SOFTWARE SUPPORT OF THE BLENDED CREATIVITY PROCESS

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ABSTRACT

This exploratory paper summarizes creativity from numerous perspectives derived from the creativity literature. The paper also presents a relationship on how software could enable more people to be creative more of the time. A framework called Meta-creativity is used to convey the idea that millions of people could benefit from creativity support tools. On the basis of the literature review and the Meta-creativity framework, a hypothesis that visualizing processes (collect activity) increases creativity emerged.

INTRODUCTION

Creativity is a process that has long been seen as a mysterious (Shneiderman 2000; Boden 2004). Indeed, creative ideas are unpredictable and sometimes they even seem to be impossible. Yet they happen and are important to individuals and organizations. Shneiderman (2002) offers us a vision on how software could enable more people to be creative more of the time. The term meta-creativity is used in this vision to convey the idea that millions of people could benefit from creativity support tools.

The vast amount of creativity literature offers numerous diverse perspectives (Gardner 1993; Couger 1996; Boden 2004) on what creativity is and how to get it. Three perspectives are identified by Ben Shneiderman (2002), as inspirationalism, structuralism, and situationalism. They offer us a frame of reference to understand the perspectives in a coherent and useful way.

THREE PERSPECTIVES ON CREATIVITY

Inspirationalists, emphasize the intuitive aspects of creativity; those remarkable "Aha!" moments in which preparation and incubation lead to moments of elucidation. Creative work starts with problem formulation and ends with evaluation plus refinement. It is thought of as a creativity-inducing process that can be taught. Some examples of techniques that support this model are brainstorming, free association, lateral thinking (De Bono 1992), and divergence. These techniques are meant to unfreeze the existing mindset, which frees the mind to perceive the problem with fresh eyes. Free association needs software support that emphasizes ways to generate novel ideas and is often oriented to visual techniques for presenting relationships and for perceiving solutions. Software such as IdeaFisher or MindMapper are examples of brainstorming tools. The method of organization is patterned after the way we naturally store information in the human brain. It explains the common experience of "one idea leading to another." Templates exist as starting points, but are coupled with ways to explore fresh combinations.

Structuralists, emphasizes more orderly approaches (Mayer 1991). Methodical techniques combined with studying previous work are used to thoroughly explore the solutions. Orderly methods are used to problem solve. When a promising solution is identified: (1) strengths and weaknesses are evaluated; (2) existing solutions are compared to it; (3) refinement takes place, with the goal of implementation. Software support in the form of digital libraries and websites of previous work are important. Key software support comes in the form of spreadsheets, programmable simulations, and domain-specific scientific models that support "what if" processes. The goal is to try out assumptions to assess their impact on the outcomes, often using visual animations and tools that draw flow charts, decision trees, and structured diagrams. Methodical techniques

should have step-by-step software support, but should allow an iterative type exploration that allows you to make changes, whenever and however you need too.

***Situationalists*,** emphasizes that the creative processes key component is its social and intellectual context. It is a social process embedded in a community of practice. Scientific journal editors, museum curators, etc. set the changing standards. For example, in the research literature there are three components to creativity: (1) a set of symbols, rules and procedures, (2) gatekeepers to the domain, (3) individual person whose creativity is manifest (Csikszentmihalyi 1996). Software tools should support access to a domain of previous work, collaboration, and dissemination of results to interested people.

Inspirationalism, structuralism, and situationalism perspectives are all useful in designing user interfaces. These perspectives' can be used individually are combined to shape the development of tools that look at previous work, as inspiration, links to associated ideas, provide templates for action, structured tools for exhaustive exploration, and collaboration software, which is now commonly used in most organizations.

Shniederman (2002) defines ***three levels of creativity***. First, everyday creativity is impromptu or personal. Second, revolutionary creativity is the great breakthroughs and paradigm shifting innovations. Third, evolutionary creativity are contributions that refine and apply existing paradigms or methods of research. Shniederman (2002) does not concentrate on revolutionary or impromptu creativity, but it does concentrate on evolutionary creativity and how to develop the software support tools according to the three perspectives identified in this paper - inspirationalism, structuralism, and situationalism.

A FRAMEWORK FOR MEGA-CREATIVITY

After several years of exploration, the genex framework (Shneiderman 2000; Carroll 2002; Shneiderman 2002) evolved into the framework for mega-creativity which has four activities:

- **Collect:** Learn from previous works stored in libraries, the Web, and other sources.
- **Relate:** Consult with peers and mentors at early, middle, and late stages.
- **Create:** Explore, compose, and evaluate possible solutions.
- **Donate:** Disseminate the results and contribute to libraries, the Web, and other sources.

It builds primarily on the situationalists' perspective by using the potential offered by the World-Wide Web. The mega-creativity frameworks goal is to suggest improvements for web-based services, personal computer software tools and calls for integrating creativity support tools. Improvements include reducing the distraction caused by poorly-designed user interfaces, users' attention can be devoted to the task. Some creativity tools already exist, but could be enhanced to ensure smooth integration across novel tools or word processors, presentation graphics, email, databases, spreadsheets, and web browsers. In an effective design, available functions would be in agreement with problem-solving strategies, leaving the users to concentrate on creativity (Shneiderman 2002).

The three perspectives (inspirationalism, structuralism, and situationalism) each generate useful suggestions for tasks. Figure 1 indicates how the eight tasks are primarily related to the four activities, but these tasks could take place during any phase.

