Discussion on Direction of Design Creativity Research (Part 2) - Research Issues and Methodologies: From the Viewpoint of Deep Feelings and Desirable Figure

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Abstract. On the basis of our definition of design as "composing a desirable figure towards the future," research issues and methodologies are discussed in this article. First, we point out three research issues, which we call the inside-outside issue, the issue of the abstraction process, and the back-and-forth issue. Throughout this discussion, these issues will help us to identify the significance of a concept-composing process (concept synthesis) that is "pushed" from the source of deep feelings. Next, these issues serve to introduce three potential methodologies of design research, namely, internal observation, computational simulation, and theoretical modeling. Further, the authors demonstrate an example of the design of a desirable motion by assuming that an emotional and creative motion extends beyond the images produced by the human ordinal imagination, which in order to resonate with the feelings residing deep within us. Finally, they indicate open issues for further discussion.

Keywords: design, design creativity, design theoretics, research methodology, deep feelings

1 Introduction

In the previous article, we have identified the features of design and creativity in post-industrial society and proposed a new definition of design as "composing a desirable figure toward the future" a definition that is expected to extend beyond the framework of a problem-solving paradigm (Taura and Nagai, 2010). We designate the discipline of design with regard to this definition as "design theoretics."

We discuss the key issues in design theoretics. First, we point out the research issues. Next, we introduce potential methodologies. Further, we demonstrate an example of the desirable design.

2 Research Issues in Design Theoretics

According to our new definition, the design process is explained as being the process of composing a desirable image while being pushed from the source of deep feelings. By focusing on these characteristics, we are then able to systematize our approach to research issues in design theoretics.

Design theoretics is concerned with the three main issues: (1) the inside-outside issue, (2) the issue of the abstraction process, and (3) the back-and-forth issue. (1) and (2) are related to space issues—(1) is a horizontal issue and (2) is a vertical issue—whereas (3) is related to the issue of time.

2.1 Inside-outside Issue in Design Thinking

The inside-outside issue in design thinking is divided into three sub-issues, as follows:

1. Boundary determination from inside or from outside
2. Intrinsic motivation versus extrinsic motivation
3. Perspectives from inside or from outside

The first sub-issue regards from which direction the boundary of thought space is determined, that is, whether from the inside or from the outside. "Autopoiesis" (which means self-creation), as applied to organization, explains that boundaries will be determined from the inside (Maturana and Varela, 1980). On the basis of autopoiesis, Winograd and Flores (1989) has introduced the framework of a network system that is formed in a topological manner (namely, autonomy). Winograd asserted the importance of software engineering in the planning of an interactive system as a form of information design

(Winograd, 1996). On the other hand, the process of creating art can be viewed as a self-referential process or a self-recognition process, because during the creative process, it is impossible to separate the artist from the created work (Hass, 2008). These are thought-provoking ideas that arise from this sub-issue, and we suppose that the boundary of the thought space of design can be determined from the inside (Nagai and Taura, 2006; Taura and Nagai, 2009).

The second sub-issue regards the motivation of the design. Many previous studies of human creative activities have reported the important role of motivation, in particular, the role of intrinsic motivation (Maslow, 1970; Amabile, 1985; Deci and Ryan, 1985; Sternberg, 1988; Conti and Amabile, 1999). Such motivation is related to the state of absorption of people who are deeply engaged in creative activity, which is totally different from the experience of extrinsic motivation of those working to obtain their reward from outside (Loewenstein, 1994; Csikszentmihalyi, 1996).

The third sub-issue deals with the location from where design thinking is captured. This is related to our observations on design. With regard to the first sub-issue, it seems impossible to observe the activity of design thought from outside because the thought space is determined from inside. It is also difficult to observe this activity at the time people are actually absorbed, as mentioned with regard to the second sub-issue. Therefore, we must say that research into the process of deep design thinking meets with difficulty or limitation. An innovative, creative research methodology is required to respond to the challenge of this sub-issue.

2.2 Issue of Abstraction Process in Design Thinking

Composing a new concept by synthesizing multiple abstract concepts is a sophisticated activity (Rothenberg, 1979; Ward et al., 1997; Sternberg and Lubert, 1999; Taura and Nagai, 2009). For example, if we knew only the two concepts of "red pencil" and "yellow car," we could derive abstract concepts from them such as "red colored objects" and "moving objects." We could then manipulate these abstract concepts to form new abstract concepts such as "a moving object with a red color" (such as a red car) and "a non-moving object whose color is not red" (such as a black pencil).

In General Design Theory (GDT), the concept regarding entity (entity concept) is modeled as an element, and the abstract concepts are modeled as a class (subset of elements) in set theory (Yoshikawa, 1981). The process of synthesizing multiple abstract concepts is modeled as the process of finding the intersection of these classes corresponding to each entity concept. Here, the process of abstraction is considered to be the process of extracting a number of common attributes (features) from a number of existing objects (Taura and Nagai, 2009). In the above example, the attributes (feature) of "red color" or "moving" are extracted. Even apart from the context of GDT, this notion of abstraction has been widely accepted.

