

A Definition of Design and Its Creative Features

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Abstract: In this paper, the authors discuss the nature and perspective of “design theoretics.” First, the necessity of discussing the notions associated with design is addressed because the word “design” is becoming increasingly popular in society, and thus gaining in importance. The ability to consider a particular concept (object) from the perspective of design is identified as designing ability. The authors classified design into three categories: drawing, problem solving, and ideal pursuing. On the basis of these categories, design is defined as “the process of composing a desired figure toward the future.” Lastly, the authors discuss a method of researching design and address the importance of pursuing the ideal design process. The definition of design formulated by this study will undoubtedly contribute toward encouraging further discussion on the notion of design, and thus serve to clarify it.

Key words: *Design creativity, Paradigm of design, Design theory, Design methodology, Simulation*

1. Introduction

The word “design” is increasingly being used in various societal contexts—for example, career-design, food-design, and community-design. All of us have come across this word in our daily lives. This phenomenon represents the fact that there is a large demand among people for things related to design. People’s dreams or hopes of changing the world in order to improve the contemporary global situation are included among the various meanings ascribed to the word “design.” Therefore, human resources connected with planning or constructing ability or those related to originality are desired in all areas of society. Recent industrial developments have had to consider the fact that the issue of “what we should produce” is gaining more importance (or seriousness) as compared to the issue of “how to produce it.” Since society is already saturated with various high-end technological products, finding a new production goal carries considerable meaning. Needless to say, modern society has accomplished rapid growth; nevertheless, although it has evolved considerably, this evolution has been accompanied by a number of serious issues like environmental pollution and global warming. These issues are beyond the scope of an individual’s or a company’s capacity and are becoming more severe. In order to overcome these serious issues, a more holistic viewpoint should be adopted, i.e., the whole societal system should be taken into account. Design is an attractive keyword toward this end, as it conveys to people the associated notions of ability and thought.

Thus far, design has mainly been discussed in terms of the study of industrial design [1, 2] and engineering design [3]. However, a comprehensive definition of the term—which is able to provide an answer to the question

“what is design?” [4]—has not yet been formulated [5]. In this paper, we aim to clarify the notion of design. Toward this purpose, we have set up a mode of **design theoretics** in the form of a study that discusses the ability and thought behind design.

Moreover, we systematize design theoretics and discuss a suitable study methodology for the subject. We further contribute to society by proposing a feasible methodology for design theoretics.

2. Definition of Design

We discuss the issues of the “ability of designing” and “thought behind design” in order to formulate a definition of the term “design” that will be able to encompass these associative aspects. We classify design into three categories: drawing, problem solving, and ideal pursuing. Moreover, on the basis of these categories, we define design as “the composition of a desired figure toward the future.”

2.1 Designing Ability

A number of studies have addressed the importance of designing ability. In recognition of the importance of design, many design educators and institutions have built education programs aimed at enhancing students’ designing ability. Many students of design persevere in their efforts to refine their designing ability. If they persist, their endeavors may be rewarded with the results they desire. However, we still do not have a clear picture of what constitutes the essence and character of designing ability. This is a very vague concept, since the word “design” has various meanings.

In order to clarify the notion of ability that is associated with design, we try and sort through the vague meanings previously attributed to the term. The above notion of designing ability should encourage efforts toward addressing the current requirements of society, which are as follows: to contribute toward building a future world, to solve difficult problems such as global warming, and to act as role models for the next generation. Hence, we need to discuss and identify the notion of design.

2.2 Classification of Design

Design can be classified into three categories: drawing, problem solving, and ideal pursuing. We explain these three categories of design and discuss their capacity to produce a really new product, system, or concept for our society and thinking.

Category A: Drawing

Design is widely thought of as the expression of images in the form of pictures or sketches; in other words, it is strongly associated with art or drawing. This is the categorization of the term on the basis of its most popular and generalized use. Although drawing seems to be creative, the drawing process itself cannot create a truly new output, since drawing itself is a process that involves only transforming an abstract image into a concrete figure or shape. Thus, it is creative only in that it entails imagining a nonexistent figure or shape. Its essential creative nature lies in the abstract image from which the figure or shape is derived.

In some cases, particularly in the field of art, this process is thought to involve an examination of the past, since the inspiration for an abstract image comes from the designer’s memory.

