic strategies so that they may be effective within the classroom and in its application to society.

This knowledge may be achieved by studying the possible relationships between human beings and objects,[16] and between systems of objects [17] and the objects and their components. This would result in more profound knowledge, sufficient to understand the totality of projectual and objectual complexity, with the possibility to present efficient projective proposals.[18] Both classes of conceptual knowledge are combined in design; first, in design's own field of knowledge, physically transferred to objectual reality (*noesis*) and, secondly, in the practical application of design—its projective ability (*poiesis*). This process cannot be reduced to a simple "mixture." [19] Thus, we may say that conceptual synergy is required in these fields. A brief discussion about each of these fields follows.

Noesis [20] of Design: The Science of Thinking About Design

Husserl [21] makes a distinction between the material or hyletic level and the *noetic* level. The *noetic* level refers to the stage of the intentional being that shapes or forms materials into intentional experiences, giving sense, so to speak, to the flow of what has been experienced. *Noesis* is a configurative synthesis that becomes an internal consciousness of reason and the passage of time. This term has been widely used to designate the science of thinking in general, and will be so used throughout this essay to indicate the elements that must be considered when discussing knowledge created by design thinking.

For those who are faced with design's theoretical endeavor, the science of design thinking, as a reflective and propositional activity, is the activity that most effort, time, and energy requires.

12 John Dewey, *Democracy and Education* Institute for Learning Technologies. webmaster http://www.ilt.columbia/edu/academic/text/dewey/d_e/contents.html, chapter 10 (Dec. 5, 1997).

13 Ibid.

14 Richard Buchanan, "Rhetoric, Humanism and Design" in *Discovering Design* (Chicago: The University of Chicago Press, 1995), 26.

15 Dewey, Chapter 5.

16 Object, as the visible and material result of design action. A design object has as characteristics of its own: exposition, the ability to demonstrate intentionality; an intentional content; a real physics; and a structure that is cognizable, recognizable, and subjected to judgments. All the possible relations between an object and human beings (planning, conception, realization, and utilization) are found in the design object.

17 The relationship between objects and objects is found in the theory of systems of objects posited by Jean Baudrillard in his book, *Le Système des Objets* (Paris: Gallimard, 1968).

18 According to Herbert Simon, these are the two sciences of the artificial: "[the] inventive sciences of design thinking" and "a science of existing humanmade products."

19 According to the description in footnote 9.

20 The Greek verb *noesis* means "discerning seeing," therefore its usual meaning of thinking. For Greek philosophers, it was used to designate an "intangible seeing" or "thinking seeing."

21 In his article "Hilético," 87–102. Quoted by J. Ferrater, in *Diccionario de Filosofía*, 291.

These efforts may be due to the short and vertiginous time design has enjoyed as an acknowledged profession, its differentially technological conceptual framework, its broad scope of development, the great number of views based on a productive context, and the industrial and technological developments that have been its driving force.

The main elements that have been part of this body of knowledge include the theory, critique, and history of design activity, as well as the results of designers' professional activities. The development of these theoretical, critical, and historical stances requires the use of disciplines equivalent to, chiefly, architecture and art, followed by technological studies. Likewise, disciplines such as semiotics, aesthetics, industrial sociology, and psychology, also have been used for its theoretical and historical analysis.

This demonstrates that design thinking is not an isolated activity from design itself, but rather a group of fields of knowledge which study and analyze the current social phenomenon of material production. Efforts behind design thinking assemble knowledge about the results of design's reflective and propositional action. Propositional actions, specially focused on a critical initiative of society to propose elements for its transformation (to be discussed later) undoubtedly has played a very important role in design and, thus, in design research.

Poiesis [22] of Design or Designing

The definition of *poiesis*, the process of achieving an idea, is comparatively similar to the design process. Designing thus is a *poietic* act.[23] This act as such can be defined as a scope of design thinking. In its structure, design thinking [24] blends intuitive, analytic, creative, imaginative thinking, as well as sensibility and expressiveness.

Design thinking is a holistic, synergetic, and continuous whole shaped according to the designer's personality and social influence which also relies directly on the sensible, expressive, or communicative abilities required to accomplish an idea. The material structure of this act is the design project. A design project not only is a plan or willingness to act; it is the action to project oneself, and it requires two fundamental aspects: understanding the design problem and the act of developing an idea, and defining "what needs to be done" with respect to social aspects.

