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Understanding, Fostering, and Supporting Cultures of Participation

Cover Story by Gerhard Fischer

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Cultures are defined in part by their media and their tools for thinking, working, learning, and collaborating. In the past, the design of most media emphasized a clear distinction between producers and consumers [1]. Television is the medium that most obviously exhibits this orientation and has contributed to the degeneration of humans into “couch potatoes” [2], for whom remote controls are the most important instruments of their cognitive activities. In a similar manner, our current educational institutions often treat learners as consumers, fostering in students a mind-set of consumerism rather than of ownership of problems, which they carry with them for the rest of their lives. As a result, learners, workers, and citizens often feel left out of decisions by teachers, managers, and policymakers, denied opportunities to take active roles.

The rise in social computing (based on social production and mass collaboration) has facilitated a shift from consumer cultures (specialized in producing finished artifacts to be consumed passively) to cultures of participation (in which all people are provided with the means to participate

and to contribute actively in personally meaningful problems) [3]. These developments represent unique and fundamental opportunities, challenges, and transformative changes for innovative research and practice in human-centered computing, as we move away from a world in which a small number of people define rules, create artifacts, and make decisions for many consumers toward a world in which everyone has interests and opportunities to actively participate.

Our research is exploring theoretical foundations and system developments for understanding, fostering, and supporting cultures of participation grounded in the basic assumption that innovative technological developments are necessary for cultures of participation, but they are not sufficient. Sociotechnical environments are needed because cultures of participation are not dictated by technology; they are the result of changes in human behavior and social organization, in which active contributors engage in the innovative design, adoption, and adaptation of technologies to their needs and in collaborative knowledge construction.



SITE	OBJECTIVES AND UNIQUE ASPECTS
Wikipedia	Web-based collaborative multilingual encyclopedia with a single, collaborative, and verifiable article; authority is distributed (http://www.wikipedia.org/)
KNOLA	A library of articles by recognized experts in specific domains; authors take credit and elicit peer reviews. Readers can provide feedback and comments, but authority rests primarily with the author (http://knol.google.com/)
iTunes U	Courses by faculty members from "certified institutions"; control via input filters—material cannot be remixed and altered by consumers (http://www.apple.com/education/itunes-u/)
YouTube	Video-sharing website with weak input filters and extensive support for rating (http://www.youtube.com/)
Encyclopedia of Life (EoL)	Documentation of the 1.8 million known living species, development of an extensive curator network, partnership between the scientific community and the general public (http://www.eol.org/)
SketchUp and 3D Warehouse	Repository of 3-D models created by volunteers organized in collections by curators and used in Google Earth (http://sketchup.google.com/3dwarehouse/)
Scratch	Learning environment for creating, remixing, and sharing programs to build creative communities in education (http://scratch.mit.edu)
Instructables	Sociotechnical environment focused on user-created and shared do-it-yourself projects involving other users as raters and critics (http://www.instructables.com/)
PatientsLikeMe	Collection of real-world experiences enabling patients who suffer from life-changing diseases to connect and converse (http://www.patientslikeme.com/)
Ushahidi	Tools for democratizing information, increasing transparency, and lowering the barriers for individuals to share their stories; originated in the collaboration of Kenyan citizen journalists during crises (http://www.ushahidi.com/)
Stepgreen	Library of energy-saving actions, tips, and recommendations by citizen contributors for saving money and being environmentally responsible (http://www.stepgreen.org/)

Table 1: Environments created by cultures of participation with unique features.

Our emerging theoretical framework is grounded in a variety of different application contexts, including open source software, urban planning, assistive technology, energy sustainability, and learning and education [4], and it has allowed us to articulate initial design guidelines and to explore the implications of these developments for future research and advances in human-centered social computing focused on cultures of participation.

Cultures of Participation

Cultures of participation offer important and interesting opportunities to address major problems our societies are facing today, including:

- problems of a magnitude that individuals and even large teams

cannot solve (e.g., to create 3-D models of all buildings in the world as addressed by Google SketchUp and 3D Warehouse)

- problems of a systemic nature, requiring the collaboration of many different minds from a variety of backgrounds (e.g., urban-planning problems as addressed by the Envisionment and Discovery Collaboratory (EDC) at the University of Colorado, Boulder)

- poorly understood and ill-defined problems requiring high-level involvement because they cannot be delegated to others (e.g., software-design problems as tackled by open source software developments)

- problems modeling unique, changing worlds that are dependent on open, living information repositories and tools (e.g.,

the unique needs of people with disabilities as addressed by design for diversity).