On the other hand, there is another meaning of "abstract." This is the meaning used in art, for example, in the term "abstract painting." In this usage, abstract paintings are drawn neither from the attributes of objects nor from the simpler representation of the object (Nagai and Taura, 2009). Such paintings are perhaps conceived in the mind of the artist. We consider such a process to be definitely connected with the desirable figure we have elaborated in our new definition of design.

2.3 Back-and-forth Issue in Design Thinking

We have explained the concept-composing process as being the synthesis of a number of concepts (concept synthesis). However, it is extremely difficult to select the appropriate concepts (base concepts) to be synthesized before designing, because the appropriateness of these concepts can only be evaluated after they have been synthesized and the design product has been evaluated. We designate this issue as the "back and forth issue."

In certain cases, the back-and-forth issue can take the form of a spatial issue. For example, consider the situation when we attempt to identify a beam of light that passes through a reflection in a mirror (Figure 1). If we attempt to predict the path of the beam based on the knowledge that "a beam of light travels along the path that takes the shortest time," we are unable to evaluate whether or not a path takes the shortest time before the beam has actually travelled.

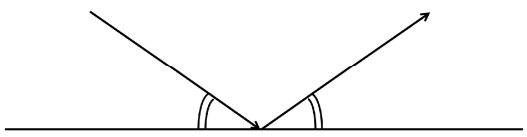

Fig. 1. Path of the beam through a reflection in a mirror

However, if we apply the knowledge that "the angle of incidence is equal to the angle of reflection," then it becomes possible to calculate the path of the light beam before we actually observe the travelling beam. In this case, the back-and-forth issue from the viewpoint of time is converted into a spatial issue.

GDT provides a rigorous method in this area. In GDT, the design process is defined as a mapping from the function space, where the specification is described and a design solution is evaluated, to the attribute space, where the design solution is described. To effectively search a design image (design solution), it is necessary to determine an appropriate searching space, and in particular, to determine the classes (subsets of entity concepts) that are used to search for the design image. With regard to this issue, it is expected that the introduction of a metric into the design space (function space and searching space) and the preservation of the similarity between these two spaces, make it possible to effectively search for a design image. In other words, if two concepts are close to each other in the searching space, under the condition that the same concepts are close to each other in the function space (evaluation space), then the search for a design image may be effective (Figure 2). This rule is valid only when the design image is searched for using a neighborhood search method.

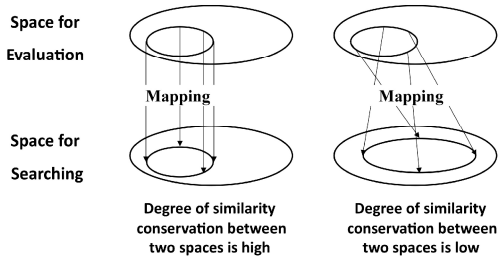

Fig. 2. Preservation of the similarity between evaluation space and searching space

Taura identified the above method of converting the back-and-forth issue into a spatial issue by applying it to the function decomposition process in design (Taura, 2008). In the initial stage of the design process, the required functions are generally decomposed into a few partial functions. Although this process is not always necessary when finding design images, its usefulness in the design process is well recognized. Not only has its importance been indicated in an empirical study, but its rationale has also been analyzed in a theoretical study.

3 Research Methodologies of Design Theoretics

One particular feature of design is to compose a design image that is a new concept that has never before existed. It is thus more important to discuss the consideration of concepts during the composing process than to simply discuss the resulting concept. Based on this belief, we have conducted challenging research on creative design and will now introduce some examples in this article.

3.1 Internal Observation of Design Thinking

As mentioned above, to observe the design thinking from an inner perspective is quite difficult when people are deeply engaged in their work. The reason for this is that when they are absorbed in their work, it is assumed that they have entered into the mental state known as "flow" (Csikszentmihalyi, 1990). The external observation of the design thinking may fail to grasp it because it is pushed from intrinsic motivation. Thus, it may be impossible to observe design thinking from either an internal or an external perspective. To surmount this barrier, we have tried to formulate a methodology on the basis of the idea that a method of inner observation is valid when the occurrence of the self-forming process (the process of forming the self) is confirmed during the observing process. Here, the "observed self" may be different from that of "the self" (the self when observation is not taking place).

We would propose a challenging method, whose characteristics are as follows. First of all, the method is based on reports. Second, it involves both an outer perspective and an inner perspective. Third, the method identifies the occurrence of novel motifs through the integration of both perspectives. The key factor that reveals the effectiveness of this method is whether or not the self-forming process is identified, that is, whether or not the occurrence of certain novel motifs (observed self) during the design process is identified. We can obtain significant results by carrying out a long-term experiment using the above research method, and report these results in detail in another paper (Nagai et al., 2010).

3.2 Computational Simulations

When observation is difficult, computational simulation is a methodology that is commonly applied. With the recent rapid development of computer science, the possibility of simulating the design thought process has become stronger. We have paid attention to semantic networks as a framework in which to simulate the process concept composition. In

fact, we have developed a method for simulating a concept-generating process. In this method, we focus on the notion of association between concepts. Concept association is assumed to be a key notion in design thinking during concept synthesis (Figure 3). We attempted to actualize this association process in a semantic network (Yamamoto et al., 2009).