In the 1970s the mastery of the project through design methods was strongly emphasized. Studies on design method and methodology made it possible to confront the complexity of design problems and their limited scope, when adopted as strict and radical restraints.

For a deeper analysis of design as a poietic act, we need to pause and find a summary of the theoretical activity of design in the essential arguments implied in a poietic act. By combining design *noesis* with *poiesis*, we must consider the following:

22 The infinitive form of this verb means "make," "form," "produce," and is used to define all disciplines directed at making or producing. This expression is related to creating or representing something. The word "poetry" comes from *poiesis* and has two essential characteristics: the notion of poetry as a doctrine of ideas that elevates it to the level of wisdom because it is the highest expression of language, and the notion of a wisdom representing sensitive aspects because it may "transappear" or "transluce" through the unintelligible. Ibid.: 441–2.

23 The acts of *poiesis* are poietic acts. Nevertheless, since the terms "poetry" and "poietic" are closely related colloquially in literary production, the term "poietic" is used in this essay. It could be said that design is the poetry of matter. Interestingly, the transposition of this concept comes from Greek philosophy and is used by Herbert Simon when dealing with the science of the artificial, an activity considered as the "inventive science of design thinking" by Buchanan in "Wicked Problems in Design Thinking," 18–19.

24 The term "design thinking" increasingly is being used, and has proved to be very adequate to assemble all of the thinking processes that are involved in designing. The most consistent theoretical referents within design are Peter G. Rowe *Design Thinking* (Cambridge: MIT Press, 1987) and Richard Buchanan, *Rediscovering Design,* 5–21.

- Thinking about doing, which refers to the design process and project.
- Thinking about how to do, which refers to technological production problems.
- Thinking about the consequences of doing, the environmental and cultural impact of design.
- Thinking about the dependence of doing, the financial and productive submissivness of design.
- And, finally, thinking about "what needs to be done" to achieve institutional and social change.

3 How Would a Model of Design Knowledge Be Structured?

"The business of every art is to bring something into existence, and the practice of an art involves the study of how to bring into existence something which is capable of having such an existence and has its efficient cause in the maker and not in itself." [25]

According to Aristotle, artifacts are brought forth by two means: technological means and theoretical considerations. Technical means, which make products possible, are materialized in the physical structure of industry and factories. In these terms, an industrial product is subjected to productive and economic forces. However, more important than this, technology is in its being in turn subjected to the theoretical and ideological conditions of those who thought of it, conceived it, and outlined it; in other words, society and design. This point should be emphasized, because it depends directly on the designer or the community of designers. Habermas has said, "It is not the informative content of theories but the formation of a reflexive and illustrated habit among theoreticians themselves that ultimately produces a scientific culture." [26]

Consequently, it is important to construct a model of design knowledge [27] as a structured system of the theoretical and conceptual elements preceding the activity of design, alluding to the historical and social responsibility that must be assumed by the designer to overcome ideological paradigms. Through objects, artifacts, equipment, and building design also can contribute to the outline of a nonmaterial culture that will be more in accordance with principles pertaining to life quality and human well-being.

Jürgen Habermas has proposed that there are three fundamental categories in science research: the empirical-analytical sciences, the hermeneutical-historical sciences, and the sociocritical sciences. The following comparative table (Table 1) analyzes the principal elements that define this categorization.

The exact sciences and the physical or natural sciences are found within the empirical-analytical sciences whose approach to knowledge is based on dividing the systems that constitute the

25 Aristotle, "What Is Meant by Art?" in *The Ethics of Aristotle* Book Six, Chapter 4, Translated by J.A.K. Thompson (England: Penguin Books, 1971), 175.

26 Jürgen Habermas, *Ciencia y técnica como ideología* (original title *Technik und Wissenschaft als Ideologie*). (Mexico: REI, S.A. de C.V., 1993),161.

27 David Perkins discusses the formation of design concepts and new notions in his book *El conocimiento como diseño* (Bogota: Editorial Universidad Javeriana, 1989), English edition: *Knowledge as Design* (New York: L. Erlbaum & Associates, 1986).

