Epistemology of Design

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May 2000

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Abstract

This document intends to provide a short description of the “epistemology of design.” Accordingly, design is organized under three tiers: 1) **Design as activity**, 2) **Design as planning**, and 3**) Design as epistemology**. This review then explores the application of the above classification to explicate the epistemology of design.

Design as activity relates to the conceptualization (pre-execution) stages of making new products, which can be classified under four main groups: fine art, industrial design (applied art), architecture and engineering.

Design as planning relates to the systematic mental processes prior to actions and conceptualization (pre-execution) stages for planning, composing and decision making. Design as planning is more affiliated with management of a wide range of fields from business to military and from hospitals to academy.

Design as epistemology relates to the synthetic methodologies needed for the mental apprehension of appropriateness for change. Design epistemology is distinct from analytic methodologies, which is crucial to develop scientific initiatives.

Epistemology of Design

> "And I have filled him with a divine spirit of wisdom, and understanding, and knowledge [*epistemes*] to invent [*dianoesthai*, innovate?] in every work and to frame [*architektonsai*, design?] works . . ."
>
> Exodus 31:3-4 (LXX)

Introduction:

This document intends to provide a short description of the epistemology of design, based on a new classification of design. Although there is no overall agreement on the meaning and organization of design, I was able to extract an overall classification for design under three main forms:

Design as activity is related to the conceptualization (pre-execution) stages of making new products. Design as activity is usually further organized under "art versus technique" or "form versus function". Fine art, industrial design (applied art), architecture and engineering are typical examples of design as activity.

Design as planning is related to the systematic mental processes prior to actions and conceptualization (pre-execution) stages for planning composing and decision making. While design as activity is more related to professional endeavors like art or engineering, design as planning is more affiliated with management of a wide range of fields from business to military and from hospitals to academy.

Design as epistemology is related to the synthetic methodologies needed for the mental apprehension of appropriateness for change. Design epistemology is distinct from analytic methodologies, which is crucial to develop scientific initiatives.

While the exact border between the three tiers of designs, as in the above, is fuzzy at best, the above classification for design constitutes a conceptual hierarchical facet that can interact with, and is complementary to the other type of classifications.

Definitions:

What comes to your mind, when you hear "Design"? Does it sound like "Function and Form" or "Form or Style? "Rebirth of Design" is the main title on the cover page of a recent issue of Time Magazine; it shows a small radio in a bowl of water and indicates "**Design: Function Is Out, Form Is In**." Do you think is it good enough to confine design to the context of form and

function? What do you think is the difference between “design engineering” and “engineering design?” Have you ever heard of Napoleon Benopart as a military “strategy designer?”

Design is a broad and deep concept; consequently proper articulation and application of its classification requires relevant attention and elaboration. Knowing the challenge that I was facing, I searched a broad range of sources about design and what they consider design to be. The sources varies from general encyclopedias to special dictionaries, and from library classifications to design museums. I came to conclusion that I need to widen the scope of the concept of design and its different aspects to be able to classify it properly.

Although there is no overall agreement on the meaning and organization of design, I was able to extract an overall classification for design, which is very helpful to understand the different aspects of the concept of design and how design interacts with the other topics. Consequently design is organized under three tiers: 1) **Design as activity**, 2) **Design as planning**, and 3) **Design as epistemology**. While the exact border between the above three groups of designs is fuzzy at best, the above classification for design constitutes a conceptual hierarchical facet that can delineate the epistemology of design.

Design as activity is mostly related to the conceptualization (pre-execution) stages of making new products; usually organized under “art versus technique” or “form versus function”. Industrial design, engineering design, art design, architecture are typical examples of design as activity.