<u>The eight tasks described below are supported by integrated creativity support tools.</u>
(1) Searching and browsing digital libraries, the Web, and other resources
(2) Visualizing data and processes to understand and discover relationships
(3) Consulting with peers and mentors for intellectual and emotional support
(4) Thinking by free associations to make new combinations of ideas

(5) Exploring solutions—What-if tools and simulation models
(6) Composing artifacts and performances step-by-step
(7) Reviewing and replaying session histories to support reflection
(8) Disseminating results to gain recognition and add to the searchable resources

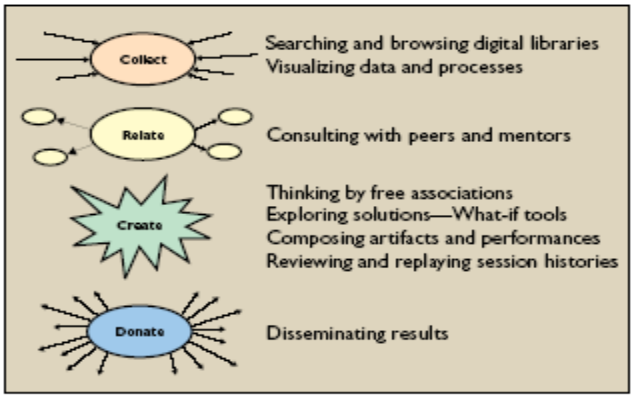

Figure 1. Primary relationships of four activities and eight tasks.
(Shneiderman 2000; Carroll 2002; Shneiderman 2002)

RELATED WORK

The mega-creativity (Genex) framework is based almost entirely on one theory (Theory of Flow, (Csikszentmihalyi 1996)). Numerous other authors (Terry and Mynatt 2002; Maiden, Gizikis et al. 2004; Farooq, Carroll et al. 2005; Warr and O'Neill 2005; Farooq, Carroll et al. 2007) offer research based on a broader range of creativity literature. Farooq, Carroll et al., 2005 present and justify "three requirements for supporting creativity:

- Divergent thinking is the ability to generate a set of possible responses, ideas, options, or alternatives in response to an open ended question, task, or challenge. Convergent thinking involves narrowing this set to one alternative, and then implementing this alternative by empirically testing and communicating it to the related community.
- Shared objectives imply a group vision of the goals of its work that members wish to achieve.
- Reflexivity is the extent to which members collectively reflect on the group's objectives, strategies, and processes as well as their wider organizations and environments, and adapt them accordingly".

Shneiderman (2007) offers a slight shift in focus and terminology, when compared to Shneiderman (2002), but the goal still remains the same; to enable more people to be more creative more often. The three perspectives described above are offered as diverse perspectives in the literature on creativity. In Shneiderman (2007) the same groups are presented, but are described as "The large amount of literature on creativity, discovery, design, innovation, and composition may be sorted into three intersecting schools" (Shneiderman 2007) The schools have the same definition, but the examples of the creativity tools have been updated and the focus shifts to important lessons being offered to designers of creativity support tools. For example, structuralist thinking encourages systematic tools (same) that include progress indicators with reminders of what is still needed (new).

The inspirationalist view supports development of image libraries, thesauri, sketching interfaces (new), and concept-mapping tools. Situationalists broaden the designer's view to include email and collaboration tools, as well as the e-science notebooks that guide users and coordinate groups through scientific processes over

weeks, months, and years (new). The mega-creativity framework is used in Shneiderman (2002) to facilitate creative work by building on four activities and eight tasks that are presented. Shneiderman (2007) shifts its focus to changing mindsets and developing design guidelines (principles) and appropriate research methods. More recent works by Shneiderman emphasize the need to study the creative process (Shneiderman, Gerhard Fischer et al. 2006; Shneiderman 2007).

Research frameworks are attempts to capture and explain the complex, interdependent, and dynamic factors and processes that exist in our world. Mackenzie (2000) presents a process approach for the organization sciences that views organizational behavior as fundamentally a physical process, thus it is a sustained phenomenon or one marked by gradual changes through a series of states. This supports Shneiderman (2007) conclusion that creativity is a process. It is important to note that variables are often a form of the outcomes (results) that come from a process and are inherently causal (Mackenzie 2000). However, a variable cannot capture the complexity of the creativity process that takes place because a process represents a developmental sequence of events. Interestingly enough, factor research models are the most commonly used models in creativity research (Shneiderman 2007), and although they are useful to researchers, a gap exists in the study of the actual processes that produce the factors. Current research (Shneiderman 2007) suggests that process and factor models complement each other, and when presented together, give a more informative and therefore more complete picture of what is being studied.

> "The emphasis on close study of domain experts as they make discoveries has led many researchers to adopt case study, observational, and interview methods with small numbers of users over weeks and months. Their goal is to capture the processes that precede breakthrough incidents and to collect evidence that supports hypotheses about how software design features promote creative moments." (Shneiderman 2007)

HYPOTHESIS

On the basis of the literature reviewed for this paper and after analyzing the Meta-creativity framework, I hypothesize that visualizing processes (collect activity) increases creativity.

CONCLUSION

In summary, creativity is a process that has long been seen as a mysterious (Shneiderman 2000; Boden 2004) Indeed, creative ideas are unpredictable and sometimes they even seem to be impossible. Yet they happen and are important to individuals and organizations. Shneiderman (2007) offers a slight shift in focus and terminology, when compared to Shneiderman (2002), but the goal still remains the same; to enable more people to be more creative more often. Consequentially, the term meta-creativity is used to convey the idea that millions of people could benefit from creativity support tools. Future research should expand this exploratory study by following Shneiderman (2007) and take into consideration the opportunity to enrich the research on creativity with methods that include process research, case studies, observational, and interviews with small numbers of users over weeks and months. As a researcher, my goal (as I move forward) is "…. to capture the processes that precede breakthrough incidents and to collect evidence that supports hypotheses about how software design features promote creative moments." (Shneiderman 2007)

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