Table 1:

Comparitive Table for the Classification of Sciences According to Habermas

Approaches	Empirical–Analytical Prediction and control	Hermeneutical–Historical Location and direction	Sociocritical Liberation
Focus and Attitude	Observation POSITIVISM	Analysis of historical events HERMENEUTICS	Social imbalance CRITICAL
Logical Procedure	Analytically breaks down systems to reconstruct them by means of relations and transformations.	Reconstructs isolated pieces of facts into a meaningful whole.	Discloses alienating situations or power manipulation in work and language. Supplies theoretical models for social action.
Purpose	• Analyze, explain, and predict. • Control over nature.	• Understanding and inter- preting phenomena of all types, especially those of a social nature.	• Transformation and liberation through critical analysis. • Knowledge of reality to change it.
Method	Analytical	Synethic	Transformational
Cognitive Interest	Theoretical Techno-scientific	Praxic Meaningful	Emancipating or liberating

study object with the purpose of understanding the system by means of relationships and transformations. Their aim thus is directed to the collection of knowledge for predicting and control- ling nature and its phenomena. Their sense is analytical and their interest is theoretical. This type of science and its results have had an influence on design, especially when attempting to understand the processes related to the physical and biological constitution of the human being, as well as to the technical and technological aspects of the production of design objects.

Historical knowledge of design involves the historical envi- ronment surrounding the birth of design, and the development and evolution of aesthetic trends, and those of industrial products. It may be classified as a historical-hermeneutical category. The proce- dure to approach knowledge consists in the holistic reconstruction of isolated pieces of facts, where history is the axis and its moments are interpreted. This type of knowledge is aimed at understanding and interpreting historical phenomena; its sense is synthetic and its interest practical.[28]

Nonetheless, design is very closely related to an attitude of change, a high sense of transforming reality according to the con- ception of society's welfare or progress. The knowledge and results of design objects ideally consist in improving the human condition. Habermas considers this kind of knowledge to be of a sociocritical nature, whose point of departure is based on the critique of social

28   "Practical action or experience through which man as subject tends to transform what is real." J.M. Mardones, and N. Ursua, 252.

imbalance, while its approach to knowledge lies in disclosing alienating or manipulative situations. Because of this pragmatic dimension, design belongs by origin and antonomasia to this category of knowledge. It also involves the theoretical elements to transform and act upon reality; ideally to improve it. Its sense is thus transformational, and its interest is emancipating. These sciences have the ability to distinguish how the foundations of socially dependent relationships have been ideologically established, yet also deriving the means to change these relationships. The legitimacy of their propositions is related to their ability for self-reflection, communication, and transformation.

4   Does Design Have a Knowledge of its Own?

The results of design activities, the *poiesis* of design, comply with and are ruled by laws governing the physics of our surrounding world and human beings—physical circumstances that may not be altered such as gravity, atmospheric pressure, and matter density in the case of the environment; human dimensions, limitation of motor activities, the perception thresholds of the senses, and the capacity for information storage in the case of human physical limitations and constants; and the constants implied in the productive process in the case of technology. Designs and designers must act in response to these unfailingly strict laws. This invariable knowledge is found within the framework of the empirical-analytical sciences; i.e., the natural, biological, and physical sciences. These are the domains of knowledge that designers must acquire and thoroughly understand when projecting.

Noesis of design, the most evident referent for design thinking, is derived from the social sciences that study human relationships and the human being itself. Some of these sciences, such as anthropology, archeology, history, economics, and, in general terms, the historical-hermeneutical sciences, study human beings in relation to their material culture.

Design produces material and nonmaterial culture; while studying it, it proposes it. The parallel between undertaking a perceptive work related to the environment and making a proposal about this environment is analyzed in Figure 1. This proposal also involves the elements that enable the environment to live, to mirror, present and project itself. Broadly speaking, it may be seen that culture as such accepts or rejects design proposals. To this extent, design is the result of "cultural phenomena." [29] Nonetheless, this may seem odd to many designers, given their generalized tendency to believe that they design but that it is society which actually does it in accordance with its material, productive, sensible, and cultural needs and hopes. Thus, we unravel the importance for designers to master the cultural phenomena of their times, and to be responsible for their proposals to change the fundamental structures of cultural phenomena.

