Converging on a Science of Design through the Synthesis of Design Methodologies

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Abstract

The goals of this workshop are: (1) to bring together the community of researchers who are exploring innovative design theories and different design methodologies; (2) to evaluate the appropriateness of design methodologies for specific contexts and explore their respective difference and synergies; and (3) to strengthen the community of researchers who are interested and involved to make progress toward creating a science of design.

Keywords

professional-oriented design, user-centered design, participatory design, learner-centered design, collaborative design, meta-design, design in the creative practices, science of design

ACM Classification Keywords

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

Introduction

The workshop will identify a number of challenges and themes originating in different design methodologies and will attempt to make a contribution towards an

emerging science of design. Peter Freeman, the assistant director of the NSF for Computer & Information Science & Engineering (CISE), has articulated the need for a *science of design* as follows [3]: *"Efforts have been underway for many years to enable the creation of complex systems in a scientifically based manner. As we move forward into a world in which the number of devices, amount of software, and degree of connectivity in complex systems will all increase by orders of magnitude, it is essential that we have a 'science of design' on which to base our efforts at building such systems. CISE is engaged in spurring the innovation and scientific development necessary to achieving this goal."* While a science of design is important for a large number of fields (architecture, engineering, organization design, etc), it is of importance for the design of complex software systems; and software engineering is becoming increasingly interested in an emerging science of design. It is of even greater importance and more challenging for HCI that focuses on socio-technical environments [7] in which humans and computers are part of the overall system.

The workshop will synthesize a new understanding of design as a science. It will explore issues, trade-offs, and synergies related to different design methodologies including: professional-dominated design, user-centered design, participatory design, interaction design, collaborative design, learner-centered design, and meta-design and the development and assessment of socio-technical environments in support of design. Specifically, activities during the workshop will ask participants to reflect on common methods and themes across two or more design subdisciplines and methods and themes that are unique to a particular subdiscipline. The following sections briefly characterize the different design methodologies that will be the focus of the workshop.

User-centered design

User-centered design approaches [10] have been a major step forward in HCI to transcend professional-dominated design which ignored real user needs and capabilities. User-centered design approaches need to be complemented by *new design methodologies* which will be described in the following sections.

Participatory design

Participatory design approaches [11] seek to involve users more deeply in the design process as co-designers by empowering them to propose and generate design alternatives themselves. Participatory design supports diverse ways of thinking, planning, and acting by making work, technologies, and social institutions more responsive to human needs. It requires the social inclusion and active participation of the users.

Learner-centered design

Learner-centered design (LCD) focuses on creating artifacts that support human understanding as opposed to task achievement [12]. LCD is an inherently multi-disciplinary design specialty, requiring an understanding of HCI, pedagogy, collaboration, and the psychology of motivation. LCD draws from a variety of methods including

- "backwards design" where system interaction is determined only after the learning goals and assessment metrics have been clearly identified;

- principle-driven design where designers consult (and contribute to) LCD-specific strategies formalized as principles or design patterns [6];

- co-design, a highly-facilitated, team-based process in which teachers, researchers, and developers work together in defined roles.

Collaborative Design

Design activities are knowledge-intensive work, and the knowledge required for solving complicated design problems rarely resides in the head of one designer. Effective designers need to find their way around the world, through interaction and collaboration with tools and people in their sociotechnical environments [5]. Design, therefore, is inherently collaborative. Collaboration in design could take place along several dimensions: spatial, temporal, technological and social [13]. The success of many Open Source Software systems and open contents environments such as Wikipedia has demonstrated that given the right sociotechnical conditions, design through the collaboration of many can flourish as a distributed knowledge system. However, it remains a great challenge to understand what the right sociotechnical environments for collaborative design are and how to design such sociotechnical environments in a systematic way. Different social structures such as community of practice, community of interest, dynamic community, intensional network, and knotworking have particular capabilities for supporting different aspects of collaborative design through their distinct organizing principles that structure the flow of knowledge, divide work, and coordinate individual design activities. We still lack a comprehensive theory of understanding the essences of collaborative design and guidelines for creating a distributed and yet coherent knowledge

system to approach complicated design problems collaboratively [8].

Meta-Design

Meta-design [1, 2] creates open systems that can be modified by their users and evolve at use time, supporting more complex interactions (rather than linear or iterative processes). Open systems allow significant modifications when the need arises. Participatory design has focused on system development at design time by bringing developers and users together to envision the contexts of use. But despite the best efforts at design time, systems need to be evolvable to fit new needs, account for changing tasks, deal with subjects and contexts that increasingly blur professional and private life, couple with the socio-technical environment in which they are embedded, and incorporate new technologies [4].

Design in the creative practices

Design approaches in the creative practices usually imply a focus on intuition and aesthetics; a greater incorporation of political, social, and ethical considerations; and more qualitative research methods [9]. Creative practices promote collaborative and transformational practices of design aimed to support new modes of human interaction and sustain an expansion of the creative process. Their design space is multidimensional and concerned with accommodating forms of interactivity that put the user in control of the interaction itself in a non-trivial and open-ended manner. Such an approach informs not only specific design methodologies but also forms of cultural intervention informing and integrating different domains. Rather than a new "model" of design, creative practices promote a more flexible and contextual

"mode" of design: an enhancement of human creative processes and conversations at the convergence of "art" and "science".

Additional Themes

In addition to the different design methodologies the workshop will explore: (1) identification of appropriate design methods, practices, and evaluation methods; (2) sources for research partnerships and funding; and (3) North American vs. non-North American perspectives and approaches to developing cognitive technologies.

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