Cultures of participation are facilitated and supported by a variety of different technological environments, such as the participatory Web (Web 2.0), tabletop computing, and domain-oriented design environments—all of them contributing in different ways to the aims of engaging diverse audiences, enhancing creativity, sharing information, and fostering the collaboration among users acting as active contributors and designers. They democratize design and innovation by shifting power and control toward users, supporting them to act as both designers and consumers ("prosumers") and allowing systems to be shaped through real-time use [5].

Table 1 provides an overview of a sample of environments created by cultures of participation with unique features.

A fundamental challenge for cultures of participation is to conceptualize, create, and evolve socio-technical environments that not only technically enable and support users' participation, but also successfully encourage it. Participation is often determined by an individual's assessment of value/effort. The effort can be reduced by providing the right kind of tools with meta-design, and the value can be increased by making all voices heard by supporting social creativity. As effort and value vary greatly among individuals, richer ecologies of participation are required to identify distinct roles. These components of our emerging theoretical framework are later.

Figure 1 illustrates (using a broad qualitative representation) some of the major cultural changes caused by new media over the past few millennia. The interesting question is whether cultures of participation will cause similar transformative changes in the years to come as reading and writing did thousands of years ago. Will the power of the collective human mind aided by technology improve further or are there major drawbacks to come (as Socrates argued would be the consequences of reading and writing)? And if so, we need to investigate whether these drawbacks will outweigh advantages and how we can avoid or at least reduce their impact.

Components of a Theoretical Framework

Without a theoretical framework, the developments listed in Table 1 may be seen merely as interesting

phenomena instead of what they really are: fundamentally different ways to cope with a large number of difficult problems in which new social organizations and new media can make a difference.

This section describes three major components of our emerging framework:

- *Meta-design* is aimed at defining and creating social and technical infrastructures in which cultures of participation can come alive and new forms of collaborative design can take place.

- *Social creativity*, focused on "transcending the individual human mind," makes all voices heard in the framing and solving of complex problems, supports interactions with other people and shared artifacts, and exploits new media for transdisciplinary collaborations.

- *Richer ecologies of participation* are focused on "creating different levels of participation" by differentiating, analyzing, and supporting distinct roles based on different levels of expertise, interests, and motivations that can be found in cultures of participation.

Meta-Design. Meta-design is focused on "design for designers" [6]. It creates open systems at design time that can be modified by their users acting as co-designers, requiring and supporting more complex interactions at use time. Meta-design is grounded in the basic assumption that future uses and problems cannot be completely anticipated at design time, when a system is being developed. At use time, users will invariably discover mismatches between their needs and the support that an existing system can provide for them. Meta-design contributes to the invention and design of sociotechnical environments in which humans can

express themselves and engage in personally meaningful activities.

Meta-design supports cultures of participation as follows:

- *Making changes must seem possible.* Contributors should not be intimidated and should not have the impression that they are incapable of making changes; the more users become convinced that changes are not as difficult as they think they are, the more they may be willing to participate.

- *Changes must be technically feasible.* If a system is closed, then contributors cannot make any changes; as a necessary prerequisite, there need to be possibilities and mechanisms for extension.

- *Benefits must be perceived.* Contributors have to believe that what they get in return justifies the investment they make. The benefits perceived may vary and can include professional benefits (helping for one's own work), social benefits (increased status in a community, possibilities for jobs), and personal benefits (engaging in fun activities).

- *The environments must support tasks that people engage in.* The best environments will not succeed if they are focused on activities that people do rarely or consider of marginal value.

- *Low barriers must exist to sharing changes.* Evolutionary growth is greatly accelerated in a system in which participants can share changes and keep track of multiple versions easily. If sharing is difficult, it creates an unnecessary burden that participants are unwilling to overcome.

- *Designers must become meta-designers.* They should use their own creativity to create socio-technical environments in which other people can be creative by shifting from determining the

meaning, functionality, and content of a system to encouraging and supporting users to act as designers. They must be willing to share control of how systems will be used, which content will be contained, and which functionality will be supported.

Meta-design allows significant modifications when the need arises. It reduces the gap in the world of computing between a population of elite, high-tech scribes who can act as designers and a much larger population of intellectually disenfranchised knowledge workers who are forced into consumer roles.

