Democratizing Design: New Challenges and Opportunities for Computer-Supported Collaborative Learning

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Abstract: The fundamental challenge for the next generation of Computer-Supported Collaborative Learning (CSCL) systems is to contribute to the invention, fostering and support of cultures of participation in which humans can express themselves and engage in personally meaningful activities. New models for knowledge creation, accumulation, and sharing are needed that allow, encourage, and support all participants to be active contributors in personally meaningful activities.

In our research, we have explored and contrasted two different models: MODEL-AUTHORITATIVE (based on strong input filters, relatively small information repositories, and weak output filters) and MODEL-DEMOCRATIC (based on weak input filters, large and diverse information repositories, and strong output filters to find relevant and reliable information). We postulate that MODEL-DEMOCRATIC democratizes design, requires support for meta-design, and fosters social creativity thereby creating new challenges and opportunities for computer-supported collaborative learning. Examples from different lifelong learning settings based on MODEL-DEMOCRATIC are described and analyzed and some general findings are derived and discussed.

Introduction

Consumer cultures based on the *industrial information economy* [Benkler, 2006] have been focused on creating finished goods such as complete software systems, movies, curricula, lectures, and information repositories. Cultures of participation based on the emerging *networked information economy* are democratizing the design and evolution of rich collaboratively constructed information environments [von Hippel, 2005] by creating *socio-technical environments*. These fundamental changes create new challenges for CSCL [Brown, 2005] by breaking down the barriers and distinctions between designers and users, teachers and learners (creating "communities of learners" [Rogoff et al., 1998]), consumers and producers (creating "prosumers" [Tapscott & Williams, 2006]) and between professionals and amateurs (creating "prom-ams") allowing and supporting humans (not all of them, not at all times, and not in all contexts) to be and act as *active contributors in personally meaningful activities* [Fischer, 2002].

The implications for CSCL are that the computer support (the "CS" in CSCL) should focus on innovative media and new technologies that do not deliver predigested information to learners but provides them with the opportunity and resources for engaging in self-directed learning, and that collaborative learning (the "CL" in CSCL) allows all participants to engage actively in framing and solving of authentic problems, have a voice in social debates and discussions, and create shared understanding. The paper explores and provides further evidence for the claim put forward at CSCL'2007 that *"CSCL is not thinking radically enough (1) by accepting too many established approaches and organizations (e.g.: a theory of human learning based solely on school learning is too limited), (2) by not embracing new learning opportunities (e.g.: exploiting the unique opportunities of social production in which all learners can act as active contributors in personally meaningful problems), and (3) by not providing broader conceptual frameworks for learning in the 21st century"* [Fischer, 2007].

Design Methodologies for Socio-Technical Environments Supporting CSCL

Design [Simon, 1996] has emerged as a fundamental topic of great importance for the world in the 21st century explored by research communities in different domains (e.g.: software design, urban design, design in the creative arts, design of learning environments, and collaborative design efforts). Most design methodologies (including *user-centered design* approaches and *participatory design* approaches) have focused primarily on activities and processes taking place at design time in the systems' original development (e.g.: a teacher preparing an instructionist lecture of a website for broadcasting information), and have given little emphasis and provided few mechanisms to support systems as living entities that can be evolved by their users. 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 blur different contexts, be coupled with the social environment in which they are embedded, and incorporate new technologies. *Meta-design* [Fischer & Giaccardi, 2006] is focused on "design for designers". It creates open systems at design time that can be modified and evolved by their users, requiring and supporting more complex interactions at use time. Open systems allow significant modifications when the need arises. The successes of collaborative knowledge construction, open source software systems [Raymond & Young, 2001], and open content environments [Benkler, 2006] have demonstrated that given the right conditions, design through the collaboration of many can create new kinds of systems.

Different Models for Knowledge Creation, Accumulation, and Sharing

The process of knowledge creation, accumulation, and sharing in society has undergone major changes. Initially, knowledge was accumulated in the heads of people and communicated by tales, stories, and myths. The *oral* tradition has been replaced by a *written* tradition that allows people to permanently record thoughts and widely distribute them [Ong, 1982]. *Information technologies* have created fundamentally new opportunities including the latest shift from professionally dominated consumer to cultures of participation which democratized design in numerous design domains.

Professionally Dominated Design Cultures: MODEL-AUTHORITATIVE. *Professionally dominated design cultures* (see Figure 1) are characterized by a small number of experts (such as teachers) acting as contributors and a large number of passive consumers (such as learners). In such cultures, strong input filters exist based on:

- substantial knowledge is necessary for contributions (e.g.: the in-depth understanding of established fields of inquiry or the need to learn specialized high-functionality tools); and
- extensive quality control mechanisms exist (e.g.: the certification of professionals or low acceptance rates for conference and journal articles); and
- large organizations and high investments for production are required (e.g.: film studios such as Hollywood, newspaper production facilities);

A consequence of the strong input filters preventing and rejecting contributions is that relatively small information repositories are created.