Another application of this method is the investigation of the impressions evoked by designed products. When designing products, designers need to create products that evoke feelings that are congenial to the emotional impressions of consumers (Feng et al., 2009); in other words, the products should be preferred by most people. We assume that there are certain kinds of emotional impressions that a user receives from a product that will affect that user's preference. We therefore focus on the impressions that may underlie the "surface impressions" that a user ordinarily receives when viewing a product, which we refer to as "deep impressions." We consider that certain "deep factors" may function in tandem with affective processing and result in the development of preferences. In order to construct a methodology for capturing deep impressions, we developed a method of constructing a "virtual impression network" using a semantic network (Taura et al., 2010).

The aim of these simulations is not only to reproduce design thinking or the process of receiving impressions but also to precisely determine a desirable design process and design products virtually.

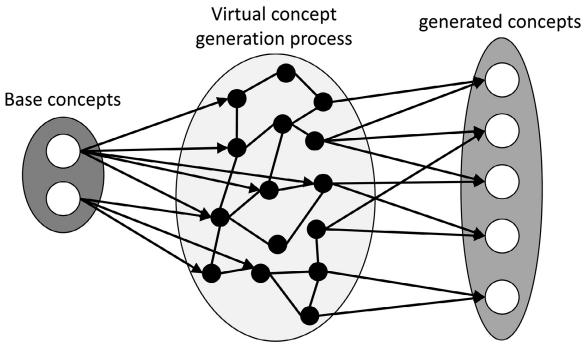

Fig. 3. Virtual concept generation process

3.3 Theoretical Modeling

There is another research methodology that addresses a desirable design process or designed product theoretically, making reference to philosophy, mathematics, and aesthetics. General Design Theory (GDT) is a good example. In GDT, the "ideal design space" is defined as one in which all the elements of the entity set are known and each element can be described by abstract concepts without ambiguity. The ideal design space is found to be a Hausdorff space, which is a separate space in which, for example, a red pencil (red and non-moving) can be distinguished from a yellow car (yellow and moving). Furthermore, the condition of separate space makes it possible for the design space to be a metric space, which is the basis of the preservation of the similarity between spaces, as described in the previous section. This discussion would suggest that the formation of ideal design knowledge generates the potential to promote the design process.

In another case, the notion of a particle is an example of such an ideal model. It provided an explanation of practical dynamics that formed a strong basis for the development of engineering from that point forward. However, we should note that the notion of a particle is nothing more than a notion. That is, such an object that has mass but not volume cannot exist.

Here, we would like to emphasize the fact that the knowledge of ideal design and the notion of a particle both involve an "ideal" situation. Furthermore, it can be said that while these models are completely different from actual phenomena, they are extremely useful to explain many actual phenomena.

Based on the above considerations, we can infer that the notion of "desirable" may be different from the notion of "existable," that is, from what can actually exist. A desirable design process or desirable design product need not necessarily exist.

We should note that design research has not yet taken to pursuing such a desirable model. Such an endeavor should be encouraged in the future.

4 Example of Design Pursuing Desirable Figure

We will introduce our recent trial design, which involves the design of a motion by focusing on rhythmic features. We are developing a method for designing an emotional and creative motion that resonates with deep feelings (Yamada et al., 2010). This study is based on the hypothesis that motion that is beyond ordinary human imagination may produce emotional impressions that resonate with deep feelings. The proposed method involves an analogy with natural objects, the blending of motions, and an emphasis on rhythmic features. In order to design an emotional and creative motion, we attempt to construct a computer system that implements the proposed method. An experiment to verify the effectiveness of

the proposed method and the validity of our hypothesis was performed.

An interesting result we have seen is that designed motions that seem to come from beyond our ordinary imagination are evaluated as being more "impressive" (as evoking deeper feelings). This result is consistent with the idea mentioned in the previous section, namely that desirable design need not necessarily be "existable."

5 Conclusion and Open Issues for Future Work

In this article, we have discussed the key issues in design theoretics. First, we pointed out three research issues: the inside-outside issue, the issue of the abstraction process, and the back-and-forth issue. Next, we introduced three potential research methodologies of design, namely internal observation, computational simulation, and theoretical modeling. Further, we demonstrated an example of the design of a desirable motion with the findings that designed motions that seem to come from beyond our ordinary imagination are evaluated as being more "impressive" (as evoking deeper feelings).

Throughout the discussion in this article, "deep feelings" and "desirable" are found to be key notions. Furthermore, these two notions interact with each other.

As a result, the following questions present themselves as open issues.

- What are "deep feelings"?
- What is the notion of "desirable figure"?
- How can we capture "deep feelings"?
- How can we capture the notion of "desirable figure"?

We expect that these open issues will be explored as the subject of ongoing discussion.

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http://www.springer.com/978-0-85729-223-0

Design Creativity 2010
Taura, T.; Nagai, Y. (Eds.)
2011, XIII, 330 p., Hardcover
ISBN: 978-0-85729-223-0