Meta-design supports underdesign by designers at design time. Underdesign does not mean less design; rather, it is a design methodology that offers users (acting as designers at use time) as many alternatives as possible, avoiding irreversible commitments they cannot undo. Additional aspects of underdesign in support of cultures of participation include the following:

- It is grounded in the need for “loose fit” in designing artifacts at design time so that unexpected uses of the artifact can be accommodated at use time; it does so by creating contexts and content-creation tools rather than content.
- It avoids design decisions in the earliest part of the design process, when everyone knows the least about what is really needed.
- It acknowledges the necessity to differentiate between structurally important parts for which extensive professional experience is required, and should therefore not be easily changed (such as weight-bearing walls in buildings), and components that users should be able to modify to their needs because their personal knowledge is most relevant.

- It creates technical and social conditions for broad participation in design activities by supporting “hackability” and “remixability.”

Social Creativity. Where do new ideas come from in cultures of participation? The creativity potential is grounded in user-driven innovations supported by meta-design environments, taking advantage of breakdowns as sources of creativity and exploiting the symmetry of ignorance (meaning that all stakeholders are knowledgeable in some domains and ignorant in others) [7]. Increasing social creativity requires diversity (each participant should have some unique information or perspective), independence (participants’ opinions are not determined by the opinions of those around them), decentralization (participants are able to specialize and draw on local knowledge), and aggregation (mechanisms exist for turning individual contributions into collections, and private judgments into collective decisions). In addition, participants must be able to express themselves (requiring technical knowledge on how to contribute), must be willing to contribute (motivation), and must be allowed to be heard (control).

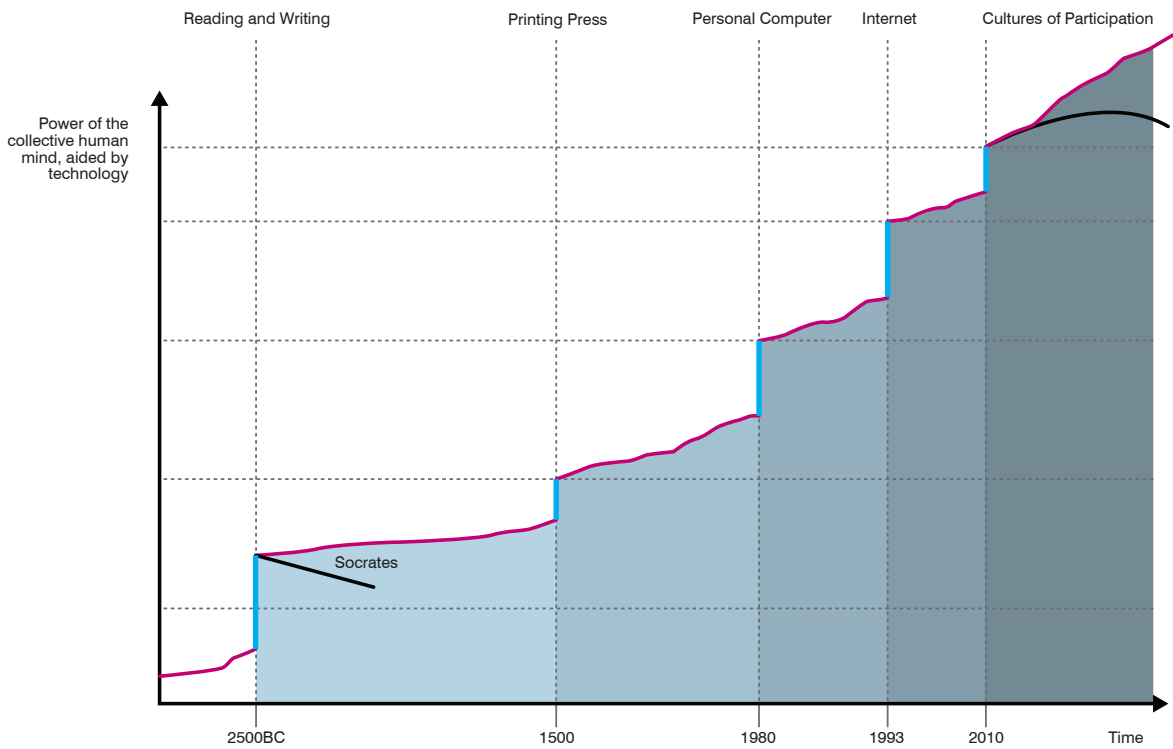
Social creativity is based on the assumption that the power of the unaided individual mind is limited [7]. Although creative individuals are often thought of as working in isolation, much human creativity arises from activities that take place in a social context in which interaction with other people and the artifacts that embody collective knowledge are important contributors to the process. The fundamental problems of the 21st century are complex and open-ended, requiring ongoing contributions of many minds, particularly from the

people who own problems and are directly affected by them [8].

