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A fundamental challenge our world faces is how to foster and nurture a culture in which humans can express themselves and engage in personally meaningful activities, and the appropriate roles of technology in that endeavor. However, a large number of the new technologies and media are designed to see humans as consumers only [Fischer, 1998].

This emphasis on people as consumers is perpetuated in other perceptions of the future as well. The President’s Information Technology Advisory Committee’s report includes the call that “The Nation must ensure that access to the benefits of the information infrastructure are available to everyone in our Nation” [PITAC, 1999, p. 10]. While the universality of this vision is important, more than just access is needed. The President’s Council on Sustainable Development set forth an example of this broader vision:

> How can more than 261 million individual Americans define and reconcile their needs and aspirations with community values and the needs of the future? Our most important finding is the potential power of and growing desire for decision processes that promote direct and meaningful interaction involving people in decisions that affect them. Americans want to take control of their lives. [PCSD, 1996, p. 7]

The Council substantiates an increasing trend toward grass-roots, bottom-up efforts to address the impacts of growth (or decline) on the quality of life in U.S. communities. The nature and intensity of these impacts require difficult decisions on how to sustainably manage such growth in the future.

The broad challenge, then, is to move toward new forms of citizen participation. Certainly this challenge is not without its difficulties. Two such challenges are (a) the paradox that citizens cannot really be informed unless they participate, yet they cannot really participate unless they are informed [Brown et al., 1994] and (b) that participation has limits that are contingent on the nature of each citizen’s situation, the issues, the problems, and the institutional designs [Arias, 1989], as well as the available technology and media. One of the benefits of addressing these challenges is that informed participation leads to ownership and a stronger sense of community.

The challenge to technology and media developers is to move beyond an emphasis on interaction that is solely focused on access to information to one that supports informed participation. This rests on the premise that one of the major roles for computational media is not merely to deliver existing and predigested information to individuals but to provide the opportunity and resources for design activities embedded in social debates and discussions in which all people can act as designers if they choose to do so rather than being confined to consumer roles.

New media and social networking have emerged in the past decade as new opportunities for participation, discourse, and collaboration. Whereas some accounts marginalize much of this activity as trivial photo sharing and friend making, efforts to apply these to broader forms of participation are making headway, notably in the political arena.

**Campaign 1.0 to President 2.0:** A prime example can be taken from the Obama campaign and its juxtaposition to earlier efforts:

> Barack Obama is the first major politician who really “gets” the Internet. Sure, Howard Dean used the Web to raise money. But Obama used it to build an army. And now, that army of digital kids expects to stick around and help him govern. Crowd-sourced online brainstorming sessions? Web sites where regular folks hash out policy ideas and vote yea or nay online? A new
government computer infrastructure that lets people get a look into the workings of Washington, including where the money flows and how decisions get made? Yes to all those and more. “This was not just an election—this was a social movement,” says Don Tapscott, author of “Grown Up Digital,” which chronicles the lives of 20-somethings raised on computers and the Web. “I’m convinced,” Tapscott says, “that we’re in the early days of fundamental change in the nature of democracy itself.”[Lyons & Stone, 2008]

The result of this effort in the short term is apparent, culminating in the victor’s successful election, whereas the sustainability and long-term impact in the face of long-established political processes remains to be seen. But the strong potential is there—how do we move forward, not for any particular political agenda, but for stronger, broader, more sustainable forms of engagement and participation. How do we understand and balance new potential forms of tyrannies (such as misinformation or crowd manipulation) as our democracy’s founders struggled with “the violence of majority faction.”

Another arena where we face challenges for the future is the area of energy use. The current paradigm for electricity use is most often one of “plug it in, plug it in” without understanding the complex network of design, technology, and operations that provide the ready supply we usually enjoy. The strong consumer mindset has been fostered against a backdrop of plentiful supply and producer incentives to sell more, whereas the emerging smart-grid development offers the potential to cultivate new mindsets, to engage citizens in ongoing design decisions that provide broad implications for the sustainability of our energy solutions in the future. We face design decisions as to how much we “automate” energy use, how much we “infomate” these processes [Zuboff, 1988], and how we support migration towards changing behavior and putting information into the action needed for sustainable solutions. Figure 1 gives a broad overview of a project we are working on as participants in CU Boulder’s Renewable and Sustainable Energy Institute (RASEI), which draws on aspects discussed in Holger Dick’s position statement, theoretical frameworks for cultures of participation described in Gerhard Fischer’s position statement, and our center’s work on the Envisionment and Discovery Collaboratory (EDC) over the past 15 years.

