Using Theoretical Ideas to Stimulate Creativity and Participation in Design

Anders I. Mørch

InterMedia, University of Oslo

P.O. Box 1161 Blindern, N-0318 Oslo

anders.morch@intermedia.uio.no

+47 4802-1736

ABSTRACT

A science of design should be about the *process of designing*, including the methods, techniques and tools to support the design process. Understanding the relationship between creativity and the design process is the main goal of this paper. Towards that end I outline a method for interface design that is inspired by creative practices in furniture design. Creativity is defined as the act of finding an inspirational idea outside a design profession, which is then expressible with the materials of the profession. Social creativity *transforms* the idea into realization. Two interactive systems the author has been involved in designing (Janus, FLE Assistant) are analyzed using this approach from a socio-cultural perspective. The retrospective analysis revealed how theoretical ideas (reflection-in-action; generalized other) served as inspiration for the designs as well as provided affordances and constraints for software realization. The sub processes involved in transforming the ideas into user interface designs constitute the first steps of a design method for theory-informed collaborative design.

Author Keywords

Creativity, social creativity, socio-cultural perspectives, extrinsic motivation, appropriation, externalization, theory-informed design, Janus, reflection-in-action, FLE-Assistant, generalized-other

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

There is a huge body of literature on creativity. Most of it centers on the creative acts of individuals. For example, Csikszentmihalyi [1996] interviewed 100 well-known creative people (inventors, artist) to identify what they have in common and how creativity can explain breakthroughs in their thinking and outcomes. Creativity is a combination of accidental discovery, seeing connections, and lots of hard work. The former is not associated with expertise per se, but with a keen sense of awareness of the environment, openness to sudden impulses, and playfulness when it comes to the possibilities of un-appropriated design material. I refer to this as *everyday creativity*. This is the act of ordinary people in their everyday lives in order to bring new insights into their lives and make new connections for their improved understanding. It is also about expressing this insight, discovery and connection in tangible form so that it can be shared with others. Related to this is *social creativity* [Arias et al., 2004; Fischer, Scharff & Ye, 2004], which has been defined as collective performance producing shared understanding and outcome that outperform the sum of what individuals can do and produce on their own or represent in their personal perspectives [Stahl, 2006]. This paper attempts to integrate a semi-professional form of everyday creativity with social creativity in order to develop a method of *theory-informed collaborative design*. It is researched from a socio-cultural perspective [Wertsch, 1991; 1998] to provide a new and unique account of creativity. This is accomplished by studying the impact of creativity on specific designs (concrete design artifacts) and profiling this in terms of "trajectories of participation" [Greeno, 1997] guided by a *conceptual-to-physical* path. Conceptual in this context is meant abstract objects (ideas) shared by a community of users, following the findings of Popper and Bereiter [e.g. Bereiter & Scardamalia, 2003]. For simplicity I use the term physical artifact to mean concrete objects, also implying computational artifacts although they may embody elements that are not strictly physical.

Creativity has received considerable attention in HCI and CSCW over the past 10 years, mostly from within the computer and cognitive sciences. Three seminal contributions are "Bringing design to software" [Winograd, 1996] and two reports from the National Research Council in the United States on information technology and creativity [Mitchell, Inouye & Blumenthal, 2003] and "Creativity Support Tools" [Shneiderman et al., 2005]. The

first work identifies how the practice of software design can be improved by applying lessons from other areas of design. The contributors provide examples of design from arts, architecture, product design, early interactive software systems, and participatory design. The second work addresses creativity in terms of the needs of creative people, i.e. professionals making computer games, animated films, computational architecture, and interactive art (to name a few). The last contribution is a compiled report that documents the results of a workshop on "Creativity Support Tools," which more specifically addresses the issues raised in the previous contribution in terms of how creative practices can be supported by a new generation of information technology [Shneiderman et al., 2005].

This paper was stimulated by the above initiatives, but departs from them in significant ways. It takes inspiration from a design profession outside of interactive systems design as advocated by [Winograd, 1996] and it suggests a way to integrate creativity with information technology as proposed by [Mitchell, Inouye & Blumenthal, 2003] and [Shneiderman et al., 2005]. In particular, I address the issues of design methodology by suggesting an approach for transforming abstract objects (ideas) into concrete objects as a form of "externalization" [Vygotsky, 1978]. Creative practices in architecture, furniture design, and the arts as well as the socio-cultural approach to learning and development [Wertsch, 1991; 1998] have been the main inspirations of the approach.

