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# Creative Design Thinking Focused on Thematic Relations between Concepts

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Understanding human creativity is absolutely fascinating. Actually, the research on creativity is conducted in various areas such as sociology, business administration, pedagogy, cognitive science, artificial intelligence, and design studies. In those researches, it is reported that the divergent thinking contributes to the creative idea generation. However, in the design, the divergent thinking does not seem to involve creative thinking.

It is also reported that creative thinking will be supported by transforming concept space. However, it is not clear what characteristic of the design space is related to creative thinking particularly, and how the design space is extended. Therefore, in the present research is clarified the factor to extend the design space.

In general, it is thought that conceptual synthesis is effective for the generation of a new design idea. However, the unsolved problem is how to combine concepts in order to achieve high creativity. Concerning this problem, many researchers conduct experiments of conceptual synthesis, in which similarity between synthesized concepts and the abstraction level of an idea are related with creativity.

In the research on the similarity of cognitive science, it is showed that there are two kinds of similarities, taxonomical relation and thematic relation, which represent the relations between concepts. A taxonomical relation is a similarity that represents the physical resemblance of two concepts. For example, apples and oranges are pair of highly alignable entities. That is, apples and oranges share many dimensions on which they can be compared, including those with similar values (e.g., superordinate category, shape, size, parts ) and one

with different values (e.g., taste, color, thick of skin). A thematic relation is similarity that represents their relation by recollecting a thematic scene between the two concepts. It is very unlikely that people would even attempt to compare such nonalignable entities as apples and baskets, which share considerably fewer common dimensions. Rather, people's knowledge about apples and baskets might lead them to integrate these theme or scenario (e.g., place apples in baskets). In the present research is clarified how the taxonomical relations and the thematic relations affect actual design.

It is focused on the relationship between creativity and the design space for clarifying the features of a creative thought process. And it is focused on searching for the factor to expand the design space, the concept synthesizing process between a taxonomical relation and a thematic relation.

The relationship between creativity and the design space is investigated from both side of the design result and the thought process in designing. For this purpose, a set of design experiment is conducted and the protocol analysis of Think-aloud method and semi-structured interviews are adopted for data collection.

The design experiment is composed of two parts design session and interview session. In the design session, the subject is asked to perform the design task by the think-aloud method, and the design sketch is recorded with a video camera. There are two kinds of design tasks. One is to synthesize two concepts in a taxonomical relation. The other is to synthesize two concepts in a thematic relation. In the interview session, the subject is asked to explain the reason for each designing while playing the video recorded during the design session. The purpose of this session is to find out the basis on their design.

The design results are evaluated based on the two view points of practicality and originality, on a five point scale.

The extension of design space was examined, focusing attention on the distance between concepts. As a result, there is a strong correlation between creativity and the extension of design space. And the creative thought process was examined focusing on the difference of relationships between the concepts synthesizing. In session, the subject uttered lots of nouns in a thematic relation in the design result with high creativity. Therefore, the one factor for extension of design space is associated with a thematic relation that the subject recollects various scenes and situations.