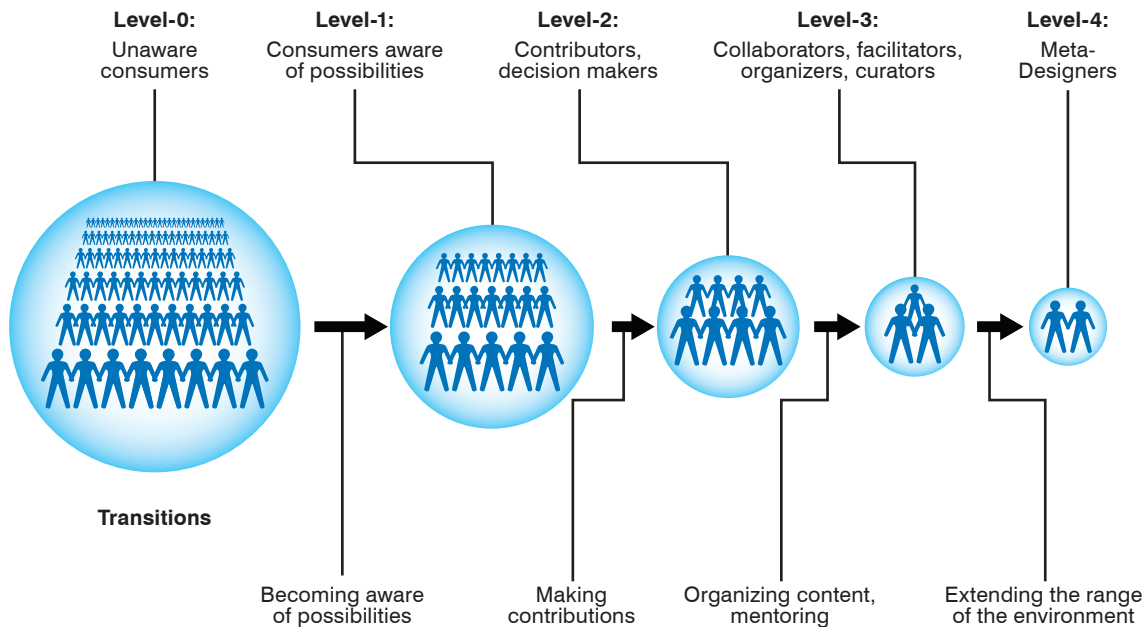
Richer Ecologies of Participation

Individual people have different motivations for doing things, and those motivations create different levels of participation. To understand, foster, and support cultures of participation requires differentiating, analyzing, and supporting distinct roles that can be found in cultures of participation: consumers, contributors, collaborators, and meta-designers. Figure 2 (inspired and derived from [6] and [9]) illustrates that most participants will start as consumers, and only a small percentage of these will eventually contribute, collaborate, and act as meta-designers, and thereby be responsible for the content that is shared with everyone. (To avoid the figure becoming overly complex, it does not illustrate that the migration paths do not always go through all stages and that people may retreat to less-demanding roles over time.)

Cultures of participation must handle the startup paradox, when early in their lifecycle they have few members to generate content and little content to attract members. To address this paradox, we have developed the seeding, evolutionary growth, and reseeding (SER) model [2], an emerging descriptive and prescriptive model that supports meta-design. Instead of attempting to build complete systems at design time, the SER model advocates building seeds (grounded in participatory design activities between meta-designers and users) that can evolve over time through contributions of a large number of people (the defining characteristics of a culture of participation). A seed is something that has the potential to change and grow. In sociotechnical environments, seeds need to



► Figure 1. Major cultural changes caused by new media.



► Figure 2. Ecologies of participation.

COLLABORATIVE EFFORTS IN LARGE-SCALE PROJECTS

In addition to our own developments, we have been engaged in collaborative efforts in large-scale projects, including the following [4]:

Modeling the Whole World in 3-D. Google's SketchUp/ Building Maker + 3D Warehouse + Google Earth (<http://sketchup.google.com/3dwarehouse/>) is an environment in which people from around the world can create 3-D models with SketchUp or Building Maker, share and organize it in collections in the 3D Warehouse, and display them in Google Earth. The amount of work and local knowledge needed to achieve this is beyond the scope and capability of any locally operating development team. It requires the contributions of a large user base, and as such represents a unique example for assessing the theoretical framework cultures of participation.