29   A cultural phenomenon may be considered as the prevailing political ideology or the political will of the social, economic and industrial context. Papanek cites the well known case of the "Volkswagen" (people's car), whose design was a result of the strong political ideology of the National Socialist regime (see: Jay Doblin, *One Hundred Great Product Designs* (New York: Van Nostrand Reinhold, 1970), while today "...in the United States, design is not overtly used in a political manner: rather it operated mainly as a marketing tool of big business." (Victor Papanek, *Design for the Real World: Human Ecology and Social Change* (London: Thames and Hudson, 1985), 106–7.
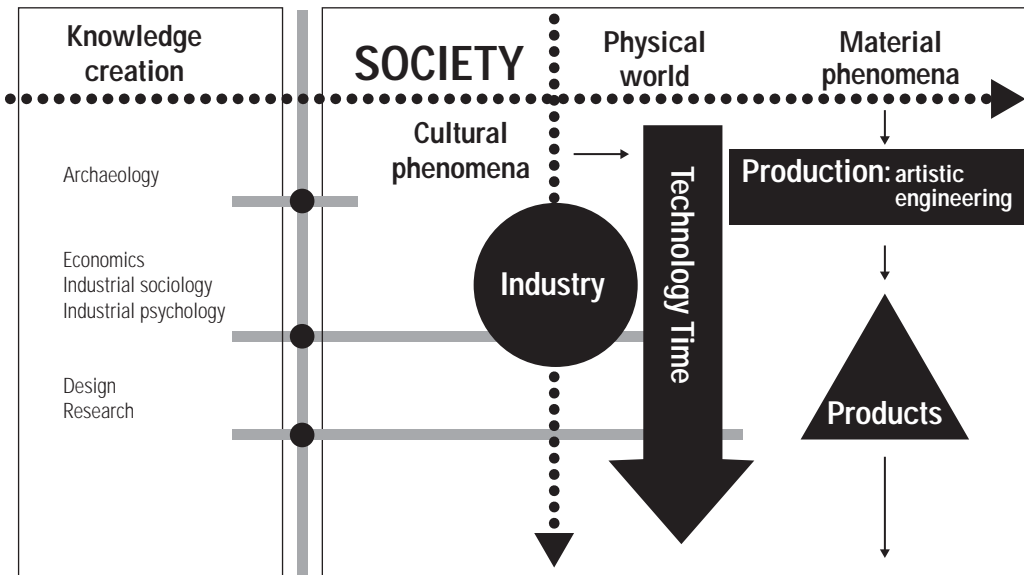
Figure 1
Relationships between material and social phenomena.

Design research is, therefore, basically directed to establishing an organized conceptual structure of design's own knowledge, whereas its foundations will rest on the immediate interpretation of material culture and the mediation between the material production of society and its diverse scientific and technological phenomena. The use of this knowledge will contribute to building a social ideal, and not only to the development of consumer goods and the broadening of the supply of products—mainly the end to which design has been used.

We will find design's own guidelines through the demonstrative exercise of contrasting design with archaeology. Archaeology is the study of the close relationships between the physical manifestations of a people and its culture; manifestations referring to objects representing the feelings of a community, such as art. When comparing design's interpretation of the world with archaeology, we find that their notion of time is different. Design sees the world almost at the same moment it is producing or creating, in a more immediate relationship, whereas, in archaeology, the view proceeds from technological processes and casts social processes into the background.
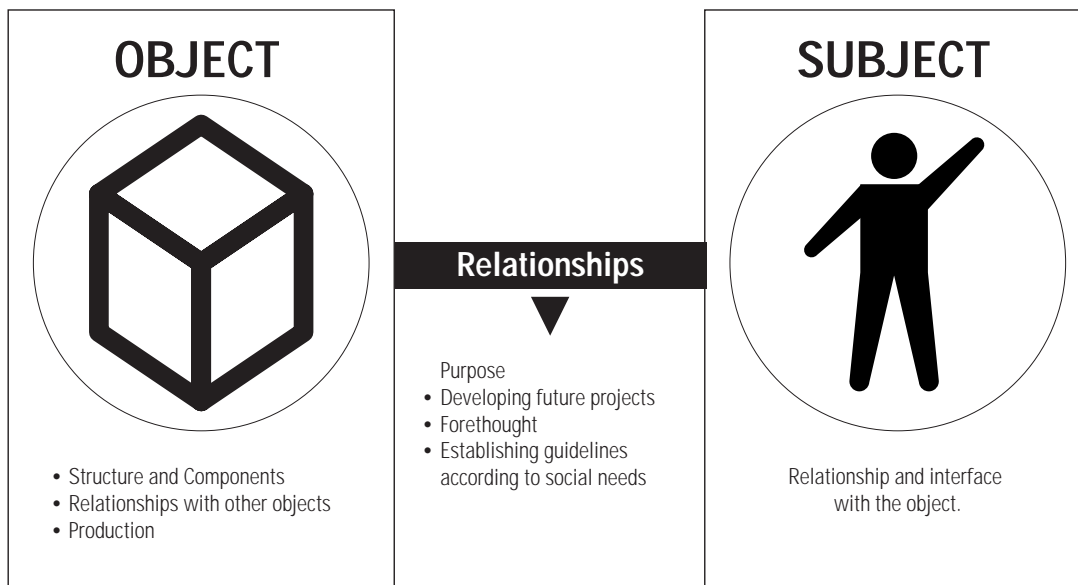
Material production and its interference with society thus are the foundations for design knowledge. Unlike other fields of knowledge, design retrieves [30] while creating, acts while it reflects. The constituent elements of this foundation include society with its cultural and material exchange; industry as the infrastructure currently in charge of material production; and human beings, particularly those who undertake activities and need this material production to achieve them.

