Extended linkography and distance graph in design evaluation: an empirical study of the dual effects of inspiration sources in creative design

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All design is influenced by previous exposure to ideas in different formats and in different levels of abstraction. This paper introduces refined methods to represent and analyze the creativity and fixation effects of inspiration sources on designs. Based on a critical review of existing design research methods, we develop an extension of linkography and a distance graph to investigate design patterns among designers of different expertise levels and exposure to different inspiration sources prior to design. In our explorative experiment, novices and experts were given five types of external stimuli—keyword, diagram, plan, sketch rendering, and precedent photo—as inspiration sources for the same design task. Our extended linkography represents and measures the creativity and fixation propensities of different inspiration sources at the micro-level of design processes.

Keywords: creativity, conceptual design, extended linkography, design knowledge, design education

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Architects draw various sources of inspiration from daily life. The term 'inspiration sources' refers to all conscious uses of previous designs and other resources, as the references for the solution to the current problem (Eckert, Stacey, & Clarkson, 2000). Inspiration sources may take the form of the basic geometrical shapes, works of art, objects and phenomena from nature and everyday life, as well as abstract texts, architectural precedents, design sketches, diagrams, and technical drawings such as plans and sections. On the one hand, inspiration sources can facilitate design thinking and function as 'triggers for idea generation, and as anchors for structuring designers' mental representations of designs' (Eckert et al., 2000). On the other hand, exposure to inspiration sources can sometime lead to design fixation, 'a blind adherence' to certain set of ideas or concepts (Jansson & Smith, 1991; Tseng, Moss, Cagan, & Kotovsky, 2008).

Previous studies have found that specific sources such as word graphs (Segers, De Vries, & Achten, 2005), or visual stimuli (Goldschmidt & Smolkov, 2006) have different impacts. In this paper we explore how the modalities and representations of external stimuli—keyword, diagram, plan, sketch rendering, and precedent photos—impact designers' subsequent designs and particularly on their design fixation. We designed an explorative experiment to seek answers to several questions: To what extent, can sources of inspiration enhance or constrain creativity? How would different inspiration sources, presented as external stimuli, affect design performance? Do novices and experienced designers respond to external stimuli differently?

To explore these questions we have employed both qualitative and quantitative methods and are particularly interested in developing a method that allows analysis of links between the sources of inspiration and the target. Below, after a brief survey of the literature on creativity and design fixation, we describe the experiments and the analysis using an extension of linkography and a distance graph. The patterns of 'extended linkography' and 'distance graph' are developed to represent how exposure to various stimuli may enhance or inhibit design performance for designers of different levels of expertise. In the last section, we report the contribution and limitation of the current study and discuss directions for future development.

1 Stimuli as sources of inspiration in design

Several studies from different theoretical backgrounds have investigated the role of stimuli as sources of inspiration (Goldschmidt, 2001; Mednick, 1962). Associative theory claims that the creation of new ideas is the result of association, which can be facilitated by providing unique stimuli (Mednick, 1962). When external stimuli are applied as sources of inspiration, the stimuli form search cues in short term memory and then can be used to probe long-term memory to ease knowledge acquisition and enhance idea production (Nijstad, Stroebe, & Lodewijkx, 2002; Nijstad & Stroebe, 2006; Perttula & Sipilä, 2007). Once an idea is activated, it may further spread activation to other ideas with related attributes (Perttula & Liikkanen, 2006). Some computer-aided design tools are developed based on associative theory, aiming to stimulate design performance. For instance, Segers et al. (2005) proposed the Idea Space System to provide word graph as feedback to help architects generate more associations and increase novelty of design concepts. The use of word graphs is found to be useful in a divergent, explorative thinking process, rather than as a convergent and focused development.

Analogical reasoning is another important strategy that accounts for knowledge transfer from source to target (Casakin & Goldschmidt, 1999; Goel, 1997; Goldschmidt, 2001). Analogy is defined as a process of mapping and transfer from one situation to another based on 'similarities between relationships' (Goldschmidt, 2001: p 201). The process of analogical mapping and