Design as activity is traditionally being further classified under two main groups: 1) **Form** and 2) **Function**. This classification for design activities is traceable to the “Bauhaus,” the school of design, architecture, and applied arts that existed in Germany from 1919 to 1933. The Bauhaus was founded by the architect Walter Gropius, who combined two schools, the Academy of Arts and the School of Arts and Crafts, into what he called the Bauhaus, or "house of building," a name derived by inverting the German word *Hausbau,* "building of a house." Gropius' "house of building" included the teaching of various crafts, which he saw as allied to architecture, the matrix of the arts. By training students equally in art and in technically expert craftsmanship, the Bauhaus sought to end the schism between the two. (Encyclopedia Britannica Online)

Since the 1950s, “ergonomics” has gained a lot of attention in the studies about or related to design. Ergonomics or human-factor design deals with the physical or psychological characteristics or impacts of human beings related to design of devices and systems for human use. Because of its broad scope, ergonomics design draws upon parts of such social or physiological sciences as anatomy, anthropometry, applied physiology, environmental medicine, psychology, sociology, and toxicology, as well as parts of engineering, industrial design, and operations research (Encyclopedia Britannica Online). However, ergonomics is not yet an equal partner with ‘form and function’ in the traditional classifications for design as activity.

Consistent with the major classification of design into form and function, the academic disciplines and professional fields for design as activity are organized along four main groups: 1) fine art, 2) applied art and industrial design, 3) architecture and 4) engineering. These four groups are practically located along the spectrum of form to function. Art is mostly about form,

and engineering holds mostly the function part of this spectrum, in the between, industrial design and architecture holds the middle part of the spectrum; from form to function.

Design as planning is mostly related to the conceptualization (pre-execution) stages of planning and decision making. Design as planning is regarded as a plan or scheme conceived in the mind and intended for subsequent execution. This is a wide process of thinking before action and requires an interdisciplinary approach among a range of disciplines like art, industry, management, military, and so on. Archer (1965) point of view that "designing is the formulation of a prescription or model for a finished work in advance of its embodiment" is more along looking at the planning aspect of design; because the work in not confine to art, industrial design, architecture and engineering.

While design as activity is more related to professional endeavors like art or engineering, design as planning is more affiliated with management of a wide range of fields from business to military and from hospitals to academy.

My studies on definition of design guided me to other terms synonymous with design as a planning; like programming, composition, strategy, and problem solving. All of the above terms imply a systematic process of thinking prior to action or implementation in areas much broader than the traditional domain of design (i.e. art, architecture and engineering.) Goldschmidt (1999) indicates "At the base of investigations of the design process is its definition as a problem-solving process, in the widest sense possible."

Friedman (1997) asserts that "the different forms of professional design practice require a process incorporating the strategic and managerial aspects of design as well as the hands-on development application of design." This point of view seems to be related to the interaction between design activities and design planning.

Design as epistemology (epistemology of design, science of design, theory of design): Epistemology in philosophy is the study of the theory of knowledge; which goes back to ancient Greek and beyond. Since the 17th century the main issue in epistemology of Western philosophy has been rationalism versus empiricism. Rationalism claims that knowledge can be obtained deductively by reasoning and empiricism says that knowledge can be attained inductively from sensory experiences. René Descartes, the leader of rationalist philosophers, argued that the main source and final test of knowledge was deductive reasoning based on self-evident principles, or axioms. Descartes's work, along with that of Galileo, Bacon, and others, established the modern analytic-scientific approach towards knowledge. Descartes's method can be summarized as follows:

1. Accepting only what is clear in one's own mind, beyond any doubt;
2. Splitting big problems into smaller ones;
3. Arguing from the simple to the complex
4. Checking when one is done.

Compared to the analytic methodology of science developed by Desartes, design as epistemology relates to the synthetic methodologies of implementation. The character of design

as a synthetic epistemology has recently being examined in more detail. The Design Institute of the University of Minnesota, established in 1998, is a very recent initiative to tackle the study of the epistemological aspects of design. Thomas Fisher the Director of the Design Institute, in a personal correspondence, refers to 'design thinking' which seems to be consistent with design as epistemology. Fisher (2000) indicates "Design thinking follows a definite process, involving a kind of upward spiral in which new information causes the designer to loop back and re-examine previous decisions, until one reaches a point (often defined by the time and money available) where the greatest number of issues are embraced by the simplest possible solution. While design is never right or wrong, it is better or worse depending upon the breadth and simplicity of its end result, which is always a means to some further end."

