Evaluation Methods for Creativity Support Environments

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Abstract
Creativity refers to the human processes that underpin sublime forms of expression and fuel innovation. Creativity support environments (CSEs) span and integrate diverse domains, including music, art, education, science, programming, performance, design, and entrepreneurship. An environment may consist of a desktop application, or involve specialized hardware, instrumented spaces, networked topologies, and mobile devices. CSEs may address temporal-spatial dimensions of collaborative work.

This workshop will gather a community of researchers developing and evaluating creativity support environments, so that people can share approaches, engage in dialogue, and develop best practices. The expected outcome is not a single prescription, but rather a landscape of routes, an ontology of methodologies with consideration to how they map to creative activities, and an emerging consensus on the range of expectations for rigorous evaluation to shape the field of creativity support environments research.

Keywords
creativity, evaluation

ACM Classification Keywords
H.5.0 [Information interfaces and presentation (e.g., HCI)]: General.

General Terms

Human Factors, Design, Theory

Introduction

Creativity refers to the human processes that underpin sublime forms of expression and fuel innovation. Innovation is widely recognized as the key to information age economies [14]. This workshop will explore methodologies for assessing interactive tools, experiences, and environments designed to support, promote, and provoke creativity. A 2005 NSF workshop saw the development of creativity support tools, and their evaluation as a strikingly new field [16]. Since a tool is designed to carry out a particular function – and valuable creative experiences may be more fluid in their inception, intention, and outcomes – we expand the scope, using the nomenclature 'environments,' a superset of 'tools.'

Rather than viewing the evaluation of creativity support environments as a strange, unknown territory, which can be dabbled in, we take the position that researchers are developing sophisticated methods, which have progressed well beyond infancy. The goal of this workshop is to bring together the community involved in developing these methods, to lay them out and set the table, and to inspire discussion and even debate about the value of particular methods in various types of situated contexts. The outcome of the workshop will not be a single prescription, but rather a landscape of routes, an ontology of methodologies with consideration to how they map to creative activities, and an emerging consensus on the range of expectations for rigorous evaluation to shape the field of creativity support environments research.

Creativity involves engagement in a range of tasks and activities, from inspiration-based human expression that defines the arts to the development of scientific and humanities research, from the development of solutions to diverse open-ended questions to the invention of new products and services. Creativity is characterized by human experiences and processes, as well as products and outcomes. Creativity involves insight, emergence, innovation, ideation, and novelty.

Both activities that are open-ended and activities that are characterized by constraints, can be creative. Open-ended tasks may involve divergent thinking questions with multiple correct answers [15]. Examples of divergent thinking tasks include the identification of paper topics, the development of theses, and contextualized design problems in diverse domains, including visual design, interaction design, architecture, and engineering. The products of divergent thinking tasks have been assessed using quantitative ideation metrics, such as novelty, variety, fluency, and quality [15].

Creativity Support Environments

Creativity support environments span diverse domains, including music, art, education, science, programming, performance, design, and entrepreneurship. Some CSEs support inter-disciplinary work, helping users to integrate work from multiple modalities and domains.

An environment may consist of a desktop application, typically referred to as a creativity support tool. It may involve specialized hardware, instrumented spaces, networked topologies, and mobile devices. CSEs may address temporal-spatial dimensions of collaborative work, requiring evaluation methods that address synchronous, asynchronous, co-located, and distributed interaction. Creativity support environments need to be sensitive to the contextualized practices within which they are

situated, potentially accounting for differentiated roles.

CSEs are designed to provide stimuli to provoke, enhance, and otherwise promote creative processes and products. While some disruption can promote creativity, other types can disrupt the sense of immersion in the creative task. Designers seek to prevent disruptions and interface distractions that hinder creative processes. Thus, to evaluate CSEs, one may need to assess both how creative work is supported in terms of factors that promote creativity, and in terms of factors that hinder creativity.

Although creativity is often associated with expertise in a particular domain, creativity likely occurs across a spectrum – from large-scale creativity (Big-C creativity) to everyday creativity (little-c) to personal creativity (mini-c) [1, 5]. CSEs are designed to support creative work across this spectrum. Evaluation approaches need to determine how well an environment supports differing skill and creativity levels.

Prior Work

The NSF workshop on creativity support tools (CSTs) discussed the importance of going beyond traditional productivity measurements [8]. Likewise, in the BELIV workshops, the information visualization community advocated novel evaluation methods [2]. Creativity tasks, as with information visualization tasks, are open-ended and require researchers to move beyond time and error metrics. The NSF workshop report emphasized that CST evaluation should involve a mixed-methods approach [6] to help researchers better understand the role of CSTs in creative processes.

