The following paper: **"**Distances in Design Communities: Sources of Social Creativity", was the keynote presentation by Professor Gerhard Fischer.

Professor Fischer (http://www.cs.colorado.edu/~gerhard/) is a professor of Computer Science, a fellow of the Institute of Cognitive Science, and the director of the Center for LifeLong Learning & Design (L3D) at the University of Colorado at Boulder. Current research interests include new media supporting lifelong learning, human-human and human-computer collaboration, (software) design, knowledge management, domain-oriented design environments, and universal design (assistive technologies).
More information about the (L3D) center can be found at: http://www.cs.colorado.edu/~l3d/

Distances in Design Communities: Sources of Social Creativity

Gerhard Fischer
University of Colorado, Center for LifeLong Learning and Design (L3D)
Department of Computer Science, 430 UCB
Boulder, CO 80309-0430 – USA
303-492-1502
gerhard@cs.colorado.edu

Abstract. Design is a ubiquitous activity. The complexity of design problems requires communities rather than individuals to address, frame, and solve them. These design communities have to cope with the following distances: (1) *spatial* (across distance), (2) *temporal* (across time), (3) *conceptual* (across different communities of practice, and (4) *technological* (between persons and artifacts). Over the last decade, we have created socio-technical environments to turn the distances into opportunities for enhancing the *social creativity* of design communities.

The Social Nature of Creativity. The power of the unaided individual mind is highly overrated [John-Steiner, 2000]. 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 [Csikszentmihalyi, 1996] exploiting distances as sources of new and innovative ideas. Creative activity grows out of the relationship between an individual and the world of his or her work, as well as out of the ties between an individual and other human beings. Creativity does not happen inside people's heads, but in the interaction between a person's thoughts and a socio-cultural context [Engeström, 2001].

Social creativity explores new media and technologies to help people work together. Social creativity is relevant to design because collaboration plays an increasing role in design projects that require expertise in a wide range of domains. Software design projects, for example, involve domain professionals, designers, programmers, human-computer interaction specialists, marketing people, and end-user participants [Greenbaum & Kyng, 1991]. Information technologies have reached a level of sophistication, maturity, cost-effectiveness, and distribution that they are not restricted to only enhancing productivity, but they open up new *creative possibilities* [National-Research-Council, 2003].

The Spatial Dimension. In contrast, distributed teams of collaborators are able to carry out effective work, and evolve totally new ways of working that have a great impact on their activities. Open source software communities provide an example of successful collaboration on a large scale mediated by computational media [Fischer et al., 2004b; Raymond & Young, 2001]. Bringing spatially distributed people allows that shared concerns rather than shared locations become the prominent defining feature of a group of people interacting with each other. It allows more people from different locations to be included, thereby creating opportunities to exploit local knowledge.

Though communication technologies enable profoundly new forms of collaborative work, Olson and Olson [Olson & Olson, 2001] have found that collaborative design can still be difficult to support at a distance. In

addition, critical stages of collaborative work, such as dealing with ill-defined problems or establishing mutual trust, require some level of face-to-face interaction.

The Temporal Dimension. A design strategy that can be recommended to anyone aspiring to make a creative contribution or to evolve an artifact in any domain is to master as thoroughly as possible what is already known in a domain. Design processes often take place over many years, with initial design followed by extended periods of evolution and redesign. In this sense, design artifacts (including systems that support design tasks, such as reuse environments [Ye & Fischer, 2002]) are not designed once and for all, but instead evolve over long periods of time.

Long-term collaboration requires that present-day designers be aware of the rationale [Moran & Carroll, 1996] behind decisions that shaped the artifact, and aware of information about possible alternatives that were considered but not implemented. This requires that the rationale behind decisions be recorded. During the lifecycle of a ongoing design project, the environment in which the artifact functions may have changed in ways that were not anticipated by the original designers. If the system cannot be adapted to its changing environment at use time, it will cease to be useful. One way to view this need for adaptation is to think of the lifecycle of a system as an ongoing design process, sometimes called design-in-use to emphasize that design of a system happens alongside use.

