

Fixation or inspiration? A meta-analytic review of the role of examples on design processes



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A meta-analytical review of design studies (N = 43) was conducted examining whether and under what conditions the presence of examples will induce fixation or inspiration. The analysis revealed that providing examples made individuals generate more example-related and fewer categories of ideas, however, the ideas produced were more novel. Also, the quality of solutions ideas was positively correlated with the degree of copying from examples. The facilitatory effects on novelty and quality increased when fewer and less common examples were presented. Presenting a single and uncommon example may encourage individuals to shift from traversing between different parts of the problem space to conducting a deeper search in a specific and remote domain, facilitating the generation of high-quality and novel ideas.

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In design, people often seek examples for inspiration. Design-by-analogy, using examples to spark ideas on what a solution to a problem might be, is a common approach to innovation concept generation (Goel, 1997; Hey, Linsey, Agogino, & Wood, 2008; Holyoak & Thagard, 1995). Even though example solutions may not always provide fully developed solutions to design problems, they can serve as cues that help retrieve relevant concepts from long-term memory and in turn facilitate the development of innovative conceptual designs. However, one risk with this approach is that example solutions, even potentially beneficial ones that do not violate design constraints, may negatively impact design processes in the form of design fixation, directing individuals to search in the example-related domains only (Chan et al., 2011; Jansson & Smith, 1991). Do examples induce fixation or inspiration? Findings of the previous studies investigating the effects of examples on design processes are inconclusive, with some reporting the fixation effect induced by the presence of examples (Chrysikou & Weisberg, 2005; Jansson & Smith, 1991); and others demonstrating how the presence of examples inspires the design idea generation processes (Helms, Vattam, & Goel, 2009). The co-existence of the positive and negative effects elicited by examples

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makes it difficult to judge whether exposure to examples is helpful or not. A comprehensive theory or model that can explain how and why examples might impact the design processes is still absent. To address these, we conducted a meta-analytical review of the past studies in this area, in an attempt to assess the impacts of examples on design processes and to identify under what conditions the presence of examples will induce fixation or inspiration. Understanding the impact of examples on design processes allows us to make an effective use of examples to promote innovation and creativity in design practice. Further, examining how the external information (e.g., examples) influences individuals' design processes also enriches our understanding of problem solving in which the detailed interaction between the external information and the individual problem solving processing is still poorly understood.

1 Fixation or inspiration

When designing a new product, individuals usually do not create something new from scratch. Instead, they transform, combine, or adapt elements of existing designs to generate new ideas (Ward, 2007). However, looking at existing designs may not always provide inspiration to individuals. Empirical studies on design processes have revealed that consulting existing designs may instead negatively impact the quality of the design solution. When individuals are given an example solution to look at, they often tend to produce a solution similar to the example provided. Individuals do not copy ideas only from relevant examples that fulfill the task requirement, design replication occurs even when the example is a poor one that does not fit the task requirement. Jansson and Smith (1991) observed and described a phenomenon called *design fixation* in engineering design that engineering design students tended to incorporate features of the examples in their design ideas even when the features of the examples were negative features. Studies have been conducted to examine how design fixation can be overcome by manipulating the properties of the examples, e.g., common-ness of the examples (Purcell & Gero, 1991), richness of the examples (Cardoso & Badke-Schaub, 2011), and modality of the examples (Chan et al., 2011; Viswanathan & Linsey, 2013a, b).

In contrast to the studies examining design fixation, there is another line of research examining how examples serve as analogies and facilitate creativity. Anecdotal reports of creative discoveries and inventions have supported the potential of exemplar analogies for creativity, such as George Mestral's invention of Velcro via analogy to burdock root seeds, and Niels Bohr's discovery of the structure of atoms via analogy to the solar system. Empirical works have been reported showing that presenting examples to individuals can inspire creativity (Casakin & Goldschmidt, 1999; Goel, 1997). The examples used in the design-by-analogy studies are potentially beneficial examples that do not violate the task requirement (termed "non-negative" examples in this paper),

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