The study of human beings is found in all human and social sciences. This knowledge also is used in design, but for the purpose

30   Retrieval of social values, attitudes, and habits that enable social coexistence.

of learning about the multidimensional essence of human beings in their relationship to objects so that objects as such, as complex systemic structures, will be in constant interaction and dialogue with human beings. Objects thus have been referred to accordingly as artifacts "from the Latin *art factus*, ...something characteristic of or resulting from a human institution or activity; ...a product of artificial character (as in a scientific test) due usu[ally] to extraneous (as human) agency." Or, according to Manzini, the "materialization of cultural contexts, of organizational forms, of technical systems, of economic interests and the will of projectionists and groups of designers, business people and the productive sectors." [31] A graphic outline of these relationships is shown in Figure 2.

Figure 2
Studies Relevant to the Poiesis of Design

OBJECT

• Structure and Components
• Relationships with other objects
• Production

Relationships

Purpose
• Developing future projects
• Forethought
• Establishing guidelines according to social needs

SUBJECT

Relationship and interface with the object.

Design's own knowledge is the result of this relationship between human beings and objects; foremost from the observation of the world and the multiple perceptions generated by this observation. Next, there is an approach to different fields of study, depending on the theoretical place of the problem to be studied. Finally, there would be an objectualized interpretation of this analysis—a new factual answer that will be presented to society, based on the projective ability of design. The experience produced by design is interrelated to the knowledge of social response. [32]

The specific focus of design analysis generally is oriented in two directions. One draws on the influence of technology on material culture, while the other deals with physical phenomena involved in the production proper of objects. Thus, there is no self-governing management in the field of design knowledge since it relies on the sociohistorical context and on a space and temporality,

31 Quoted by Ezio Manzini, *Artefactos: hacia una ecología del ambiente artificial* (Madrid: Celeste Ediciones, 1992), 91–92.
32 There are several perspectives and discussions about this. Personally, I agree that "Social Forces Determine the Shape of Technology," as posited by Thomas Kuby, quoted by Pauline Madge, "Design, Ecology, Technology: A Historiographical Review" in *Journal of Design History* 6:3 (1993):158. Nonetheless, in design, it must be analyzed how this technology influences society directly.

in addition to cultural change processes derived from the liberating interests of society. Design knowledge is the intuitive knowledge of society, the

> material intuition which is not only understanding relations but the understanding of a material reality, of a suprasensitive object or fact... this material intuition may be of different kinds. Its diversity is based on the deepest psychic structure of Man. The spiritual being of Man presents three fundamental forces: thinking, feelings, and volition. Accordingly, we must distinguish a rational intuition, an emotional intuition, and a volitional intuition... The same categorization may be reached from the structure of the object. All objects present three aspects or elements: essence, existence, and value. Therefore, we may speak of an intuition of essence, an intuition of existence, and an intuition of value. The first one coincides with the rational, the second one with the volitional, and the third one with the emotional.[33]

5   What Are the Basic Categories of Design Knowledge?
By basic categories, I identify the fields of knowledge pertaining to design which enable the establishment of possible fields of research. They include:

Object
The object is the tangible materialization of the *poietic* act of design because it reflects the emotional, volitional, and cognitive interests of the designer. Furthermore, the material object is considered an object of knowledge for the perceiver, because it is cognizable, it is real; it has a sensitive and communicative existence that enables it to represent the constant dialectics between the ideological condition and value of the designer and the user.