The Conceptual Dimension. Design communities are increasingly characterized by a *division of labor*, comprising individuals who have unique experiences, varying interests, and different perspectives about problems, and who use different knowledge systems in their work. Shared understanding [Resnick et al., 1991] that supports collaborative learning and working requires the active construction of knowledge systems in which the meanings of concepts and objects can be debated and resolved.

Our own research efforts have focused on supporting communication within two types of communities:

- *Communities of Practice (CoPs)* are homogeneous design communities that consist of practitioners who work in a certain domain. Examples of CoPs are architects, urban planners, software developers, and end-users. In our past work, we have developed *domain-oriented design environments* [Fischer, 1994] to support CoPs by allowing them to interact at the level of the problem domain and not only at a computational level.
- *Communities of Interest (CoIs)* are heterogeneous design communities that bring stakeholders from different CoPs together to solve a particular design problem of common concern. Examples of CoIs are (1) a team of software designers, marketing specialists, psychologists, and programmers, interested in software development; or (2) a group of citizens and experts interested in urban planning. The Envisionment and Discovery Collaboratory [Arias et al., 2000] supports CoIs in creating a shared understanding of the task-at-hand, which often does not exist at the beginning, but is evolved incrementally and collaboratively and emerges in people's minds and in external artifacts. Members of CoIs must learn to communicate with and learn from others who have different perspectives and different vocabularies to describe their ideas and to establish a common ground.

The Technological Dimension. Design can be described as a reflective conversation between designers and the designs they create. Designers use materials to construct design situations, and then listen to the "back-talk of the situation" they have created [Schön, 1983]. Unlike passive design materials, such as pen and paper, computational design materials are able to interpret the work of designers and actively talk back to them. Barriers occur when the "back-talk" is represented in a form that users are unable to comprehend, or when the back-talk created by the design situation itself is insufficient, and additional mechanisms (e.g.: critiquing, simulation, and visualization components) are needed

Media change the nature of learning and communication in design. Ideally, new media will improve both individual and collaborative design by augmenting the cognitive abilities of designers and allowing them to transcend some of the distances that have limited knowledge creation and sharing in design.

New media should be designed from a *meta-design perspective* [Fischer & Giaccardi, 2004; Fischer et al., 2004a] that allow owners of problems to act as designers rather than being confined to a consumer role. Fundamental objectives of meta-design are: (1) to create socio-technical environments that empower users to engage actively in the continuous development of systems rather than being restricted to the use of existing systems; and (2) to extend the traditional notion of system development to include users in an ongoing process as co-designers, not only at design time but throughout the whole existence of the system. A necessary, although not sufficient, condition for meta-design is that software systems include advanced

features permitting users to create complex customizations and extensions. Rather than presenting users with closed systems, meta-design provides them with opportunities, tools, and social structures to extend the system to fit their needs. In meta-design, control is shared between designers and users and it empowers users to create and contribute their own visions and objectives. Meta-design creates the technical and social conditions for broad participation in design activities.

Conclusions. The key to interdisciplinary work (as required for collaborative design) is not in *"Leonardos who are competent in all sciences"* or in educating the *"intellectual superhuman"* who knows all about a complex design problem. With information and tools growing exponentially in all disciplines, it is impossible for any single researcher or practitioner to have the time to gain mastery in multiple disciplines.

Bringing people and media together is a means to overcome distances. These distances are not only spatial, but also temporal, conceptual, and technological, each creating barriers of different kinds. Our research has tried to see these distances as opportunities to bring different media together to achieve new levels of social creativity. Our work has only scratched the surface of exploiting the power of collective minds equipped with new media. The challenges of the complex problems that we all face make this approach not a luxury, but a necessity.

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