The long-term aim of this work is to provide a *socio-cultural account of creativity*, starting not with brilliant individuals but with brilliant ideas and the creative acts of ordinary people (everyday creativity). Trajectories of participation (social creativity) function as scaffolds (Vygotsky, 19878) to guide the further development and expression of the ideas. The other aim is to provide examples of the phenomena (products and processes). The paper starts by outlining the design process behind an award-winning chair in the Nordic design tradition in order to motivate the need for creativity in the early phases of the design process. Next, it surveys past work in theory-based design in HCI and CSCW (this and rest is abbreviated). A socio-cultural version of theory-informed design is developed and illustrated by discussing the design process behind two interactive systems the author has been involved in designing (Janus, FLE-Assistant). These systems were inspired by the theories of D.A. Schön (refection-in-action) [Schön, 1983] and G.H. Mead (generalized other) [Mead, 1934], respectively.

CREATIVITY AND DESIGN
Designers of user interfaces to computer systems are heavily involved (directly or indirectly) with usability, usefulness, enjoyment (pleasure to use), and domain-specific needs. Creativity, especially in the early phases, has not received the same attention, but there are notable exceptions [e.g. Yamamoto & Nakakoji, 2005]. The

questions explored in this paper are 1) how to define a space for creativity in the early phases of user interface design, i.e. before designers start to think in terms of software objects (software components, GUI objects, programs, and systems), and 2) how to trace the development of the inspirational idea into a user interface design as it unfolds over time. The motivation for this has been to look outside of software design to find a comparable domain user interface design can draw on, and adopt useful ideas from it (processes, methods, techniques). Furniture design is one such domain.

Pieces of furniture (chairs, tables, lamps) and interactive systems are artifacts (tools) people use to accomplish everyday tasks or fulfill certain needs and desires. These are supported with affordances and constraints for realizing those needs [Norman, 1988; 1999]. Usability, usefulness, pleasure to use, and domain-specific needs are equally important to furniture designers, as they are to user interface designers – but not exclusively. Furniture designers also have to integrate creativity with utility to succeed. The Norwegian designer Olav Eldøy [Eldøy, 2006] explained the role of creativity as the first step of his design process in the following way: 1) find a recognizable idea that can be expressed in physical form 2) balance creativity against the usage requirement, and 3) provide a construction that affords production and export. All phases were essential for the design of the award winning Peel chair he is known for (Figure 1). When a design fails, according to Eldøy [2006], it is often as a result of not being able to pass through the latter stages (2-3).

Figure 1. Peel chair by Olav Eldøy, produced by Stokke, Norway (2002). Orange peels falling to the ground have inspired this design.

Finding a recognizable idea that can be expressed in physical form has been a key to success for many designers, but it is not a common way to design user interfaces. A reason for this could be that a software product is not a physical artifact in the same way a chair is. Alan Kay has a said that a computer interface is more like a book to read or a car to drive [Kay, 1984], which would imply that the

above metaphor cannot be adopted as is. Instead, I turn to an analogous metaphor – *genius loci* (spirit of a place; site; surrounding nature) in architecture [Nordberg-Schultz, 1985]. A working hypothesis in this paper is that theories, models, concepts, and notions, in sum *ideas*, might serve as inspiration for designers of software applications in the same way as genius loci have served as inspiration for designers of the built environment.

Despite the claimed similarities between pieces of furniture and computer applications as tools for everyday use there are also significant differences that should not be overlooked. In many respects computer applications are more complex that furniture. An application has a large number of interacting components (like a complex machinery), multiple levels of representation spanning concrete to abstract systems (hardware, software, user interface data base), and it interacts with users in different organizations (developers, managers, support, super users, end users). Social creativity addresses these issues by bringing together stakeholders representing the different points of view (communities of practice) and fields of expertise (communities of interest) in order to manage the complexity associated with designing and implementing interactive systems in user organizations [Fischer, 2001].

SOCIO-CULTURAL APPROACH

The following concepts are used in the analysis of tracing the transformation of abstract ideas into concrete expressions in two interactive systems: extrinsic motivation, appropriation, and externalization.