The *advantage* of this model (this is at least the basic underlying assumption) is the likelihood that the quality and trustworthiness of the accumulated information is high because the strong input filters will reject unreliable and untrustworthy information. Based on the smaller size of the resulting information repositories, relatively weak output filters are required.

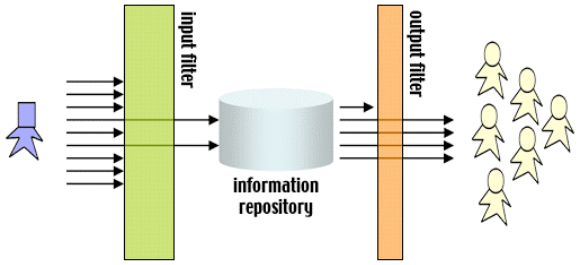

Figure 1: MODEL-AUTHORITATIVE underlying Professionally Dominated Cultures

The *disadvantage* of this model is that it greatly limits that "all voices can be heard". Their intake is limited because with only a small number of contributors too many views are unexplored and underrepresented because the controlling mechanisms behind the input filters suppress broad participation from different constituencies. In our complex globalized societies, no one knows everything and concepts such as symmetry of ignorance, conceptual collisions, and epistemological pluralism should be seen and supported as unique opportunities to support social creativity. Relevant information and divergent opinions (which may be of great value not at a global level but for the work of specific individuals) will often not be included in the information repository. Most people are limited to accessing existing information, denying them a voice even in the context of personally meaningful problems and in situations in which specialized idiosyncratic knowledge would represent a unique contribution.

Democratized Design Cultures: MODEL-DEMOCRATIC. *Democratized design cultures* [Fischer, 2002; von Hippel, 2005]) (see Figure 2) can be characterized by weak input filters allowing users not only to access information but to become active contributors by engaging in *informed participation*. The weak input filters result in much larger information repositories (with information repositories such as the World Wide Web being the prime example).

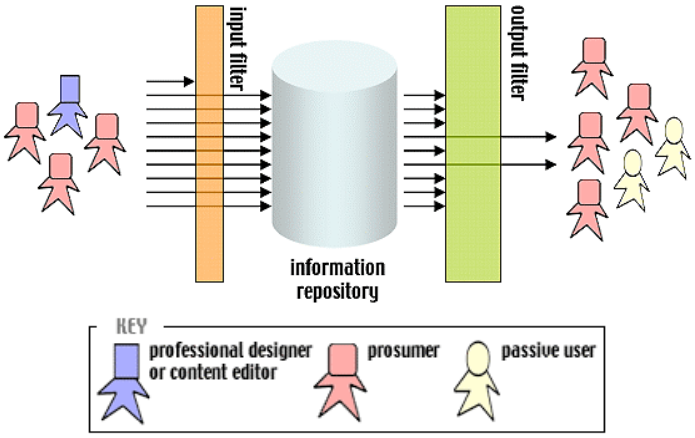

Figure 2: MODEL-DEMOCRATIC underlying Democratic Design Cultures

MODEL-DEMOCRATIC on the *technical* side requires powerful tools for creating content (such as Wiki substrates and end-user development environments), for organizing content (such as supporting collections), and for distributing content (such as powerful search capabilities and recommender systems). On the *social* side, it requires active contributors (who master the design tools and who are motivated to contribute), curators (who organize the large information repositories) and docents (who assist in helping learners to identify and locate relevant information). Embracing a social-technical perspective, our research activities focused on MODEL-DEMOCRATIC are grounded in the basic assumption that technology alone does not determine cultures of participation but that it creates feasibility spaces for them.

The advantages and disadvantages of the two models are to some extent reversed. Major limitations of the second model are the potentially reduced trust and reliability of the content of the information repositories based on the weak input filters. The amount of available information is exploding, and since too much information consumes the true scarce resource of human attention, the large information repositories will be a mixed blessing unless we are able to develop strong new output filters (e.g.: powerful search mechanisms to find relevant information, collaborative filtering, recommender and tagging systems, and user and task models to personalize information).

Examples of CSCL Environments Based on Model-Democratic

New developments over the last few years supported by Web 2.0 architectures [O'Reilly, 2006] [Benkler, 2006; Tapscott & Williams, 2006] have created numerous environments providing interesting examples for MODEL-DEMOCRATIC. All of these environments are dominated by user-generated content and all participants have the opportunity to act simultaneously as "teachers" and "learners" and learning takes place by contributing, by analyzing, reflecting, and evolving other participants' contributions, and by supporting a rich ecology of different roles (including: contributors, local developers, gardeners, curators, docents, raters, taggers) and allowing participants to migrate between these roles.

