Chapter 10
A Computational Model of Collaborative Creativity: A Meta-Design Approach

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ABSTRACT
The role of collaboration in the realm of social creativity has been the focus of cutting edge research in design studies. In this paper, the authors investigate the role of collaboration in the process of creative design and propose a computational model of creativity based on the newly proposed meta-design approach. Meta-design is a unique participatory approach to design that deals with opening up of design solution spaces, and is aimed at creating a viable social platform for collaborative design. A meta-design-based collaborative approach to the design process may achieve ET-creativity by expanding the conceptual space of design beyond what would have been possible by individual, non-collaborative design. The model has been implemented using interactive genetic algorithms, which casts the design problem as an optimization problem and uses a set of collaborative users for subjective fitness evaluation. The design problems investigated include the collaborative design of architectural floorplans and editorial design of brochures.

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INTRODUCTION

Recent advances in computational creativity can be broadly classified into two groups – studies involving development of programs and computational techniques that are capable of intelligent and creative tasks, and those involving computer systems and programs that put the human-user in the loop with the aim of enhancing user creativity. The latter is often labeled computer-supported creativity. The definitions of creativity and creative design have been debatable, although it is broadly agreed that creativity is the generation of ideas that are both novel and valuable (Boden, 1999). The word “ideas” is domain-specific and has been used to mean concepts, products, processes, theories, melodies, paintings, numerous other forms of art, and so on. Novelty of ideas is defined with respect to past ideas, using either the creator or the entire humanity as a reference and keeping in mind the domain in which the idea is proposed, leading to classification of creativity into P-creativity (personal creativity) and H-creativity (historical creativity). Value to the idea can either be attributed at the time of proposition or later. In fact, many creative ideas have been recognized as being creative long after their being proposed – a result of the fact that creative ideas are ahead of their times and therefore can be impractical. An example of a creative idea in the business domain is the Netflix model of visual media distribution that is both novel (the model was far removed from static late-fee based Blockbuster model) and valuable (the implementation of the model made the parent company one of the most profitable technology companies in the last decade).

In this paper, we propose a new paradigm of computational creativity that is at the intersection of the two broad classes – a model that supports user-centric creative endeavors in design and is capable of producing designs that have creative aspects. The rest of the paper is organized as follows: in the next section we present the need for the new paradigm and review the formalized notion of computational creativity and the meta-design approach based on open systems. We then present the proposed collaborative interactive framework for creative design and relate it to the formalized notions of creativity and the meta-design approach. Before concluding we also present the algorithmic implementations of the model for collaborative design of architectural floorplans and editorial design of documents and brochures.

COMPUTATIONAL CREATIVITY: A FORMALIZED NOTION

Researchers in computational creativity are interested in the underlying process of creative ideation. This fundamental question has led to the definition of a conceptual space of ideas, which a computer program can search in. Creativity that is a result of simply searching the conceptual space for complete or partial possibilities is labeled E-creativity, for exploratory creativity. If the conceptual space is considered bounded by static rules, such E-creativity is often regarded as merely “innovation”, and not creativity. On the other hand, if the rules that bound the conceptual space can be changed with respect to time, then the search for ideas in a continuously changing space is called T-creativity, for transformational creativity (Boden, 1999). This can be mapped to how a human thinker comes up with creative ideas. The mind is a veritable storehouse of ideas and if the mind could be mapped, this storehouse then becomes the conceptual space of ideas. If the thinker does not broaden his mind (by incorporating more domain knowledge, knowledge from other domains, etc.) he or she is just exploring a well-defined unchanging conceptual space producing ideas that may not necessarily be creative. It is only when the thinker moves out of rigid definitions of what-is and what-can-be, thereby modifying the conceptual space of ideas, that creative ideas are born. Kekule’s discovery of Benzene rings, Watson and Crick’s double