The EDC [Arias et al., 2000] is a long-term research platform that explores conceptual frameworks for

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**Figure 1: Beyond Technologies Alone: Reflective Communities and the Smart Grid**
social creativity and democratizes design in the context of framing and resolving complex urban planning and emergency management problems. The knowledge to understand, frame, and solve these problems does not already exist [Engeström, 2001], but is constructed and evolves in ongoing interactions and collaborations—an ideal environment to study social creativity and collaborative design. The EDC supports social reflection-in-action [Schön, 1983]: a problem is discussed and explored by providing participants with a shared augmented-reality table-top construction space (see Figure 2, Panes (a) and (c)) in which they interact with computationally enhanced physical objects that are used to represent the situation (the action space). These design activities are dynamically linked to relevant information shown in various vertical displays (such as those shown in Figure 2, Pane (a)—called the reflection space). As a socio-technical environment the EDC incorporates a number of innovative technologies, including table-top computing and the integration of physical and computational components supporting new interaction techniques [Eden, 2002].

The EDC interactive table (Panes (a) and (c) in Figure 2), used as an action space for citizen participants, will allow them to bring their individual perspectives to the process and collectively interact with the design (for example, sketching proposed elements shown in Figure 2, Pane (a), with the resulting sketches shown in Pane (c)). To allow participants to visualize the impacts of the design on neighborhood views and local environments, the sketch would be shown in Google Earth as a simple 3D model (visible in the EDC_{VR} in Figure 4, Pane (b), but it would be shown in the EDC_{F2F} reflection spaces, as well). This would allow discussion of, for example, whether proposed towers would block the view of the mountains from certain neighborhoods. As the process progresses, the crude sketches could be used to locate exemplars in the Google 3D Warehouse or the sketches could be imported to SketchUp to create more complete models for use in both the action space and the 3D Google-Earth reflection space [Schön, 1983].

**Extending Participation with the EDC_{VR}**. Our work on the EDC to this point has focused primarily on face-to-face meetings (which we will refer to as EDC_{F2F}, see Figure 2, Panes (a) and (c)) and has been studied in demonstration and role-playing settings by engaging authentic and semi-authentic participants in the use of the system. The focus on face-to-face interaction has resulted in a limited scope of participation. To explore RQ-4, the proposed research will study the process of making the EDC more broadly accessible by enabling participation beyond co-present settings, supporting a richer ecology of roles, and the encouraging migration among those roles.

This effort aims to transcend the constraints of EDC_{F2F} by extending the participation opportunities.
into the virtual sphere by designing and developing the EDC\textsubscript{VR} utilizing opportunities represented by \textsc{Second Life} and the emerging open-source \textsc{Opensim} effort. A mock-up of one approach to the EDC\textsubscript{VR} is shown in Figure 2, pane (b). As part of this project, development of the EDC\textsubscript{VR} will expand our test-bed environment to instantiate, evaluate, and further develop our theoretical framework for how to design appropriate socio-technical environments for participative roles and migration among them. These developments will be used to compare and contrast various aspects of participation as they relate to the research questions outlined above.

The ability to allow \textit{more people} to participate, represented by the EDC\textsubscript{VR} and the utilization and development of substrates that support a range of roles, will provide an environment to study and develop specific interventions to encourage and cultivate increasing involvement. This effort builds on research that has shown how the “online” and “offline” social worlds are related—and how they are different [Borgatti et al., 2009]. To understand the evolution of new forms of social interaction in on-line virtual reality and their historical and continuing relations to the off-line world, the EDC\textsubscript{VR} will be integrated with the EDC\textsubscript{F2F} to form an EDC\textsubscript{HYBRID}. This will allow on-line, face-to-face, and combined participation to take place, building synergy between the strengths of the respective environments and allowing the study of the impact of these approaches on role development and migration. One aspect of this hybridization is shown in Figure 2, pane (a), with a mockup of a portal into the EDC\textsubscript{VR} as shown in a reflection space display. These developments will extend the EDC to include greater flexibility [Bonifacio & Molani, 2003] and explore the way in which technical and social infrastructures can be integrated to sustain \textit{usefulness}, \textit{sociability}, and \textit{meaningfulness} [Fischer, 2005; Preece & Maloney-Krichmar, 2003] and thus create new prospects for social creativity and collaborative design.

\textbf{References}