Some of the most prominent examples that we have analyzed: LINUX, WIKIPEDIA, SECOND LIFE, FLICKR and YOUTUBE, *SCRATCH* programming environment, *SAP Developer Network, COURSES-AS-SEEDS, 3D WAREHOUSE*, and *CREATIVEIT*. Over the last few years, we have investigated specifically the last *four examples* of this list and the last two will be briefly described .

SketchUp, 3D Warehouse, and Google Earth: Sharing 3D Models. Google is interested in modeling the whole world in 3D and uses Google Earth for exploring this world. This objective cannot be achieved by a development team at Google alone. The most feasible approach is to engage the whole world in this major undertaking with MODEL-DEMOCRATIC. To do so poses a number of challenging problems for participants acting as active contributors. They need to learn ***(1)*** *SketchUp***,** a high-functionality environment for 3D modeling (http://sketchup.google.com/), and (2) the mechanisms how to share 3D models by uploading them from SketchUp to the 3D Warehouse and (b) how to download models from the 3D Warehouse and from SketchUp and view them in Google Earth (if the models have a location on earth). In order to motivate and empower enough people, we have explored in close collaboration with researchers from Google new learning mechanisms for SketchUp to allow everyone who wants to contribute to learn doing so by reducing the "thickness" of the input filters. The *3D Warehouse* (http://sketchup.google.com/3dwarehouse/) is an information repository for the collection of models created by all users who are willing to share their models containing ten thousands of models from different domains. It supports *collections* to organize models and supports ratings and reviews by the participating community. It lets viewers connect with the owners of models. It has *weak input filters* (such as content policies), mechanisms to ensure the quality of user contributions (such as tagging and ratings), and an

emerging set of output filters (such as search support and different sorting algorithms). It is integrated with SketchUp (as the design environment) and *Google Earth* as a viewing environment which has the capability to show 3D objects that consist of users' submissions and were developed using SketchUp.

Distributed Scientific Communities. We have designed and seeded a wiki-based socio-technical environment (http://swiki.cs.colorado.edu/CreativeIT) to foster and support the emerging *CreativeIT Community*, consisting of participants (researchers, artists, graduate students) in the NSF research program on "Creativity and IT" (http://www.nsf.gov/pubs /2007/nsf07562/-nsf07562.htm). The unique challenges of supporting this specific community with MODEL-DEMOCRATIC are that people working in interdisciplinary projects or in niches of their disciplines are often isolated in their local environments unaware of relevant work in other disciplines. Based on this research, we have developed a deeper understanding of how technical and social environments can be changed through design interventions. We are in the process of assessing and collecting a variety of data (using tools such as *Google Analytics* as well as our own tools) to gain a better understanding of the value of recording implicit interactions versus engaging participants in explicit activities (such as tagging, rating, commenting).

Implications

Harness Social Creativity. Cultures of participation challenge the assumption that information must move from teachers and other credentialed producers to passive learners and consumers. As long as only experts (including: teachers, professionals in different disciplines, commercial producers of software and movies, etc) can determine what is right and worthwhile to be published, we will never be in a position to harness people's social creativity and local knowledge. Arguing that MODEL-DEMOCRATIC supported by meta-design opens the opportunity to harness social creativity, we do not imply that it is the preferred model for *all* human activities. We need a deeper understanding under which conditions and for which kinds of activities MODEL-AUTHORITATIVE is the preferred model rather than MODEL-DEMOCRATIC and the views of experts maybe more relevant, reliable, and insightful compared to the "wisdom of crowds" [Surowiecki, 2005].

Quality of Information Repositories. How do we know that the content produced with MODEL-DEMOCRATIC by widely dispersed and qualified individuals is not of substandard quality? There are many open issues to be investigated including: (1) *errors* will always exist; the questions will be which model is better suited to deal with errors over time; how do knowledge workers acquire the important skill to be always *critical of information* rather than blindly believing in what others (specifically "experts") are saying?; and (2) *ownership* may be a critical dimension: the community at large has a greater sense of ownership and thereby is more willing to put an effort in that errors will be fixed.

Motivation for Participation. Being an active contributor requires more effort and more time than being a passive consumer. In order for MODEL-DEMOCRATIC to be a viable alternative, we have to explore the fundamental question: *what motivates people to participate* [Renninger, 2000]? Active contributors are often domain professionals, competent practitioners, and discretionary users and should not be considered simply as naïve users.