March (1984) compared "design" with "logic" and "empirical science." According; he regards "Logic has interests in abstract forms. Science investigates extant forms. Design initiates novel forms." March then continues, "a scientific hypothesis is not the same thing as a design hypothesis. A logical proposition is not be mistaken for design proposal."

Gordon (1973) made simple comparison between designers and scientists and concluded; "A designer and a scientist travel the same road but sometimes in opposite directions. The designer goes from the abstract to the concrete, scientists from the concrete to the abstract." This description is more related to the comparison of the methodologies for design and science.

Luckman (1967) classified design under three topics; "Analysis, Synthesis and Evaluation" which seems to be relevant to the epistemology of design. According to Hilleri (1967) "design as we know it can be seen as the socially differentiated transformation of the reflexive cognition of the maker in terms of the latent possibilities of this tools, materials, and object types." This point of view, to a large extent, can be regarded as part of the epistemology for design.

Consequently one can also envision design epistemology as a "method of expression and change (manipulation)" compared to (but not in contrast with) science as a "method of examination and investigation." In another word, research is the main method of science, and design is the main method of technology and art. Science is aimed at searching for truth; rather technology is aimed at expression and implementation. Exploring "Truth", which is the main goal of science, has been a long-standing philosophical discussions since the ancient Greek and beyond (Nonaka 1995). Modern science (which is based on the footsteps of Galileo, Bacon and Descartes) has further streamlined this process under the scientific-analytic methodology.

There are numerous commonalties; as well as distinctions; between design and technology in one hand and research and science on the other hand. Sharing the empirical-experimental method they differ on many other aspects. 1) Research uses mostly analytic methodology and technology uses mostly synthetic methodologies. 2) Science and research are mostly text-based, design and technology are mostly graphic based. 3) Research is mostly deductive, but design is inductive. 4) Research and science are based on classification, design and technology are based on model making (modelification.) 5) The analytic method of science has been first articulated by Renes Descartes in his Method book, and during the last 2 century it has further elaborate, but the synthetic method needed for of design – which has been in use since the ancient Greek and beyond has not yet been fully articulated.

