Software Engineering Themes for the Future
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Collaborative Design, Social Creativity, and Meta-Design

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ABSTRACT
The objective of this tutorial is to provide the participants with opportunities to think differently about future challenges facing software engineering research and practice. Collaborative design, social creativity, and meta-design are identified as themes that will be of great importance in the years to come. The concept of design is used very broadly affecting all aspects of the process of creating, using, and evolving software-intensive systems. Stakeholders coming from different disciplines and engaging in collaborative design can contribute to social creativity by exploring new approaches, new problems, and new visions. Meta-design is a methodology empowering users to act not only as passive consumers but as active contributors and designers, thereby facilitating and supporting social creativity.

The themes of the tutorial will be illustrated with specific theoretical frameworks and innovative systems. The relevance of these themes has been demonstrated by their desirability and importance on research, education, and design practices in companies, educational institutions, and research organizations.

Categories & Subject Descriptors
D.2 SOFTWARE ENGINEERING: D.2.10 Design; D.2.2 Design Tools and Techniques

General Terms: Design

1. INTRODUCTION
The tutorial will discuss some fundamental problems effecting software engineering in the future. Our approach is grounded in the assumption that system development is difficult not because of the complexity of technical problems, but because of the social interaction between users and system developers as they learn to create, develop, and express their ideas and visions [Greenbaum & Kyng, 1991]. Software engineering (especially its upstream activities) is a human-centered field [Fischer, 2003], and as such will always have the openness of other design disciplines, such as architecture and graphic design, rather than the hard-edged formulaic certainty of downstream engineering [National-Research-Council, 2003; Winograd, 1996].

2. DESIGN AND COLLABORATIVE DESIGN
Design and specifically collaborative design are ubiquitous activities [Schön, 1983; Simon, 1996] that are practiced in everyday life as well as in the workplace by professionals in many domains and they are of special importance in the creation, use and evolution of software-intensive systems. Designers engage in problem solving and decision making. But apart from problems in school, most problems in real life are not given. For these problems, understanding the problem is the problem: they must be framed, a process in which the important objects are determined and the desired outcomes are defined.

The tutorial will emphasize domain-oriented design. Domain models should be designed to fit what people want to do — first through participation with users and eventually by users themselves requiring support for design in use, end-user modifiability, and meta-design. Domain-oriented design environments [Fischer, 1994] recognize the legitimacy of specialization to the domain by not serving all needs obscurely, but serving a few needs well.

Complex design problems require more knowledge than any single person possesses because the knowledge relevant to a problem is usually distributed among many stakeholders. Large and complex design projects cannot be accomplished by any single person, and they often cut across different established disciplines, requiring expertise in a wide range of areas [Arias et al., 2000]. Software design projects, for example, involve designers, programmers, human-computer interaction specialists, marketing people, domain experts, and user participants.

Collaborative design is done by communities. The tutorial will introduce and differentiate between communities of practice (as homogenous design communities) and communities of interest (as heterogeneous design communities). Four specific distances (spatial, temporal, conceptual, and technological) that exist in these communities will be discussed in detail.

3. SOCIAL CREATIVITY
The power of the unaided individual mind is highly overrated. Although creative individuals are often thought of as working in isolation, much of our intelligence and creativity results from interaction and collaboration with other individuals [Bennis & Biederman, 1997], exploiting the “symmetry of ignorance” as a source of power.
Focusing on social creativity does not mean that the importance of individual creativity will be ignored [Csikszentmihalyi, 1996]. Creative individuals can make a huge difference. Individual creativity can be greatly enhanced by providing appropriate social-technical settings because much human creativity arises from activities that take place in a social context in which interactions with other people, along with artifacts that embody group knowledge, are important contributors to the process. Creativity does not happen inside people’s heads, but in the interaction between a person’s thoughts and a socio-cultural context. Situations that support social creativity need to be sufficiently open-ended and complex that users will encounter breakdowns.

4. META-DESIGN

Meta-design [Fischer et al., 2004] is an emerging conceptual framework aimed at defining and creating systems as living entities. It allows users to act as active contributors rather than being confined to passive consumers. Meta-design extends the traditional notion of system design beyond the original development of a system to include an ongoing process in which stakeholders become co-designers—not only at design time, but throughout the whole existence of the system. A necessary, although not sufficient, condition for users to become co-designers is that software systems include advanced features that permit users to create complex customizations and extensions. Rather than presenting users with closed systems, meta-design approaches provide them with opportunities, tools, and social reward structures to extend the system to fit their needs.

The tutorial will discuss the seeding, evolutionary growth, reseeding (SER) process model [Fischer et al., 2001] as a foundation for meta-design approaches. Instead of attempting to build complete systems, the SER model advocates building seeds that can be evolved over time through contributions of a large number of people [Raymond & Young, 2001]. It postulates that systems that evolve over a sustained time span must continually alternate between periods of planned activity and unplanned evolution, and periods of deliberate (re)structuring and enhancement.

By empowering individuals and communities, meta-design will redistribute control between developers and users [Levy & Murnane, 2004]. The pitfalls associated with creating “do-it-yourself” societies that put a big burden on users will be explored.

The tutorial will describe the broad application of meta-design in the following domains:

design — with a focus on: customization, personalization, tailorable, end-user development, design for diversity;
architectural design — with a focus on: underdesign, support for “unself-conscious culture of design”, design patterns;
teaching and learning — with a focus on: teachers as facilitator, learning communities, courses-as-seeds;
informed participation — with a focus on: beyond access, social creativity;
open source — with a focus on: success model of decentralized, collaborative, evolutionary development;
living organizational memories — with a focus on: Wikis, Wikipedia, digital library evolved by their communities of users; and
interactive art — with a focus on: collaboration, co-creation putting the tools rather than the object of design in the hands of users.

5. REFERENCES