Category B: Problem solving

On the other hand, the notion of design comes to the fore when attention is paid to the procedural aspect of designing rather than to its results in the form of sketches and drawings. In this case, the design process is mainly considered within the framework of problem solving. The proposed design process models that have so far been

introduced in previous studies have discussed the notion of design within the framework of problem solving [6]. Within this framework, a problem is defined as the difference between the current state and the desired goal. Thus, the process of developing a solution toward the desired goal is synonymous with the design process. However, in many cases, the solution can be found by analyzing the gap between the current state and the design goal. In other words, it can be said that the solution lies hidden in the gap. This discussion suggests that the problem-solving process itself cannot really create a new goal. Therefore, our next concern is with regard to the question “how do we determine the desired goal?” [7] We can have explicit goals (problems) that need to be achieved, such as finding solutions to natural disasters. Similarly, in a case where we need to meet our customers’ requirements, which are clearly spelled out, it is easy to set goals. However, there sometimes exist cases in which the goals are unclear. We will now discuss the latter case.

Category C: Ideal pursuing

We can use the term “design” to mean the pursuit of certain ideals; such an explanation would differ in meaning from the other definition of design, i.e., the solving of obvious problems. For example, from a social perspective, designing involves the notion of ideal pursuing. Moreover, the term “ideal pursuing” contains within it the notion of the future. In comparison with the problem-solving category, which is usually used in the context of current problems, ideal pursuing refers to looking ahead at the future (Figure 1).

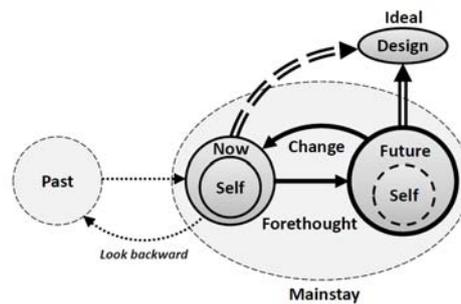


Figure 1: Conceptual Model of Design under Category C

In this model, we can identify a distinct feature of design as something that is aroused within us and is supported by the requisite criteria of our ideals. It involves the presence of the abstraction process in an ideal environment [8]. Moreover, it recognizes designs that conform to the perspective of the “future” and “something which is meant to be”—that is, something only human beings can predict. The aim of design is not “change,” as change simply influences the ultimate form taken by an ideal design.

2.3 Definition of Design

In order to facilitate design theoretics, we feel that all the abovementioned categories should be included within the definition of the term “design.” Therefore, we define design as **the process of composing a desired figure toward the future.**

3. Discussion

We formulated a definition of design in the previous section. On the basis of this definition, we will now discuss what we mean by **toward the future**. This part explains the “directional” feature of the definition of design. The notion of the future is an extremely abstract concept. For example, we can never draw an exact picture of the future. We can imagine and picture what things will be like in the future, but it is impossible to visualize a precise concept of the future itself. This kind of highly abstract concept can only be represented in language. In the context of design, the future has two sides. One meaning that is ascribed to the future is that of a thing that we grasp inductively, such as a market prediction. The other attributed meaning is the desire for recognition/expression led by internal sensibility, as in art. As far as the argument concerning the difference between *mono* (a Japanese word that means an object or a thing) and *koto* (an event or a state of affairs) [9] goes, the former case deals with an object and the latter, with an event. This differentiation corresponds to the difference between objective and subjective time [10] in the critical discussion of time. We contend that both the meanings described above need to be considered with regard to the notion of the future and within the purview of design.

Next, we discuss what we mean by **a desired figure**. This part determines the object of design. A desired figure comprises three parts: abstract images (category A), obvious goals (category B), and ideal (category C). Some parts impart a feeling of resonance. One important point regarding artifacts is the concept of the “natural.” We had assumed that the process of making artifacts should come naturally to humans. However, there is no common process that resonates with all human beings even though we create artifacts by copying them from the natural world. In contrast, there are some things that differ from what is found in nature, but nevertheless resonate within the human mind. Music is a good example. Music comprises man-made sounds, most of which differ from natural sounds like the sound of breeze or birdsong. In fact, music resonates in the human mind and makes a deep, natural impression. It is in the human mind that the desired figure of the artifact originates. If we pursue the origin of our natural impressions, we can approach nature without trying to duplicate it [11]. We will discuss an example later in this article.

We will now discuss **composing**. Composing provides an explanation for the design process. In design, one of the typical processes is the composition of the parts, as we make our products in a way that differs from what occurs in the natural world. There are many notions similar to composition, such as combination and synthesis.