Studying the object of design may involve the following studies that assemble the realities of an object: the first one, its analysis as physical element, studied by methods that could be similar to those used by the physical and natural sciences; the second one, its interpretation as a social and historical entity, where the subject matter would be the social significance of the object; and the third form, with the object as social transformer, to examine the social and individual changes it generates in habits and social values. The three perspectives are explained in Table 2.

Design, as a projective and communicative structure, must recognize among its highest ideals the design and development of products capable of transforming social reality. Its objects, as such, are directed at changing attitudes, values, and habits that are affecting society adversely so that they will become positive attitudes, values and habits for humanity's quality of life.

33   Johan Hessen, *Teoría del conocimiento* translated by José Gaos (Buenos Aires: Losada, S.A., 1997), 103–104. Originally published in *Leitfäden der Philosophie* (Köln, 1925).

Table 2:

Comparative Table of Possible Studies of the Design Object

Empirical–Anayltical Natural and physical sciences	Hermeneutical–Historical Social sciences	Sociocritical Critical sciences
PHYSICAL OBJECT	**SOCIOHISTORICAL OBJECT**	**EVOKER-TRANSFORMER OBJECT**
The object is considered a physical entity; it is studied in itself and its components.	The object is considered within an interacting system, yeilding social signification.	The object is studied as a lever of social transformation.
Type of Knowledge Produced:		
• The physical • The mechanical • The organoleptic properties	• The sensorial and the perceptive • The semiotic • The communicative	• The paradigms changed by the object. • The attitudes, values and habits modified by the object.

The Project

> Design is related to the current situation of an era, to time, to the world. Today's world is characterized by being permanently in project. Modern civilization is something that men have made and, therefore, projected. Project quality is world quality.[34]

The project not only has been described above as a plan in as much as it is more than planning, arranging, or projecting. Existentially, the project defines the action of projecting oneself, and acting as a project in itself. The project depends directly on the experience of the individual who develops it and, consequently, relies on his or her knowledge and understanding of reality, jointly with the conception about possibilities of change. Knowledge derived from the project is of a *poietic* nature. Nonetheless, it may be defined in the following broad categories:

- Development and encouragement of projection and ideation abilities.
- Expression and communication of the project.
- Proprio-perception of the project and its recording.
- Social, environmental, and personal conditions for its development.

The Conceptual Meta-structure of Design

As initially analyzed, the meta-structure of design refers to a domain that is part of design knowledge. Although shared with other fields of knowledge, this domain encompasses all the studies of design objects and projects. Nonetheless, when attempting to define the course of design in forthcoming years there are essential categories that must be taken into account such as:

34 From the introduction by Wolfgang Jean Stock in Otl Aicher, *El mundo como proyecto* (Mexico: Ediciones Gustavo Gilli, S.A., 1994), 12. English edition: *The World as Design* Axel Menges, ed. Michael Robinson, trans. (Berlin: Ernst & Sohn, 1994).

- The social and institutional role of design.
- The social changes produced by design, and, especially, those that need to be generated in the future to structure, in general terms, a theory of social change set forth by design.
- The reliance of design on technical thought which needs to be changed by a global perspective involving cultural and social aspects.
- Problems related to ethics and the changes generated by design.

6   Is Design Only Knowledge?

It should be first pointed out that the observation and differentiation of the elements that produce design knowledge do not imply that design is only knowledge. The development of a design project or idea evidently requires more than knowledge. Within design thinking, definitions of clear limits between rational and irrational aspects, objective and subjective aspects, and logical and creative aspects have been established. The fragmentation of the design process has prevented the understanding of both types of aspects, at times even with the tendency to adopt either one. This undoubtedly has led to undesirable extremes, as evidenced by an excess of logical, mathematical, and rational thinking in design or, on the other hand, an extremely intuitive, instinctive, or unreflecting approach.

The challenge in design teaching and practice therefore lies in balancing both aspects. All creative processes require profound previous knowledge of the phenomenon or product to be developed. Design thinking actually arises from incremental creativity rather than from improvised creativity. Incremental creativity [35] involves long-standing and significant knowledge, ripened through self-reflection, experience, and evaluation of the generated elements. The process of evaluating a product once it has been produced generates knowledge, whose accumulation results in the experience proper of design's daily activities.

