The cognitive profile of creativity in design

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A R T I C L E   I N F O

A B S T R A C T

The objective of the study was to explore the cognitive profile of creativity in design by applying a new approach to the assessment of creativity based on the theory of meaning (Kreitler & Kreitler). The assessment of meaning enables to identify cognitive processes that characterize an individual as well as those necessary for good performance of some cognitive act, such as creativity. It was hypothesized that creativity in design will include partly cognitive components identified in previous studies of creativity and partly new ones. The participants were 52 students in a school of design, who were administered a designing task and the Meaning Test, assessing a broad range of cognitive processes. The design products were assessed for creativity by three experienced architects. The cognitive processes, differentiating significantly between the students who produced highly creative designs and those who produced less creative ones, were interpreted as constituting the cognitive profile of creativity in design. The obtained profile supported the hypothesis and provided information about the cognitive processes of creativity in design, which may also be used for promoting creativity in design students.

1. Introduction

Design activity involves problem solving. As such, it has often been conceived in terms of the so-called Rational Model that assumes a stage-bound procedure of applying systematically a variety of known strategies for attaining a clearly defined set of objectives (Brooks, 2010; Dorst & Dijkhuis, 1995, p. 261; Newell & Simon, 1972; Pahl, Beitz, Feldhusen, & Grote, 2007; Ralph, 2010). This model has been criticized on many grounds, especially because it is not supported by empirical observations about how design is actually performed and mainly because it leaves little space for creativity (Brooks, 2010; Cross, Dorst, & Roozenburg, 1992; McCracken & Jackson, 1982; Ralph, 2010; Schön, 1983). In recent years there has been increased recognition of the role of creativity in design. This is not surprising insofar as design activity deals with problem-solving situations which are ill-defined and open ended, posing mostly incomplete and imprecise design goals (Goel, 1995; Simon, 1973). It has been argued that problems of this kind cannot be solved through the application of routine problem solving procedures (Gero, 2000), and hence have the potential for promoting innovative and creative solutions (Purcell & Gero, 2006). Following insights of this kind an alternate approach to design production has been developed. It is often called "The Action-Centric Model" and is based on assuming that emotion, intuition, innovation and other processes that constitute creativity play a major role in design production (Cross et al., 1992; Ralph, 2010; Schön, 1983; Truex, Baskerville, & Travis, 2000). Observations of this kind have made it clear that creativity is involved at least to some degree in every act of design production.

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Awareness of the important role that creativity may be playing in design has prompted interest in promoting creativity in design, which has led to attempts to deepen understanding of the processes involved in creativity in this domain.

1.1. Cognition in design creativity

Notably, most of the conceptualizations of creativity in design are based on the exploration of the cognitive aspects of creativity. While creativity is a multifaceted phenomenon which can be studied in terms of emotional (Averill, 2005), motivational (Collins & Amabile, 1999; Runco, 2005), and behavioral (Runco, 2005) aspects, there is general agreement that cognition constitutes a major factor in regard to creativity (Finke, Ward, & Smith, 1992; Weisberg, 1986). This is evident even in the common definitions of creativity as a set of high abilities necessary for producing remarkable discoveries, communicating unusual thoughts, forming exceptional judgments, and understanding reality in extraordinary ways (Csikszentmihalyi, 1997).

The studies of creativity in design up to now have focused mainly on describing rather general aspects of the cognitive processes of designing. Thus, Schön (1983), who adopted the "reflection-in-action" paradigm, claimed that designers alternate between "framing", "making moves", and "evaluating moves" in their approach to a designing problem. During the framing process, the designer maintains a 'reflective conversation' with the design, by means of which design goals are refined and different mental representations of the design situation are constructed. Ralph (2010) preferred to conceptualize the process in terms of sense-making, which includes both framing and evaluating moves, implementation, which refers to constructing the design object, and co-evolution, which consists in refining the mental representation of the design object in view of its context.

Further studies focused on more specific cognitive components of creative design problem solving. Casakin (2007), for example, investigated the effect of metaphors in enhancing creative design solutions. Bonnardel and Marmeche (2005), and Casakin (2010) carried out a comparative analysis between experts and novice designers in the use of analogical reasoning. Goldschmidt and Tatsa (2005) and van der Lugt (2005) showed how meaningful ideas that constitute a basis for creative design thinking, have a significantly higher number of links and relationships than other less important ideas. Goldschmidt (1991) and Casakin and Goldschmidt (1999) investigated the use of visual reasoning as a critical component of creative design thinking.

In view of the evidence about the role of cognition in design creativity, the objective of the present study is to shed more light on the issue by basing our approach on the following two assumptions. The first assumption is that creativity in design may be a specific kind of creativity, possibly different from creativity in other domains. One obvious reason for this assumption is that in design, the creative product is expected to be not only original and esthetic, as is common in other art domains, but also useful, functional and valuable (Christiaans, 2002). Another reason is that evidence is accumulating showing that creative performance is domain-specific (Baer, 1998). Kaufman and Baer (2005) presented a review of whether creativity is a general or a domain-specific process. The relation between general and domain-specific creative abilities was also recently investigated in a variety of domains such as family interactions, social leadership, and salesmanship (Milgram & Livne, 2007). Milgram and Feldman (1979) showed that a strong relation exists between general creative thinking and domain-specific creative problem solving in the classroom by elementary school teachers.

Studies with adults and children indicate that creativity depends to a large extent on the particular content of the problems dealt with (Gayle, Dow, & Mayer, 2004; Han & Marvin, 2002; Reiter-Palmon, Illies, Kobe Cross, Buboltz, & Nimps, 2009). This assumption is in accord with the growing conviction that cognitive acts in general are guided by domain-specific systems of knowledge that consist of specific components and specific sets of processes (Carey & Spelke, 1994). The assumption about the specific nature of creativity in design indicates the need for studying creativity in this domain, despite the fact that cognitive aspects of creativity have been studied in other domains of creativity.

The second assumption is that a comprehensive assessment system would be better suited for exploring the cognitive correlates of creativity in design, in preference to an approach that capitalizes on assessing one or two specific components. The reason is that a more comprehensive system is more likely to provide information that would be encompassing, and hence reveal more specific aspects of creativity in design.

The method we applied in the present study is based on the theory of meaning (S. Kreitler & H. Kreitler, 1990). The theory of meaning is a psychosemantic approach that consists in specifying a comprehensive set of cognitive contents and processes, describing the manner in which they cluster into structures underlying cognitive acts, and other psychological dispositions, such as emotions and personality traits (S. Kreitler & H. Kreitler, 1990).

1.2. The meaning system

The major assumption of the theory of meaning is that meaning provides the major contents and processes used by the cognitive system. The assessment of meaning consists of two main steps. The first is identifying in a verbal or nonverbal communication units consisting of a referent (i.e., a stimulus, subject, input) and a content serving to communicate the meaning of the referent. Examples of meaning units are: "glass – serves for drinking", "building – is located in the city",