Grand Challenges for Future HCI Research: Cultures of Participation, Interfaces Supporting Learning, and Expansive Learning

PANELISTS

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BRIEF DESCRIPTION

This panel will analyze the research activities (including objectives, theoretical foundations, developments, synergy, and differences) of three research centers:

- **Center for Research on Activity, Development, and Learning (CRADLE)**, University of Helsinki, with a research focus on "*expansive learning*";

- **Center for LifeLong Learning and Design (L3D). University of Colorado,** with a research focus on "*cultures of participation*";

- **InterMedia, Center for Communication, Design and Learning, University of Oslo**, with a research focus on "*interfaces supporting learning*".

The three researchers centers (1) *share some common basic beliefs and objectives* (e.g. with regards to participation, learning, and design), but (2) but they also have *their own identity and focus* (e.g. with regards to work, technology, and technology-enhanced learning).

The panel will take advantage of the discussions and findings of the recent International Workshop *"Collective Creativity and Learning"* which took place at the University of Helsinki in December 2009(http://www.helsinki.fi/cradle/news_archive/ws_collective_creativity_and_learning.htm).

OBJECTIVES OF THE PANEL

The panel will explore the relevance and impact of the three themes Cultures of Participation, Interfaces Supporting Learning, and Expansive Learning towards articulating and defining *grand challenges* for HCI research to expand boundaries. A *grand challenge* defines a commitment by a scientific community (in this case: the HCI community) to work together towards a common goal — valuable and achievable within a predicted timescale. The shared objective of our three centers is to evolve HCI research and practice and expand its boundaries towards (1) increased openness, participation, and inclusion of diverse communities, disciplines, and people and (2) creating and supporting theory-guided socio-technical environments to make learning a first class activity.

THE IMPACT OF THE THREE THEMES TO *"EXPAND BOUNDARIES"* FOR FUTURE HCI RESEARCH

Cultures of Participation

The rise in *social computing* (based on social production and mass collaboration) has facilitated a shift from *consumer cultures* (specialized in producing finished goods to be consumed passively) to *cultures of participation* [6] (in which all people are provided with the means to participate actively in personally meaningful problems) [2]. These developments represent unique and fundamental opportunities and challenges for expanding boundaries of HCI research.

Cultures of participation are facilitated by the participatory Web ("Web 2.0") contributing to the aims of engaging diverse audiences, enhancing creativity, sharing information, and fostering the collaboration among users

acting as active contributors and designers. They are supported by *meta-design* [7] focused on "design for designers" and that represents an emerging conceptual framework aimed at defining and creating social and technical infrastructures in which new forms of collaborative design can take place. Meta-design extends the traditional notion of system design beyond the original development of a system by supporting users as co-designers. It is grounded in the basic assumption that future uses and problems cannot be completely anticipated at design time, when a system is developed. Users, at use time, will discover mismatches between their needs and the support that an existing system can provide for them. These mismatches will lead to breakdowns that serve as potential sources of new insights, new knowledge, and new understanding. Meta-design complements and transcends participatory design that design time never ends.

Meta-design supports cultures of participation by making changes possible and technically feasible, by providing professional social, and personal benefits, and by creating low barriers for sharing changes.

Cultures of participation democratize design and innovation [11] by shifting power and control towards the users, supporting them to act as both designers and consumers ("prosumers") of the system and allowing the system to be shaped through real-time use.

The *seeding, evolutionary growth, and reseeding (SER) model* [8] is an emerging descriptive and prescriptive model supporting cultures of participation. In the past, large and complex socio-technical environments were built as complete artifacts through the large efforts of a small number of people. Instead of attempting to build complete systems, the SER model advocates building *seeds* that can evolve over time through the small contributions of a large number of people and which includes reseeding phases from time to time to organize and structure evolving information spaces.