Design Categories	To look at	Driving force	Thought mode	Creativity
Category C: Ideal pursuing	Future	Prediction (forethought)	To surpass the present conditions for desiring the image, that there should be	(1) Unexpected (2) Resonance with human mind or society
Category B: Problem solving	Present	Gap (problem)	To analyze the current state and the desired goal in order to find a solution	Problem solving (changing)
Category A: Drawing	Past	Memory	To transform an abstract image into a concrete figure or shape	Expression (figurative)

Table 1. Features of the three categories of design

4. The Research Methodology of Design

We now discuss the ways in which we can facilitate design research methods by addressing the importance of pursuing the ideal design process.

Indeed, the study of design can be divided into two approaches that are based on practical design and follow the ideal design process without simultaneously following the actual trends in design. The latter approach perhaps stimulates not only the study of the outcomes (products) of ideal design, but also inspires the ideal design process. Thus, the issues that we are now faced with are related to the discovery of the ideal design process and the areas in which we can apply this process.

We propose two method types to address the above issues. The first method involves referring to other sciences that have pursued an ideal form of knowledge—for instance, philosophy, mathematics, or aesthetics. General design theory is an example of this type [12]. Simulation is the other method type. Going by the successful development of computational technology and the growth of concept dictionaries, it is apparent that methodologies aimed at the successful simulation of thought processes in design can be partly fulfilled. By accelerating the simulation technology, we move forward to our investigation of the ideal design process, which should be more than an imitation of real design activity. Thus, we expect advances in the simulation process to be feasible. Additionally, we pay attention to the role played by languages in such advances in simulation [11, 13]. Thus far, shapes and figures have been considered important dimensions because they have been considered as the key elements of “category A design” (as we have shown above). However, in comparison to “category C design,” which is far more extensive than category A design, the area of language deserves greater attention because it plays a much more important role.

5. Identifying a Desired Figure: Simulation of the Impressions of a Design

As we mentioned above, “music resonates in the human mind and makes a deep, natural impression. It is in the human mind that the desired figure of the artifact originates. If we pursue the origin of our natural impressions, we can approach nature without trying to duplicate it.” We introduce our developed simulation that aimed to provide us with a desired figure [11] that resonates within the human mind. We focused on the users’ minds because designers usually want to provide products that fit the users’ expectations. Thus, we focused on user’s impressions or reviews of products in order to create “truly good” products. On the basis of the definition of design as **the composition of a desired figure toward the future**, we consider that a “truly good” product should be aimed for. Moreover, the use of simulation in the development process is one of the hallmarks of a good product, and this process entails careful attention to the true nature of the human mind. In order to achieve this purpose, a central structure—the origin of users’ impressions (we name this impression the “Heart of Impressions”)—is what we should be targeting. The Greek philosopher Plato originally formulated the notion of archetypes. Later, in psychology, Jung called the contents of the collective unconscious, which are present at the bottom of the unconscious, “archetypes.” He further explained that an archetype is an unlearned tendency to experience things in a certain way and has no form of its own, but acts as an “organizing principle” for the things we see or do. An archetype is generally defined as an original model of a person, object, or concept from which similar instances are derived, copied, patterned, or emulated.

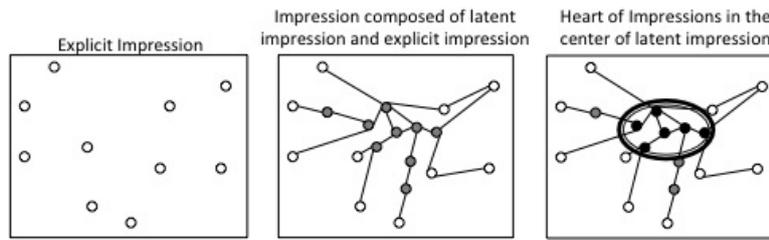


Figure 2: Relationship between Explicit and Latent Impressions

In order to find an ideal archetype, we consider two viewpoints. The first concerns the “structure of impressions,” which assumes that the Heart of Impressions is more than the sum of partial impressions, and the second involves “latent impressions” that underlie the surface impressions. From these two viewpoints, we build a framework of the simulation of impressions for approaching a desired figure, and develop the following hypothesis: the Heart of Impressions exists in the center of the network structure, which involves not only the surface impressions but also the latent impressions.

Figure 2 shows a diagrammatic representation of our hypothesis. The white circles are nodes that correspond to explicit impression words. The circles in gray or black are latent impression words. The black circles are nodes in the center of the structure of the network that express the Heart of Impressions. A “virtual impression network” having these types of nodes is depicted in the center of Figure 2.