Energy Sustainability. New developments in the energy domain, such as smart grids and smart meters, provide support for measuring and visualizing energy consumption. To take advantage of these developments, users must change from passive consumers of energy into active decision makers. Migrating toward these roles (see Figure 2) provides foundations for behavior changes to reduce energy consumption that can be fostered through social as well as technological interventions. While these developments are focused on individuals, they are complemented by supporting cultures of participation at the national and international level with the Open Energy Information (OpenEI) (<http://en.openei.org/>) initiative environment developed by National Renewable Energy Laboratory's (NREL). OpenEI (and other environments, such as Stepgreen, mentioned in Table 1) represents collaboratively constructed information repositories to inform participants about energy sustainability themes and allow them to share their experiences.

Community Networks. SAP's Community Network (SCN) (www.sdn.sap.com) is an example of a successful sociotechnical environment for peer-support communities that consists of more than one million registered users forming a highly active online community. To move beyond anecdotal examples, we have analyzed SCN using our theoretical framework, compared it with open source communities, and interpreted a variety of data in order to understand the context- and application-specific nature of the collaborations underlying cultures of participation in this specific context [12].

be designed and created for the technical as well as the social component of the environment. The SER model postulates that systems that evolve over a sustained time span must continually alternate between periods of planned activity (the seeding phase), unplanned evolution (the evolutionary growth phase), and periods of deliberate (re)structuring and enhancement (the reseeding phase).

In cultures of participation, not every participant must contribute, but all participants must have opportunities to contribute when they want to. For cultures of participation to become viable and be successful, it is critical that a sufficient number of participants take on the more active and more demanding roles. To encourage and support migration paths toward more demanding roles, mechanisms are needed that lead to more involvement and motivation, and that facilitate the acquisition of the additional knowledge required by the more demanding and involved roles. These mechanisms will include objectives such as:

- “low threshold and high ceiling,” allowing new participants to contribute as early as possible, and at the same time supporting experienced participants with a broad functionality for their more complex tasks
- scaffolding mechanisms to support migration paths
- special interaction mechanisms for different levels of participation (e.g., contributors, curators, and meta-designers)
- support for different levels of participation with regard to the time and effort that an individual must invest
- rewards and incentives needed to reduce the funnel effect [10] from one level to the next.

Exploring Different Application Domains

To assess the viability and applicability of the concepts and components of the theoretical framework described in the previous section, we have explored cultures of participation in numerous domains, including the following:

- open source software, with an emphasis on open source as a success model of decentralized, collaborative, evolutionary development
- architectural design and urban planning, with an emphasis on underdesign and allowing and supporting all participants (as illustrated by the EDC, a tabletop computing environment supporting stakeholders from diverse backgrounds in face-to-face meetings)
- design of computational artifacts, with an emphasis on customization, personalization, tailorability, end-user modifiability, and design for diversity (as illustrated by the Memory Aiding Prompting System (MAPS), supporting people with cognitive disabilities and their caregivers)
- new models of teaching and learning, with an emphasis on learning communities, teachers as meta-designers, and courses-as-seeds (these approaches challenge the assumption that information must move from teachers and other credentialed producers to passive learners and consumers)

These developments will be described in the sidebar “Collaborative Efforts in Large-Scale Projects.”

Open Source Software. Open source software is one of the earliest success models of cultures of participation. Some of the slogans developed in these communities served as indicators of the opportunities associated with cultures of participation: “if there are enough

eyeballs, all bugs are shallow,” indicates the public scrutiny of collaborative developed artifacts can lead to a high reliability and trustworthiness, and “do not send a bug report, send a bug fix,” indicates the desirable migration from the role of bug reporter to bug fixer.

In software design, many of the challenges mentioned earlier were clearly recognized, including the need for open and evolvable systems (perpetual beta) based on fluctuating, conflicting requirements, which will lead over time to mismatches between an evolving world and the software system that models this world—as well as the need for supporting communication and coordination in a richer ecology of participants who have different interests, skills, and background knowledge.

A recent interview with a geoscientist at the University of Colorado, Boulder highlights the importance of these challenges. He uses a couple of domain-specific software systems to analyze his research data, but none of the existing systems can provide complete solutions to his problems as his research unfolds and his understanding of the problem, data, and results proceeds.

“I spend on average an hour every day developing software for myself to analyze the data I collected because there is not any available software. Even if there is a software developer sitting next to me, it would not be of much help, because my needs vary as my research progresses and I cannot clearly explain what I want to do at any moment. Even if the software developer can manage to write a program for me, I will not know if he or she has done it right without looking at the code...So I spent three months to gain enough programming knowledge to get by. Software development has

now become an essential task of my research, but I do not consider myself a software developer and I don't know many other things about software development.”

Clearly, he is not a professional software engineer and does not intend to become one, but he is definitely acting as a participant.