Researchers in creativity support environments have already developed a range of evaluation methods, including metrics and longitudinal studies. Kerne et al developed a quantitative methodology for the evaluation of *information-based ideation* tasks, invoking a battery of mutually independent ideation metrics to assess creative products [10]. Webb and Kerne refined methods for calculating the novelty and variety information-based ideation metrics [19]. Carroll et al. [3] developed a survey metric called the Creativity Support Index, which is similar in form to the NASA Task Load Index [7] but designed specifically for CSTs. Kim and Maher used a protocol analysis to show that tangible interaction improved engagement in spatial cognition [11]. Latulipe et al. used physiological sensors to measure audience responses to creative outputs [13].

Qualitative approaches are also significant. Shneiderman and Plaisant [17] conducted longitudinal case studies with expert users of information visualization tools. Latulipe et al.'s longitudinal studies investigated the integration of technology into the creative dance process [12]. Kerne and Koh used grounded theory [4] to analyze case studies of the utilization of *information composition* by undergraduate project teams in a course on creativity and entrepreneurship [9]. Wakkary and Maestri used qualitative analysis to assess creativity in families designing everyday household systems [18].

The Workshop

We seek to gather the community of researchers developing and evaluating creativity support environments so that people can share approaches, engage in dialogue, and develop best practices. The assumption underlying this workshop is that there is no one right way to evaluate creativity but rather that different methods can provide valuable perspectives. We seek papers and presentations that develop in-depth methods for evaluating creativity support environments. The methods must be explained

with sufficient clarity and detail that others can apply them. Submitted papers should ground proposed methods by showing how they have been applied in the study of particular CSEs. They should also discuss the validity of their findings. They should motivate the kinds of CSEs for which a particular evaluation method is well suited.

References

[1] R. Beghetto. Toward a broader conception of creativity: A case for" mini-c" creativity. *Psychology of Aesthetics*, 2007.

[2] E. Bertini, A. Perer, C. Plaisant, and G. Santucci. Beyond time and errors: novel evaluation methods for information visualization. In *Proc ACM CHI*, 2008.

[3] E. A. Carroll, C. Latulipe, R. Fung, and M. Terry. Creativity Factor Evaluation: Towards a Standardized Survey Metric for Creativity Support. In *Proc ACM Creativity & Cognition 2009*.

[4] J. M. Corbin and A. L. Strauss. Basics of qualitative research: Techniques and procedures for developing grounded theory. Sage Publications, Inc, 2008.

[5] M. Csikszentmihalyi. *Creativity*. flow and the psychology of discovery and invention. Harper, 1997.

[6] J. Frechtling. User-friendly handbook for mixed method evaluations. DIANE Publishing, 1997.

[7] S. Hart. Development of NASA-TLX (Task Load Index): Results of empirical and theoretical research. *Human Mental Workload*, 1988.

[8] T. Hewett, M. Czerwinkski, M. Terry, J. Nunamaker, L. Candy, B. Kulers, and E. Sylvan. Creativity Support Tool Evaluation Methods and Metrics. In *NSF Workshop on Creativity Support Tools*, 2005.

[9] A. Kerne and E. Koh. Representing collections as compositions to support distributed creative cognition and situated creative learning. *NRHM*, 13(2):135–162, 2007.

[10] A. Kerne, S. M. Smith, E. Koh, H. Choi, and R. Graeber. An experimental method for measuring the emergence of new ideas in information discovery. *IJHCI*, 24(5):460–477, 2008.

[11] M. Kim and M. Maher. Comparison of designers using a tangible user interface & graphical user interface and impact on spatial cognition. In *Proc. Human Behaviour in Design*, 2005.

[12] C. Latulipe, E. A. Carroll, and D. Lottridge. Evaluating Longitudinal Projects Combining Technology with Temporal Arts. In *Proc CHI 2011*, pages 1835–1844.

[13] C. Latulipe, E. A. Carroll, and D. Lottridge. Love, Hate, Arousal, and Engagement: Exploring Audience Responses to Performing Arts. In *Proc CHI 2011*, pages 1845–1854.

[14] National Academy of Engineering. Engineering Research and America's Future: Meeting the Challenges of a Global Economy. 2005.

[15] J. J. Shah, S. M. Smith, and N. Vargas-Hernandez. Metrics for measuring ideation effectiveness. *Design Studies*, 24(2):111 – 134, 2003.

[16] B. Shneiderman, G. Fischer, and M. Czerwinski. Creativity support tools: Report from a US NSF sponsored workshop. *IJHCI*, 20:61–77, 2006.

[17] B. Shneiderman and C. Plaisant. Strategies for evaluating information visualization tools: Multi-dimensional in-depth long-term case studies. In *BELIV Workshop of AVI 2006*, pages 1–7.

[18] R. Wakkary and L. Maestri. Aspects of everyday design: Resourcefulness, adaptation, and emergence. *IJHCI*, 24(5):478–491, 2008.

[19] A. M. Webb and A. Kerne. Integrating implicit structure visualization with authoring promotes ideation. In *Proc JCDL*, pages 203–212, 2011.