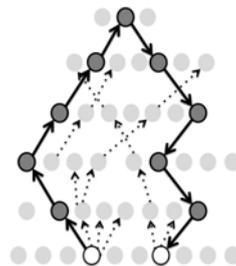


Figure 3: Representation of the Structure of Impressions

We constructed a “virtual impression network structure” that involves the notions of structure and latent impressions by using the semantic network. The term “explicit impression word” implies a word explicitly expressed by humans on an artifact, while the term “latent impression word” implies concepts that are thought to underlie an explicit impression word.

The network construction processes are shown below.

Step 1: Extracting paths between two explicit impression words in the semantic network. Here, a path is a set of links that directly join one word and the next word. The words that are found along each path are regarded as latent impression words.

Step 2: Collecting words appearing in the extracted paths, that is, explicit impression words and latent impression words.

Step 3: Drawing the network with collected words as nodes and the links comprising the extracted paths as edges. Semantic networks have a word meaning as a node. Therefore, we sought the shortest path between meanings of explicit impression words and extracted the latent impression words in the path between the explicit impression words. Figure 3 depicts the search for a path in a semantic network. The circles represent nodes in the semantic

network. The white ones are nodes for explicit impression words and the gray ones, for latent impression words. The arrows are the links comprising the path.

An experiment was conducted to verify our hypothesis. The subjects were ten adult graduate students (Japanese), who were asked to perform two types of tasks. One task required participants to describe their impressions upon looking at a picture of a product. The other task involved indicating the boundary for liking or disliking the products.

Experimental Method

Six cups were used in the experiment. First, the subjects were shown a picture of each cup and asked to describe their impressions in Japanese. The participants were asked to classify the words they used as noun, adjective, and verb in separate columns, with at least one word under each category being employed (they were given 2 minutes to describe their impressions of each cup). Next, the subjects were asked to rank the six cups according to preference and draw a boundary for like and dislike.

Experimental Results

We will now discuss the results for one subject. The number of explicit impression words described by this participant for a cup is 20. The impression words were as follows: cup, weak, hold, winter, carry, sea, usage, difficult, small, saucer, spoon, cold, break, coffee, black tea, cake, weight, cleaning, fall, and blue.

Analysis Tool

WordNet 3.0 [14] was used as a semantic network to construct the virtual impression network structure. WordNet is a huge lexical database in English. However, it contains only links between words belonging to the same POS (part of speech, for example, noun-noun). Accordingly, we performed two preprocesses. First, we translated the impressions into English, while confirming that the meanings were consistent with those in Japanese. Next, we replaced all verbs and adjectives with the corresponding nouns. After this process, the virtual impression network was constructed according to the network construction method explained in section 3.2.

Analysis Method 1 - Extraction of Nodes with High Centrality

As the approximate Heart of Impressions, we extracted the nodes with high centrality by using the network visualization and analysis tool Pajek [15]. Figure 4 shows the virtual impression network of a certain participant, that is, her impression of a cup design. In this analysis, nodes having more than 3 links were extracted as the approximate Heart of Impressions (hereinafter called “central nouns”). The following words were listed by the participant: abstract entity, activity, change, nutrient, physical entity, property, substance, tableware, and ware. It can be seen that the participant chose not only highly abstract words but also relatively low abstract words such as “tableware” and “change,” which are expected to be the approximate Heart of Impressions.



Figure 4: Virtual Impression Network for a Cup of a Certain Participant

Analysis Method 2 - Comparative Study Using the MDS Method

In order to verify the possibility that the extracted words were the Heart of Impressions, we classified the explicit impression words and the central nouns of a cup obtained from each subject by using multidimensional scaling (MDS). Figure 5 shows the distribution based on the explicit impression words, and Figure 6 shows that based on the central nouns. As a result, a boundary between subjects (whether they like the cup or not) can be recognized in Figure 6, while one cannot be recognized in Figure 5. This figure shows that central nouns may indicate the Heart of Impressions.