7   By Way of Conclusion

Through the unplanned sociocultural consequences of technological progress, the human species has challenged itself to learn not merely to effect its social destiny, but to control it. This challenge of technology cannot be met with technology alone…. Only by elaborating this dialectic with political consciousness could we succeed in directing the mediation of technical progress and the conduct of social life, which until now has occurred as an extension of natural history;…. The redeeming power of reflection cannot be supplanted by the extension of technically exploitable knowledge.[36]

35 Incremental creativity is opposed to AHA!—creativity. R.W. Weisberg *Creativity: Genius and Other Myths* (New York: Freeman, 1986) is the author of the incremental activity theory.

36 Jürgen Habermas, "Technical Progress and the Social Life—World" in *Toward a Rational Society: Student Protest, Science, and Politics* (Boston: Beacon Press, 1971): 61.

With our conceptual model it is now possible to build a process that will combine ideas and actions. The model may be applied to the academic, professional, and research domains related to designing.

When approaching the design project, the materialization of the *poietic* act, we obviously encounter the projectual research required to embark on a dialogue between reality, with its problems, and the designers' proposals. This is the main difference between a confusing situation—reality as such and the way we encounter it—and the definition of a design problem, which is already a conceptual elaboration where the designer adopts a position to face the problem and solve the plan of action initially materialized in the project and, consequently, in the object or product of this action. This type of research or acquisition of basic knowledge about the project is, what I call, primary projectual research. This is related to the subject matter of the design problem, and may be documented so that it will become an element of knowledge compilation. The documentation process will, in the long run, enable practice and its two fundamental objectives: documenting topics about design problems, and assembling the material required to describe the evolution of the products and the history of its design solutions. With respect to the design project, proprioceptions or personal reflections about the project also may be recorded and documented during the project itself, according to the essential mental processes for product development.

In general terms, the model of design knowledge categories allows a conceptual classification for different research studies in design and the efficient use of the available methodological tools, in accordance with the research process categories proposed by Habermas. Different cognitive interests converge in design-technical, practical, and emancipating interests. This is the reason behind the broad range of research which may transcend the object, project, or the conceptual meta-structure of design according to every interest.

Interrelating the fields of study with the cognitive results produces an overall view of the available fields of work in research design. This diagram shows that research design may transcend different social problems (Table 3). These new fields of study will enable us to balance an excessively technical or productive approach in design. It is true that when research studies related to historical-hermeneutical or sociocritical approaches are made, there is a risk of embarking on a social study as opposed to a design study. To overcome this inconvenience, we rely on "reflexive experience" [37] from the perspective of design which is, undoubtedly, the best point of reference. [38]

37 According to Dewey, reflexive expression is found "in discovery of the detailed connections of our activities and what happen in consequence… The deliberate cultivation of this phase of thought constitutes thinking as distinctive experience," *Democracy and Education,* chapter 7.

38 This is a problem I have had to deal with in doing research on creativity in design, so that it would not result in a psychology study. Although the theoretical referents came from the cognitive sciences, I managed to overcome the problem by focusing on the problems from my design experience. The author would like to thank the National University of Colombia for the fellowship assigned to the study of the Master's Degree in Industrial Design at the National Autonomous University of Mexico, as well as the ICFES-ICETEX Fund of Colombia for the 1996–1998 period.

Table 3:
Research Areas in Design

DESIGN CATEGORY	COGNITIVE INTEREST		
	Technical	Praxic	Emancipator
OBJECT	Industrial product	ARTIFACT	Materialization of cultural changes DIALECTIC ARTIFACT
PROJECT	Resolution of technical problems	Source of personal and historical reflection.	Dialectics of reflection with society.
META-STRUCTURE	Rational nature of design	Subjective, historical and irrational nature of design.	Dialectic and sociocritical nature of design.

By way of conclusion, it should be noted that there is a very important relationship between design research and the theories of social action of philosophers John Dewey and Jürgen Habermas, both quoted in this essay. Their philosophical concepts are a free and comprehensive contribution for a conceptual framework of design. In addition, the application of their concepts to different classes of pedagogical theories will certainly be a part of future academic design programs in all school grades.

On the threshold of the 21st century, whether or not design is a science, as is the case of the human and social sciences, still is under discussion. Therefore, rather than restricting the definition of science to the knowledge produced by design, it is of vital importance to assess, encourage, and preserve these reflexive processes as a dialectical approach of design towards society.