

Title	製品デザイン教育における創造性を高めるためのトポロジ的バリエーション指向アプローチ
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# Abstract

This thesis introduces an approach for aiming at promoting the effect of product design creativity by using topological properties variations. The study first proves that the visual perception of topological properties variations is useful for product innovation and second verifies the approach for product design creativity based on topological properties variations.

A primitive and general function of the visual system is the perception of global topological properties. People will give priority to directing their attention to the global topological properties of an object compared with the local geometric properties. If a variation of topological transformation occurs in the shape of a product, the product will receive more attention from customers, and opportunities will be gained to publicize the product's innovative points that cannot be perceived by vision, such as function, performance, experience, and so on. The hypothesis is that the perception of topological properties (holes, connectivity and inside/outside) exists in the shape of the product, and humans can pay attention to products that are relational to topological properties variations that have occurred in the shape. From the first experiment conducted in recognition of bicycles, we ascertained that people pay attention to bicycles with variations of topological transformation. The Repertory Grid Technique was used to discover and discriminate the reasons for such attention. We extracted the mental constructs of the participants for the products with topological properties variations and identified the reasons for innovations.

The topological variation – oriented approach for creativity generation (TVC) as a visualized sheet that evolved from a rich picture and showed the relationship between products and human was constructed through four territories: product, human, interaction, and experience. Each field is distributed in a vertical direction from left to right in a logical order of product, human, interaction, and experience. Each field is divided into several elements, and corresponding elements of each field are arranged in a horizontal direction. When topological properties variations occurred, certain new relationships arose in the elements and the novel products were generated strong possibility. In the second experiment, instruct the subjects to master TVC to design the chair. Subjects use this approach to get creative ideas that are significantly innovative. In this experiment, on the one hand, the subject's design ability was significantly improved after using TVC. On the other hand, testing TVC has advantages in some respects over the other approach that students are good at in product design. Finally, the thesis discusses the contribution of the research to knowledge science and product design education.

From the perspective of knowledge science, TVC reveals the roots and evolution of creativity as a visual sheet, revealing that the root of creativity is to create new connections between things. In a narrow sense, TVC is a visual plane that can be applied to product design creativity. In a broad sense, TVC is a key to open the door to the study of the cognitive laws of new things, as well as the study of many psychological concepts. Creating new product design theories and methods is very important basic research work in universities. Topological visual perception is the fundamental and primitive functions of human beings vision system. The product form design theory and method developed from this basic visual perception feature is minimally influenced by regional culture and ideology and has a strong universality. It is suitable for the rapid globalization of the commodity market and can attract the attention of consumers to the greatest extent.

**Keywords:** topological perception; product shape; topological properties variations; creativity; product design education