The Envisionment and Discovery Collaboratory (EDC). The EDC is a long-term research platform that explores conceptual frameworks for democratizing design in the context of framing and resolving complex urban planning by bringing together participants from various backgrounds in face-to-face meetings [7]. The knowledge to understand, frame, and solve such problems does not already exist but is constructed and evolves during the solution process. The EDC (representing a sociotechnical environment) incorporates a number of innovative technologies, including tabletop computing, the integration of physical and computational components supporting new interaction techniques, and an open architecture, and has proven to be an ideal environment in which to study and support meta-design and social creativity by making all voices heard.

During the past decade, our research with the EDC to foster and support cultures of participation within collaborative design activities led to the following observations:

- Each urban-planning problem is unique: It has to take into consideration the geography, culture, and population of specific locations.
- More creative solutions to problems can emerge from the collective interactions with the environment by heterogeneous communities (such as communities of interest, which are more diverse than communities of practice).

- Boundary objects are needed to establish common ground and establish shared understanding for communities of interest.

- Participants must be able to naturally express what they want to say.

- Interaction mechanisms must have a low threshold for easy participation and a high ceiling for expressing sophisticated ideas.

- Participants are more readily engaged if they perceive the design activities as personally meaningful by associating a purpose with their involvement.

The further investigation of the above has been thwarted by obstacles that rest with the difficulties of democratizing the design of the EDC by providing more control to the participants [5]. Currently, EDC developers have to customize the system at the source-code level to reflect the specific characteristics of the city and its urban-planning problem. As urban planning deals with ill-defined problems, the domain- and context-specific knowledge is sticky, tacit, and difficult to transfer from local urban planners to the EDC developers. The EDC supports problem-solving activities by bringing individuals who share a common problem (the representatives of the Boulder City Council and the Regents of the University of Colorado) together in face-to-face meetings and promoting social reflection-in-action. Problems are discussed and explored by providing participants with a shared construction space in which they interact with computationally enhanced physical objects that are used to represent the situation. Computer-generated information is projected back onto the tabletop construction area, creating an augmented reality environment.

This construction in the table-top environment is coupled with information displayed on a vertical electronic whiteboard relevant to the problem currently being discussed. A key aspect of the EDC that makes it a critical and unique component (and sets it apart from other environments, such as the Google 3-D modeling environment) is the emphasis on the collaborative construction of artifacts, rather than on the sharing of individually constructed items.

Coping with “Universes of One”: Design for Diversity. Individuals with disabilities are often unable to live independently due to their inability to perform activities of daily living, such as cooking, housework, or shopping. But with socio-technical environments to extend their abilities, and thereby their independence, these individuals can lead lives less dependent on others.

Our research to support and empower people with cognitive disabilities explored cultures of participation by supporting mobile-device customization, personalization, and configuration by caregivers and effective use by clients [10]. People with cognitive disabilities represent a “universe of one” problem: A solution for one person will rarely work for another. Understanding and addressing unexpected and great variations in skills and needs, particularly with respect to creating task support, requires an intimate knowledge of the client that only caregivers can provide. Currently, a substantial portion of all assistive technology is abandoned after initial purchase and use—the very population that could most benefit from technology is paying for expensive devices that end up in the back of closets after a short time.

A unique challenge of cultures of participation in the domain of cognitive disabilities is that the clients themselves cannot act as designers. However, the caregivers, who have the most intimate knowledge of the client, need to become the designers. The scripts needed to effectively support users are specific for particular tasks, creating the requirement that the people who know about the clients and the tasks (i.e., the local caregivers, rather than a technologist far removed from the action) must be able to develop scripts.

Caregivers generally have no specific professional technology training, nor are they interested in becoming computer programmers. This creates the need for design environments with extensive meta-design support to allow caregivers to create, store, and share scripts. The Memory Aiding Prompting System (MAPS) allows caregivers to create complex multimodal prompting sequences that enables sound, pictures, and video to be assembled by using a film-strip-based scripting metaphor [11].

The design of MAPS involved three different groups of participants; assistive technology professionals and special education teachers; parents of clients; and professional caregivers. By designing the MAPS environment to enable script redesign and reuse, caregivers were able to create an environment that matched the unique needs of an individual with cognitive disabilities. MAPS represents an example of democratizing design by supporting meta-design, embedding new technologies into sociotechnical environments, and helping people with cognitive disabilities and their caregivers have more interesting and more rewarding lives.

Rethinking Learning and Education. The current mind-set about learning, teaching, and education is dominated by a view in which a supposedly all-knowing teacher explicitly tells or shows unknowing, passive learners something they presumably know nothing about. A critical challenge is to reformulate and reconceptualize this impoverished and misleading conception.