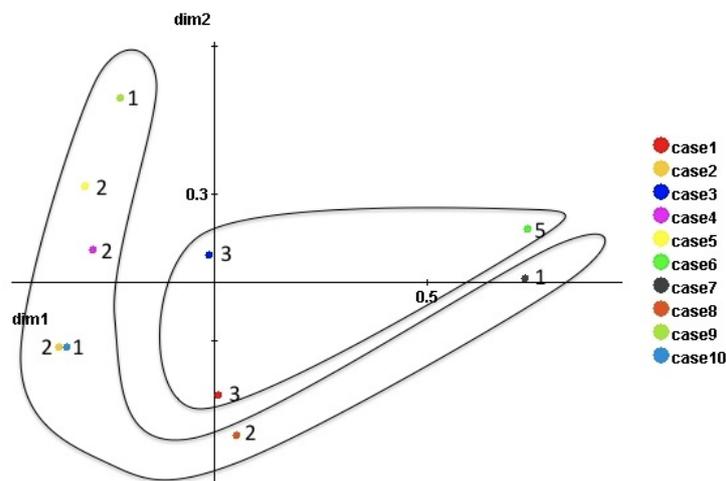


Figure 5: Distribution of Participants on the Basis of Impression Words

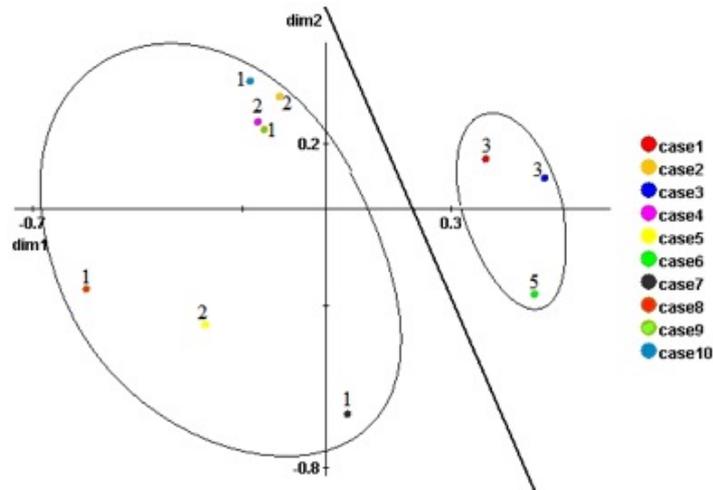


Figure 6: Distribution of Participants on the Basis of Central Nouns

Outcomes

We identified the unexpressed impressions of an artifact (namely, the unspoken impressions) through the use of simulation. Concretely, we discussed two issues: “where in people’s mind can we capture impressions?” and “how can we capture impressions?” Regarding the first issue, we pointed out the importance of deep impressions for designing a truly good product. Regarding the second issue, we focused on two viewpoints: structure of impressions and latent impressions. On the basis of the above discussions, we proposed a hypothesis—namely, that a Heart of Impressions exists in the center of the network structure that involves latent impressions as well as explicit impressions. We performed an experiment and showed the possibility of using this method as an approach for identifying the Heart of Impressions. Although this method can be applied only to the analysis of existing artifacts, it can be extended in order to identify a more ideal artifact. We believe that the outcome of this identification is a feasible research methodology that can potentially be adopted toward the development of a notion of design theoretics that we aim to test through an advanced study on our definition of design.

Note: Chapter 5 partially introduced a previous study that the authors had already published (Yamamoto et al. 2009); the authors have since further developed their study [13].

6. Future Study

We have discussed the research methodologies for pursuing the ideal design process in design theoretics in order to advance design studies. We introduced a research method that we employed as an example of the methods for simulating thought processes in design. As we pointed out in the previous chapter, it is one of the feasible methods of design research (that is, ideal pursuing) for identifying an important key to approaching something that is being at a depth level, where the centering place of human hearts. We have defined design as “the process of composing a desired figure toward the future.” We need to examine ideal pursuing within the framework of the future not only with respect to the human mind but also with respect to society. Although developing an approach toward serious issues at the social level will require a considerable amount of time and effort, we believe that an understanding of the human mind (individual) is connected to such an approach. Design theoretics is promoted by continuing one step accumulation, and we encourage an each step of the further (creative) advance. This will ultimately enable us to achieve the desired design.

7. Conclusion

First, we defined design as the composition of a desired figure toward the future. Second, we discussed the significant aspects of design on the basis of the above definition in order to identify the research methodologies of design. Another important issue that we discussed and that was closely related to design was the notion of creativity. There are numerous definitions of creativity. Novelty is usually considered to be one of the principal factors of these definitions. On the other hand, creativity in design can be defined as the parameters formulated to achieve the desired figure on the basis of our above definition of design [16]. Thus, we can perhaps evaluate the creativity of a designing activity by judging how close it is to the desired ideal figure. In that case, we can say that novelty is a result, as opposed to a factor, of creativity. In other words, if we started off by aiming at novelty, we would not be able to achieve our desired figure; instead, we would end up with a strange, unsuitable result.

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