Supporting the "Long Tail". In systems supported by MODEL-DEMOCRATIC there is something for everybody. Not all active contributors are equally creative but *most people have some unique expertise* residing in the "Long Tail" [Anderson, 2006; Brown & Adler, 2008] which is more likely to become externalized and documented with weak input filters. Providing platforms for user-generated content and motivation for participation, Long Tail environments can achieve coverage that a small team of professionals is unable to generate (as argued and demonstrated with the examples described earlier).

Conclusion

Cultures supported by MODEL-AUTHORITATIVE encourage consumption of polished, finished goods. The emergence of democratized design cultures as characterized by MODEL-DEMOCRATIC and supported by Web 2.0 environments provides a richer set of cultural forms and practices and requires new forms of computer supported collaborative learning. Whether the *advantages* of democratized design cultures (such as: extensive coverage of information, creation of large numbers of artifacts, creative chaos by making all voices heard, reduced authority of expert opinions, shared experience of social creativity) will outweigh the *disadvantages* (accumulation of irrelevant information, wasting human resources in large information spaces, lack of coherent voices) will require more investigations and explorations.

References

Anderson, C. (2006) The Long Tail: Why the Future of Business Is Selling Less of More, Hyperion, New York

Benkler, Y. (2006) The Wealth of Networks: How Social Production Transforms Markets and Freedom, Yale University Press, New Haven.

Brown, J. S. (2005) New Learning Environments for the 21st Century, available at http://www.johnseelybrown.com/newlearning.pdf.

Brown, J. S., & Adler, R. P. (2008) Minds of Fire: Open Education, the Long Tail, and Learning 2.0, available at http://www.educause.edu/ir/library/pdf/ERM0811.pdf.

Fischer, G. (2002) Beyond 'Couch Potatoes': From Consumers to Designers and Active Contributors, in Firstmonday (Peer-Reviewed Journal on the Internet), available at http://firstmonday.org/issues/issue7_12/fischer/.

Fischer, G. (2007) "Designing Socio-Technical Environments in Support of Meta-Design and Social Creativity." In Proceedings of the Conference on Computer Supported Collaborative Learning (Cscl '2007), Rutgers University, July, pp. 1-10.

Fischer, G., & Giaccardi, E. (2006) "Meta-Design: A Framework for the Future of End User Development." In H. Lieberman, F. Paternò, & V. Wulf (Eds.), End User Development, Kluwer Academic Publishers, Dordrecht, The Netherlands, pp. 427-457.

O'Reilly, T. (2006) What Is Web 2.0 - Design Patterns and Business Models for the Next Generation of Software, available at http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html.

Ong, W. J. (1982) Orality and Literacy, Routledge, London.

Raymond, E. S., & Young, B. (2001) The Cathedral and the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary, O'Reilly & Associates, Sebastopol, CA.

Renninger, K. A. (2000) "Individual Interest and Development: Implications for Theory and Practice." In C. Sansone, & J. M. Harackiewicz (Eds.), Intrinsic and Extrinsic Motivation. The Search for Optimal Motivation and Performance, Academic Press, New York, pp. 375-404.

Rogoff, B., Matsuov, E., & White, C. (1998) "Models of Teaching and Learning: Participation in a Community of Learners." In D. R. Olsen, & N. Torrance (Eds.), The Handbook of Education and Human Development — New Models of Learning, Teaching and Schooling, Blackwell, Oxford, pp. 388-414.

Simon, H. A. (1996) The Sciences of the Artificial, third ed., The MIT Press, Cambridge, MA.

Surowiecki, J. (2005) The Wisdom of Crowds, Anchor Books, New York.

Tapscott, D., & Williams, A. D. (2006) Wikinomics: How Mass Collaboration Changes Everything, Portofolio, Penguin Group, New York, NY.

von Hippel, E. (2005) Democratizing Innovation, MIT Press, Cambridge, MA.

Acknowledgements

The author thanks (1) the members of the Center for LifeLong Learning & Design at the University of Colorado, who have made major contributions to ideas described in this paper. The research was supported in parts by grants from the (1) National Science Foundation including: (a) IIS-0613638 “A Meta-Design Framework for Participative Software Systems”, (b) IIS-0709304 “A New Generation Wiki for Supporting a Research Community in ‘Creativity and IT” and (c) IIS-0843720 “Increasing Participation and Sustaining a Research Community in ‘Creativity and IT’”; (2) by a Google research award “Motivating and Empowering Users to Become Active Contributors: Supporting the Learning of High-Functionality Environments”; and (3) by a SAP research project “Giving All Stakeholders a Voice: Understanding and Supporting the Creativity and Innovation of Communities Using and Evolving Software Products”.