Interfaces Supporting Learning
Vygotsky [12] proposed the idea that learning is a "socio-cognitive" process that occurs on two planes: first the social and then on the individual. Transformation between the two planes is incremental and initiated in productive dialogs with others and more capable peers, or by interacting with interesting socio-cultural artefacts. According to Vygotsky (p. 57) *"the transformation of an interpersonal process into an intrapersonal one is a the result of a long series of developmental events. The process being transformed continues to exist and to change as a external form of activity for a long time before definitively turning inward."* Artifacts play a central role during this transformation, mediating and scaffolding developmental events. This sociocultural perspective on learning has implications beyond educational research and practice. Design implications range from pedagogical interventions in

classrooms and workplaces to design principles for interfaces supporting learning. The multidisciplinary research center InterMedia has operationalized Vygotsky's idea by innovative research designs and interactive systems and studied mediation and scaffolding in various collaborative learning environments. Our projects include: (http://www.intermedia.uio.no/ display/Im2/Projects):

- Integrated work and learning environment for service work in gasoline stations;
- Interaction of amateur (customer) and professional communities in software product development;
- Interaction of amateur (viewer) and professional communities in cultural heritage sites;
- Scaffolds for collaborative learning and progressive inquiry in science education;
- Student essay critiquing system for English as second language;
- Web-based communication portals and hand held devices for health care workers.

Based on our system building efforts and empirical studies, we have identified sub-processes and stages between interaction and individual learning. A claim we make is that there are techniques to bridge the "socio-cognitive gap" by traversing these stages. Two such techniques are *externalized design* and *mutual development*.

Externalized design [10] is a technique for transforming a conceptual artifact (idea, concept) from an unfamiliar domain (where one is a novice) into a concrete instantiation (a design) in a familiar domain (where one is expert). It is defined in terms of three stages: selection, appropriation and translation. It can be exemplified with theory-based design of user interfaces and collaborative learning in a group. In the latter case externalized designs are the personally meaningful artifacts individual students create on the basis of the group's joint outcome.

Mutual development is a model of collaborative design between two basic levels of development: *general* (formal, planned) and *specific* (informal, situated). The model was originally proposed to explain the findings of an empirical study in customer initiated software product development [1]. End-user developers and professional developers interacted for the purpose of developing a commercial software product. They were found to be mutually dependent on each other's activities [10]. We currently explore the potential of applying this model for other contexts, one being interaction between the two Vygotskian planes, in order to allow for iterative and incremental transformation between developmental events. In the same way as externalized design is broken into stages [9], mutual development is broken into sub-processes. The grand challenge for HCI derived from this approach is how to build interactive systems that support learning seen from

the perspective of transforming mediated interaction into a learning experience.

Expansive Learning

The *theory* of expansive learning, originally formulated in [3] has been used in a wide variety of studies and interventions [4]. The objective of the theory is to create foundations how to help practitioners to generate and support learning that grasps pressing issues the humankind is facing. The theory of expansive learning puts the primacy on communities as learners, on transformation and creation of culture, on horizontal movement and hybridization, and on the formation of theoretical concepts. Traditional modes of learning deal with tasks in which the contents to be learned are well known ahead of time by those who design, manage and implement various programs of learning. When whole collective activity systems, such as work processes and organizations, need to redefine themselves, traditional modes of learning are not enough. Nobody knows exactly what needs to be learned. The design of the new activity and the acquisition of the knowledge and skills it requires are increasingly intertwined. In expansive learning activity, they merge.

The theory of expansive learning focuses on learning processes in which *the very subject of learning is transformed from isolated individuals to collectives and networks*. Initially individuals begin to question the existing order and logic of their activity. As more actors join in, a collaborative analysis and modeling of the zone of proximal development are initiated and carried out. Eventually the learning effort of implementing a new model of the activity encompasses all members and elements of the collective activity system. As activity systems are increasingly interconnected and interdependent, many recent studies of expansive learning take as their unit of analysis a constellation of two or more activity systems that have a partially shared object. Such interconnected activity systems may form a producer-client relationship, a partnership, a network, or some other pattern of multi-activity collaboration.

