Seven Issues for Creativity Support Tool Researchers

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Introduction

Workshop participants discussed several concepts, types of practices, and aspects of human cognition as important ingredients for research on tools for supporting creativity. There were lively discussions as participants from different disciplines learned about each others' perspectives and approaches to research. We made progress in coming to a more coherent view of tools supporting creativity. This section lists seven diverse concepts that appeared repeatedly in our discussions. Although not completely woven within the research framework, these issues in some sense constitute the idiosyncratic nature of research on tools for supporting creativity.

Seven Issues

Three Roles of Tools Supporting Creativity

The workshop participants had lively discussions on the roles of tools for supporting creativity. Such tools may be positioned in terms of three dimensions, analogous in sports to dumbbells, running shoes, and skis.

The first dimension includes tools to train people to develop creativity, or skills of creative thinking (for instance, see tools by Resnick et al. and Eisenberg et al. in Section xxx-CompositionTool). Such tools aim at helping people to develop skills to engage in creative ways of looking at problems and framing solutions by using these tools, and to maintain such skills even without using the tools. In this sense, tools in this dimension are like dumbbells used to develop muscles — once developed, muscle can be used for other kinds of physical exercise than merely using dumbbells. The second dimension includes tools to support people's creative process while engaging in a creation task (for instance, tools by Myers and Pausch in Section xxx-CompositionTool, Terry et al. [2002][2004] and Nakakoji & Yamamoto [2005]). These tools are like high-tech running shoes, with which runners, especially skilled ones, can run faster and/or more comfortably. People can still run without wearing such shoes, but they would have different kinds of running experiences, and probably better ones, by wearing the shoes. The third dimension includes tools to enable people to have new kinds of experiences that they would not be able to have without using these tools (for instance, see interactive media art systems, such as those described by Edmonds & Candy [2002] and Giaccardi [2005], as described in Section xxx-MediaArt), allow people to engage in completely new experiences of producing expressions. For our analogy, the act of skiing cannot take place without wearing skis.

These three dimensions are by no means exclusive. Each tool, described within the research framework of supporting creativity, simultaneously embodies multiple aspects. Yet, it is important to be aware of the differences among them. The workshop has seen the beginning of a taxonomy emerging, and we need to further develop it to more adequately refer to each aspect of the research field.

Engagement, Embodiment, Trust, and More

In the field of human-computer interaction (HCI) research, usability and learnability have been studied regarding the quality of computational tools. Those concepts have been primarily measured in terms of efficiency and productivity.

Designing tools for supporting creativity (in all of the three aspects described above), in contrast, needs to take into account new concepts that have not been considered within the traditional HCI framework. Studies suggest that supporting creativity requires people to experience a "flow" [Csiksentmihalyi 1990], which needs tools *engaging*. The relationship between users and a tool might be better described as

embodiment rather than *use* [Fels 2004]. Information provided by tools needs to be *trustful* for people to use it as a source for nurturing creativity [Nakakoji, et al. 2000]. Logical *aesthetics* of systems [Hallnaes, Redstroem 2002] play an important role for people to regard tools as expressive media. The utility of such tools may be described in terms not necessarily of objective measurements, such as productivity and efficiency, but of subjective ones, such as *values* [Gaver et al. 2004].

Creative Processes in Software Development

Software development, especially programming, was referred to a number of times during the workshop as a representative design practice in a knowledge-intensive domain. However, many participants were also aware of the existence of counter arguments, such as "*programming is boring*."

In fact, although the software engineering community has changed its focus not only on organizations but also on individuals (such as with Personal Software Processes [Humphrey 1997]), the predominant view still holds that there should be no fundamental differences among individual programming processes. The psychology of programming has primarily looked at the differences of programming productivity and efficiency between experts and novices, and studied the benefits of programming features (e.g. IF statement design), methods (e.g. object oriented), and usage (e.g. mnemonic variable names)[Shneiderman 1980][Soloway 1984], but not so much on individual differences in programming processes.

Having seen the emergence of the eXtreme Programming (XP) style [Beck 1999] being accepted within the industry, especially the successfully deployed pair-programming style, researchers in the software engineering community have started to seek scientific accounts for why such free-form working styles outperform more rigid, structured, process-oriented styles. This trend has made the focus slowly shift more to the human side of programmers, and to programmers' creative thinking processes. It should also be noted that studies have been reported on how open-source software developers work collectively, which demonstrates the aspect of social creativity [Ye et al. 2004].

The workshop participants believed that there is a research opportunity in studying the usability and design of programming languages, notations, and CASE (Computer-Aided Software Engineering) tools (such as Cognitive Dimensions by Green [2000]) by looking at programming as a creative endeavor. We need to study and identify elements of creative programs, strategies, and individuals to support more effective software development.