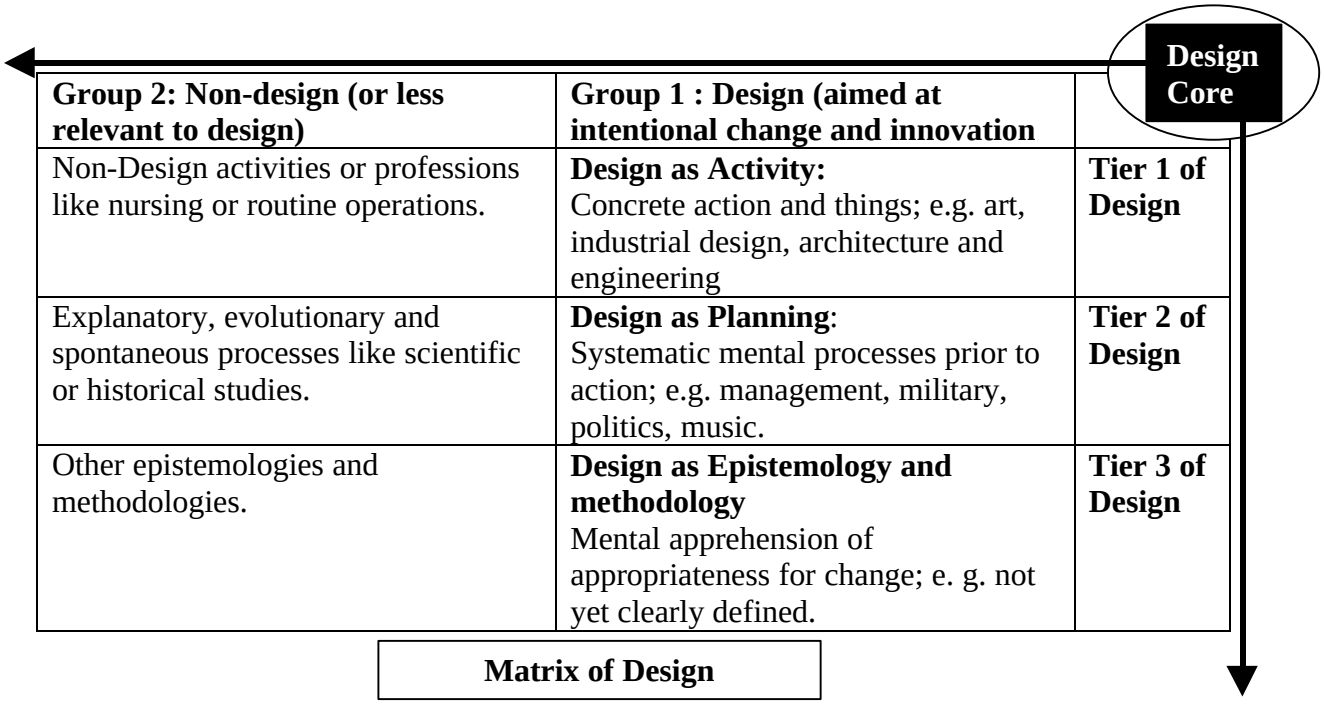
Comparing the epistemologies of science and technology, Vincenti (1990) indicates:

> "Most people tend to think of engineering as applied science. … From this point of view, studying the epistemology of science should automatically subsume the knowledge content of engineering. Engineers know from experience that this view is untrue. … The character of engineering knowledge as an epistemological species is only now being examined in detail."

After more than a decade, apparently we are not very far from where Vincenti was!

Matrix of Design

Using a dichotomy analogy, the classification of design as three main tiers "activity, planning and epistemology" can be complemented with relevant non-design classes to make a matrix configuration, as in the following diagram.



Group 2: Non-design (or less relevant to design)	**Group 1 : Design (aimed at intentional change and innovation**	
Non-Design activities or professions like nursing or routine operations.	**Design as Activity:** Concrete action and things; e.g. art, industrial design, architecture and engineering	**Tier 1 of Design**
Explanatory, evolutionary and spontaneous processes like scientific or historical studies.	**Design as Planning**: Systematic mental processes prior to action; e.g. management, military, politics, music.	**Tier 2 of Design**
Other epistemologies and methodologies.	**Design as Epistemology and methodology** Mental apprehension of appropriateness for change; e. g. not yet clearly defined.	**Tier 3 of Design**

Matrix of Design

The Matrix of design, as above, provides a context to organize design based on both Tier (vertically) and Group (horizontally) under 6 major classes.

Making a comparison with related contrasted topics may also facilitate the understanding of the distinctions between the three different tiers of design. Design as activity, which is organized along related disciplines or fields of design like art, architecture and engineering, is distinct from non-design fields or professions for instance nursing. Design as planing, which is regarded as a plan or scheme conceived in the mind and intended for subsequent implementation, is contrasted with spontaneous processes like natural and biological evolution. Design as a synthetic

epistemology is contrasted with other types of methodologies, for instance the analytic / scientific methodology.

As another example, education conventionally is not classified as art or engineering activity, but the 'design of an education course,' can be classified under design as planning, because it is based on a plan in mind and intended for subsequent implementation. As another example, selective mutation may well be considered as design as planning, but the natural evolution of species, with all its beauty and diversities, is not a design. A spontaneous social revolt is not a design by planning (if spontaneous is applicable to social revolts), but military coups or operations should be classified as 'design as planning,' even the military blunders.

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