A culture-of-participation perspective for learning and education is focused not on delivering predigested information to individuals, but on providing opportunities and resources for learners to engage in authentic activities, participate in social debates and discussions, create shared understanding among diverse stakeholders, and frame and solve personally meaningful problems. It is grounded in the fundamental belief that all humans have interest and knowledge in one or more niche domains and are eager to actively contribute in these contexts.

Over the past decade, we have reconceptualized and reinvented our teaching activities and grounded them in sociotechnical environments in which communities of mutual learners act simultaneously as learners and as active contributors (based on the assumption that being a teacher or a learner is not an attribute of a person but an attribute of a context). Peer-to-peer learning is supported, and teachers act as “guides on the side” rather than as “sages on the stage,” and courses are considered seeds rather than finished products [2].

Implications and Impact

As illustrated in Figure 1, the new opportunities and the drawbacks of cultures of participation need to be carefully assessed. These

assessments should be based on measurements; however, new ways to measure developments are needed—especially as new discourses are established to understand, foster, and support cultures of participation.

Drawbacks of Cultures of Participation. Cultures of participation open up unique new opportunities for mass collaboration and social production, but they are not without drawbacks. One such drawback is that humans may be forced to cope with the burden of being active contributors in personally irrelevant activities. This can be illustrated by do-it-yourself societies. With modern tools, humans are empowered to perform many tasks themselves that were done previously by skilled domain workers serving as agents and intermediaries. Although this shift provides power, freedom, and control to customers, it also has forced people to act as contributors in contexts for which they lack the experience (which professionals have acquired and maintained through the daily use of systems) and the broad background knowledge to do these tasks efficiently and effectively (e.g., companies offloading work to customers).

More experience and assessment is required to determine the design trade-offs for specific contexts and application domains in which the advantages of cultures of participation (such as extensive coverage of information, creation of large numbers of artifacts, creative chaos by making all voices heard, reduced authority of expert opinions, and shared experience of social creativity) will outweigh the disadvantages (accumulation of irrelevant information, wasting human resources in large information spaces, and lack of coherent

voices). The following research questions need to be explored:

- Under which conditions is a fragmented culture (with numerous idiosyncratic voices representing what some might characterize as a modern version of the Tower of Babel) better or worse than a uniform culture (which is restricted in its coverage of the uniqueness of local identities and experience)?

- If all people can contribute, how do we assess the quality and reliability of the resulting artifacts? How can curator networks effectively increase the quality and reliability?

- What is the role of trust, empathy, altruism, and reciprocity in such an environment, and how will these factors affect cultures of participation?

Measurement. Some aspects determining cultures of participation can be easily measured—e.g., how well a site lives up to certain usability and sociability factors [9], how people located a site, and how often they visit it—and tools for obtaining these measurements exist (such as Google Analytics). But other aspects are much more difficult to assess and measure. In our collaborative work analyzing the SAP Community Network (SCN) (see sidebar) as a culture of participation, we have created and investigated the following parameters [12]:

- *Responsiveness.* How responsive are communities to the needs of its members?

- *Engagement intensity.* How timely is the peer support?

- *Role distribution:* How wide is the participation of users and in what kind of roles do they participate?

- *Reward system.* What is the impact of explicit reward (point) systems on community behavior?

Establishing New Discourses: Motivation, Control, Ownership, Autonomy, and Quality. Cultures of participation are establishing new discourses. Human beings are diversely motivated beings. We act not only for material gain, but for psychological well-being, for social integration and connectedness, for social capital, for recognition, and for improving our standing in a reputation economy. The motivation for going the extra step to engage in cultures of participation is based on the overwhelming evidence of the IKEA effect [13]: People are more likely to like a solution if they have been involved in its generation, even though it might not make sense otherwise. Creating something personal (such as hand-knitted sweaters and socks and home-cooked meals) even of moderate quality has a different kind of appeal than consuming something of possibly higher quality made by others—even something of very high quality.

Cultures of participation rely on intrinsic motivation for participation by providing contributors with the sense and experience of joint creativity, by giving them a sense of common purpose and mutual support in achieving it, and, in many situations, by replacing common background or geographic proximity with a sense of well-defined purpose, shared concerns, and the successful common pursuit of these.