The *object* plays the focal role in activity. The object is an invitation to interpretation, personal sense making and societal transformation. One needs to distinguish between the generalized object of the historically evolving activity system and the specific object as it appears to a particular subject, at a given moment, in a given action. The generalized object is connected to societal meaning, the specific object is connected to personal sense. For example, in medical work, the generalized object may be health and illness as societal challenges, whereas the specific object may be a particular condition or complaint of a particular patient.

Contradictions are the necessary but not sufficient engine of expansive learning in an activity system. In different phases of the expansive learning process, contradictions may appear (a) as emerging latent primary contradictions within each and any of the nodes of the activity system, (b) as openly manifest secondary contradictions between two or more nodes (e.g., between a new object and an old tool), (c) as tertiary contradictions between a newly established mode of activity and remnants of the previous mode of activity, or (d) as external quaternary contradictions between the newly reorganized activity and its neighboring activity systems. Conflicts, dilemmas, disturbances and local innovations may be analyzed as manifestations of the contradictions. There is a substantial difference between conflict experiences and developmentally significant contradictions. The first are situated at the level of short-time action, the second are situated at the level of activity and inter-activity, and have a much longer life cycle. They are located at two different levels of analysis. The roots of conflicts can be explored by shifting from the action level of conflict to the activity level of contradiction.

The theory currently expands its analyses both up and down, outward and inward [5]. Moving up and outward, it tackles learning in fields or networks of interconnected activity systems with their partially shared and often contested objects. Moving down and inward, it tackles issues of subjectivity, experiencing, personal sense, emotion, embodiment, identity, and moral commitment.

Controversial Issues by Contrasting the Three Approaches

Specific controversial issues (that will be debated in the panel by contrasting the approaches) are:

- What is meant by development, and at what levels does it occur, and what is it aimed at? How is design related to development?

- End-user development is mentioned by Fischer and Mørch, but not by Engeström and Sannino. How does it fit into the picture of activity theory?

- Fischer does not address learning when he talks about cultures of participation. How are cultures of participation related to learning?

- Is individual learning an issue in the approaches of Engeström/Sannino and Fischer? How would it fit into their approach?

- It is unclear how mutual development and externalized design as proposed by Mørch is related to user interface design, i.e. interfaces supporting learning

- What is the relationship of Cultural Historical Activity Theory to HCI, where is the point of convergence between the two?

- The three approaches put their lens on different levels of abstraction of extending boundaries in HCI: (a) expansive learning is about development of activity systems in which HCI is one component in the activity system (the mediating artifact and/or object of activity);

(b) cultures of participation (supported by meta-design) provides a framework for the development of socio-technical environments that remain in a stage of "perpetual beta"; and (c) interfaces supporting learning are focused on interactive systems for the purpose of learning by design.

Grand Challenges for HCI

> *"I don't know who discovered water, but it probably wasn't a fish"* — Marshall McLuhan

Grand challenges define a commitment by a scientific community to work together towards a common goal that addresses some fundamental problems and that is valuable and achievable within a predicted timescale. Grand challenges can serve as driving forces to extend boundaries of disciplines in which the inspirations are often derived from the outside (e.g., based on interdisciplinary collaborations).

The grand challenge for HCI derived from the three approaches is a focus on increased openness, participation, and inclusion of diverse communities, disciplines, and people to be achieved by creating and supporting theory-guided socio-technical environments to make learning a first class activity. This objective is addressed by exploiting the synergistic effects of the three approaches at the conceptual level:

- cultures of participation represent a framework to support the design of socio-technical environments in which users can act as co-designers in personally meaningful problems;

- interfaces supporting learning provide techniques for the design of user interfaces, and a model of collaborative design;

- expansive learning is a theory of learning to analyze development of activity systems.

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