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Transformation of Concept Space in Design Thinking

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So far, many studies have pointed out that design, creativity and *concept space* are closely related to each other. And considering that, it seems that concept space is affected by design act as well as design act that affected by concept space. Therefore, it is thought that concept space is transformed by design act. But so far, no studies researched effect of design act that makes an impact to concept space. The effect of design act that make an impact to concept space is important element for science of design. And quantitative research is necessary for future of science of design.

Therefore purpose of this study is to research the transformation of concept space by quantitative method, and to research the effect of design act that makes an impact to concept space. This study focused on *conceptual blending* as design act. Because conceptual blending is creative thinking process, and is typical design act. On conceptual blending, it seems that subjects were forced to correlate two concepts. And this forced association process seems to makes transformation of concept space. Specifically, after the conceptual blending, the distance between the two concepts and adjacent spaces of the two concepts seem to be closer than the distance on pre-conceptual blending. Therefore hypothesis of this experiment is the decrease of distance between two concepts.

To confirm above hypothesis, a psychological experiment was performed. In this

experiment, subjects were divided into two groups, the conceptual blending group and the control group. Tasks of each group consist of three parts which contains same tasks except in the part 2. Parts are in order of the time series with part 1, part 2, and part 3. In the part 1, all subjects were asked to fill out questionnaire. This questionnaire was used to investigate subject's concept space. In the questionnaire, the subjects judged the distance between two concepts on a scale of one to seven. Twenty concepts were presented, and the 190 combinations among them were judged. In the part 2, subjects who belong to conceptual blending group were asked to conduct a design task. In the design task, subjects were asked to create new design idea by conceptual blending. In this conceptual blending, subject synthesized "bird" concept and "glass" concept. This combination of concepts makes good design result. And in the part 2, subjects who belong to control group were asked to work out a puzzle. On the part 3, in order to compare conceptual blending group with control group, subjects were asked to fill out the same questionnaire in the part 1 again.

From the difference between results of the part 1 and that of the part 3, transformation of concept space was investigated. And differences of conceptual blending group and control group were compared with. The questionnaire results of these two groups (conceptual blending group and control group), were analyzed by multidimensional scaling (MDS) method. From the result of MDS method, the distances from the concepts of "bird" and "glass" to a variety of other concepts were calculated.

Comparing the results of two kinds of subjects, the difference was admitted between two kinds of subjects. And this difference seems to indicate the possibility of transformation of concept space caused by conceptual blending. Next, I examined what kind of transformation occurred in concept space. And possibility of closeness of the distance between the two concepts (bird and glass) and adjacent space of the two concepts was detected.

This study focused on transformation of concept space caused by design thinking. And purpose of this study was to search the transformation of concept space. And an experiment of searching the transformation of concept space was planned. The result of the experiment detected the possibility of transformation of concept space caused by design thinking. On the conceptual blending, distances between two concepts which were used in conceptual blending and adjacent space of the two concepts closed. This study offers the new method to observe the human mind. So far, there was no method that observe the transformation of concept space, but this method. Therefore, this method seems to be the key factor of clarifying the relation among thinking process, concept space and creativity. It has the possibility of becoming new approach to creativity.