Extrinsic motivation [e.g. Davis et al., 1992] is when one is motivated by external factors, as opposed to the internal drivers (e.g. pleasure, fun) of intrinsic motivation. Extrinsic motivation drives one to do things for tangible rewards. In this paper the external factors are theoretical ideas and the tangible rewards are concrete expressions of the ideas, which require appropriation and externalization (see below);

Wertsch [1998, p. 53] defines *appropriation* as "the process of taking something that belongs to others and making it one's own." He also argues that the path to appropriation is not always straight and smooth, but sometimes involves tension between what we appropriate and the use we make of it within a particular context. Someone who can appropriate a cultural tool, such as a theoretical idea, can, according to Wertsch, unravel its mysteries and understand its components in order to integrate it into one's daily practices;

Externalization [Vygotsky, 1978; Kaptelinin, 1996] means to put something outside of its original borders. For Vygotsky this meant to put a human function outside of the human body (e.g. thought to speech). The opposite of externalization is internalization (i.e. a child learning a new word so that it can be repeated), which means to transform inter-subjective mental actions (talk with others) to intra-subjective (mental) representations [Kaptelinin, 1996]. In the work of Vygotsky, externalization is studied in conjunction with internalization, but receives a lesser treatment. In the work outlined here externalization is the more elaborated process and borrows additional meaning from the arts in the way artists transform inspirations (e.g. nature) and models (e.g. human body) into physical expressions on canvas or in sculpture.

RETROSPECTIVE ANALYSIS

I have employed a version of "retrospective analysis." Carroll and Kellogg [1989] used this method to identify the "myriad of claims and their interrelations" embodied in Training Wheels and HyperCard in order to determine how the claims were given coherence by being codified in designed artifacts. Their use of the term "psychological claims" (personal theories, conjectures) is in this work replaced by established (shared) theoretical ideas. This is consistent with the socio-cultural approach to development, which puts more emphasis on cultural tools [Wertsch, 1991] and conceptual artifacts [Bereiter & Scardamalia, 2003] than cognitive artifacts [Norman, 1988; Carroll & Kellogg, 1989]. Furthermore, creativity has an important social dimension [Arias et al., 2000; Fischer, Scharff & Ye] that we want to explore within the cultural context. However, a shortcoming of this approach is that many theoretical ideas suffer from being complex and difficult to grasp by newcomers, thus relegating them to a small community of scholars. This is arguably less a dilemma for general theories of human communication, practical action and collaborative learning. The theories that are of special interest are those associated with the socio-cultural approach (Vygotsky and followers) and theories originating within the American Pragmatist tradition (Pierce, James, Dewey, Mead, Schön, Garfinkel). Furthermore the act of appropriation gives the users flexibility in the interpretation of abstract ideas.

TENTATIVE RESULTS

Two systems are used to illustrate the approach of theory-informed collaborative design along the lines proposed above, namely Janus [Fischer, McCall & Morch, 1989; McCall, Fischer & Morch, 1991] and FLE-Assistant [Chen, Dolonen & Mørch, 2003; Mørch, Jondahl & Dolonen, 2005]. Table 1 provides a summarized account of the findings when the two systems are analyzed in terms of the sub-processes and steps of transformation.

Sub-processes	Janus	FLE-assistant
Selection	Reflection-in-action (D.A. Schön)	Generalized other (G.H. Mead)
Appropriation	Action, reflection, action-present, back-talk	Game, roles, rules, roles-organized-according-to-rules
Translation	Work area, design units, critic messages argumentative hypertext	Participation measure, statistics, aggregated performance conceptual awareness, advice

Table 1. Transformation of theoretical ideas into user interface expressions for two interactive systems

Three steps are used to accomplish this:

1. *Selecting* a theoretical idea from a field of research one wishes to explore and understand, stimulated by extrinsic motivation for accomplishing it [Davis et al, 1992]. The idea(s) should be of general interest so that others also share the interest, ultimately leading to concrete results through a collaborative effort, e.g. originating in human communication, collaboration, learning, everyday creativity, practical action;

2. *Appropriating* the idea [Wertsch, 1991] so that its basic elements stand out in a contemporary design context [Schön & Rein, 1994];

3. *Translating* the elements into a user interface design as an act of externalization [Vygotsky, 1978; Kaptelinin, 1996].

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