Cultures of participation support users as active contributors who can transcend the functionality and content of existing systems. Through the facilitation of these possibilities, control is distributed among all stakeholders in the design process. There is evidence that shared control will

DESIGN GUIDE	RATIONALE
Support human-problem interaction	By advancing human-computer interaction to human problem-domain interaction with meta-design environments, owners of problems are put in charge and social creativity is supported.
Underdesign for emergent behavior	Instead of providing fixed content, rules, and processes, create seeds for open, living information repositories and contexts in which participants can create content, cope with exceptions, design work-arounds, and engage in negotiations .
Support different engagement levels	Honor the fact that users have different capabilities, different interests, and different knowledge; support migration paths to more demanding roles.
Reward and recognize contributions	Transcend the sole reliance on economic incentives by supporting social capital, reputation economies, and gift cultures.
Co-evolution of artifacts and user community	Support the mutual cross-pollination between the evolution of communities and the resources for system developments.

Design guidelines supporting cultures of participation.

lead to more innovation: “Users that innovate can develop exactly what they want, rather than relying on manufacturers to act as their (often very imperfect) agents” [5]. (A similar argument surfaced in the interview with the geoscientist described earlier.) Cultures of participation erode monopoly positions held by professions, educational institutions, experts, and high-tech scribes [2].

Our experiences gathered in the context of the design, development, and assessment of our systems indicate that cultures of participation are less successful when users are brought into the process late (thereby denying them ownership) and when they are “misused” to fix problems and to address weaknesses of systems that the developers did not fix themselves.

Many teachers will tell their students that they will not accept research findings and argumentation based on articles from Wikipedia. This exclusion is usually based on considerations such as: “How are we to know that the content produced by widely dispersed and qualified individuals is not of substandard quality?” The online journal *Nature* has compared the quality of articles

found in the *Encyclopedia Britannica* with Wikipedia and has come to the conclusion that “Wikipedia comes close to Britannica in terms of the accuracy of its science entries” [14]. There are many more open issues to be investigated about quality and trust in cultures of participation. Errors will always exist, resulting in learners acquiring the important skill of always being critical of information rather than blindly believing what others (specifically experts or teachers) are saying. Ownership is also a critical dimension—the community at large has a greater sense of ownership and is thereby more willing to put an effort into fixing errors.

Technology alone does not determine social structure, nor does it change human behavior; rather, it creates feasibility spaces for new social practices [1] and can persuade and motivate changes at the individual, group, and community levels. Human-centered technologies can change people’s lives by making it easier for people to do things, by allowing people to explore cause-and-effect relationships, and by providing value that cannot be accounted for in monetary terms [13].

Research in behavioral psychology has shown that providing feedback, goal setting, and tailored information are useful in motivating people to change their behaviors [13]. Our studies provide evidence that we become engaged when we can decide and that we value what we make [6]. All people want to be in some situations a consumer (in personally irrelevant activities) and in others an active contributor (in personally meaningful activities). Being a consumer or active contributor is not an attribute of a person, but of a context. Cultures of participation empower humans to be active contributors in personally meaningful activities.

Conclusion

Cultures of participation, which include technological changes in human-centered computing, pursue a much broader and more fundamental agenda: participation is invited, supported, encouraged, and valued rather than prohibited; control, creative contributions, and innovations are decentralized and extended from design time to use time; new relationships between the individual and society are established; artifacts are

CHALLENGES FOR FUTURE RESEARCH

Identify the social abilities, technical skills, and cultural competencies that people need in cultures of participation.

Extend the theoretical framework to support the design of sociotechnical environments in which users can act as co-designers in personally meaningful problems.

Analyze the different processes and trade-offs underlying cultures of participation (e.g., creating seeds for open, living artifacts) and consumer cultures (e.g., create complete systems).

Broaden the scope of human-centered design from the usability of systems to providing resources, incentives, information to encourage participation and sustain it and allow users to reflect upon changing their behavior.

Create a deeper understanding of how cultures of participation harness important social benefits related to national priorities, such as energy sustainability, lifelong learning, education, and healthcare.

Differentiate domains in which cultures of participation will flourish and be successful from the ones that are not suitable by exploring the drawbacks associated with cultures of participation.

developed as open, evolvable seeds rather than finished products; and the focus of education is shifted from teaching to learning.

While social computing is potentially the most important new driving force behind cultures of participation (illustrated with the examples in Table 1), the framework also strives to increase social creativity, put domain professionals in charge of exploring ill-defined problems, and make owners of problems independent of high-tech scribes.

The major role for new media and new technologies from a culture-of-participation perspective is not to deliver predigested information and non-changeable artifacts and tools to individuals, but rather to provide the opportunity and resources for engaging them in authentic activities, for participating in social debates and discussions, for creating shared understanding among diverse stakeholders, and for framing and solving personally meaningful problems.

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