Cabinets of Curiosity

The first phase of the four-phased creativity model is *collection*. People have historically developed the idea of "cabinets of curiosity," which display things that look curious. Such cabinets seem to help people in the collection phase leading to creative thinking and creative artifacts. Architectural designers as well as industrial designers put large numbers of sketched sheets of papers on walls surrounding their desks, collect magazine clips in albums, and carry their sketch books all the time. These practices also imply that people need to collect "stuff" and be surrounded by it to help them engage in creative practice.

Despite the existence of these practices, however, we still do not have empirical evidence of how they work, and we still do not know what the computational tools deliberately designed to support such a collection process would be. Browsing the Web would certainly serve the purpose, but would it be sufficient? Would carrying their working environment on a laptop PC help? What else could we design for tools to support the collection process?

Learning from Media Arts

Creativity is often associated with art, and research on tools for supporting creativity is often naively viewed as supporting artists. None of the workshop participants, however, believed that we could develop tools supporting creativity of artists if we take a romantic account of design by which a creative process is viewed as a result of "magical abilities of creation" by "imaginative masterminds" [Fallman 2003]. Rather, our target users have been, and will be, design practitioners and children, taking a pragmatic account of

design [Fallman 2003] by which a creative process is viewed as a reflective practice [Schoen 1983].

Arts, especially media arts in this context, become relevant to the workshop by looking at media arts as tools for supporting creativity (as more thoroughly elaborated in Section xxx-MediaArt). As stated above, concepts that have not been well understood, such as engaging, embodiment, aesthetics, or trust, need to be taken into account in designing and evaluating tools for supporting creativity. As researchers, our goal is to develop rigorous accounts and identify scientific evidence for how such concepts are instantiated within tools.

Although we do not yet know how to do it, some media art works achieve some of the concepts, such as engaging experience for participants (see Section xxx-MediaArt for further explanation). Our research could then treat them as success cases and draw scientific accounts for which aspects of the works achieve what concepts, by deconstructing them and re-appropriating them. This type of deductive reasoning could be one way to address the challenges of research on tools to support creativity.

Creativity in Context

Many of the workshop participants take the view that creative practice is a never-ending endeavor. Producing an artifact should not be regarded as a one-shot affair, but rather as formulating a growing experience engaging in the development of creating generations of artifacts.

In this regard, a statement of “tools supporting creativity” might have to be restated as “tools supporting creativity in what context.” This aspect was brought up when Gary Olson reported the result of a study, saying that the sum of the outcomes of individuals’ brain storming sessions outperforms the outcome of a group brain storming session in terms of quality and speed. Yet, the real value of group brainstorming seems to be not within the quality of the brainstorming per se but within information sharing and value sharing. The subsequent processes would work better having such shared experience during a group discussion.

Tools for supporting creativity could also face the same challenge. Some tools work well for a user to produce a creative artifact at a certain stage. However, if the user needs to keep working on the artifact in subsequent stages, different tools might work better as a whole. In modeling, designing, and evaluating tools for supporting creativity, therefore, we need to identify what contexts of the creativity our tools are aiming at. Otherwise we could easily fall into a fruitless discussion by referring to creativity in different contexts.

Beyond Adaptation and Beyond End-User Modifiability

As discussed above, aspects conventionally associated with the quality of tools do not necessarily hold for tools supporting creativity. If the quality of creativity support tools could be measured only in terms of subjective factors such as values, then since different individuals have different value systems, there may be creativity support tools not for all of us but only for a subset of people who share the same value systems. For instance, when designing creativity support tools for programmers, the ease of use might not necessarily be a requirement for professional programmers; skilled professional programmers often find pride in their being able to use complex notations within difficult-to-learn environments, and some may not like to use too-easy-to-learn tools that may threaten their professional identity.

This seems to suggest almost a paradigm change for existing HCI research, which has been seeking “appropriate” models and tools for certain domains. Adaptive mechanisms and end-user modifiability have been explored as ways to allow people to adjust tools for individual differences, but such minor adjustments cannot afford the variety of tool needs. End-users cannot modify a Porsche to turn it into a Mercedes; they are two fundamentally different tools, both of which are for those who are fond of high-quality driving experiences, but each designed with a completely different philosophy than the other.

Concluding Remark

Because creativity is such a humane matter, designing, developing, and evaluating tools for supporting creativity will uncover issues and challenges that have not been so obvious in the traditional HCI research framework. Research on tools for supporting creativity would make computer technologies truly human-centered.

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