National Initiative for Social Participation

Goal: to promote dramatically increased research support and educational opportunities for technology-mediated social participation especially as related to national priorities.

Draft: June 2, 2009

Organized by:

Ben Shneiderman, Univ of Maryland
Peter Pirolli, PARC
Jenny Preece, Univ of Maryland
Ben Bederson, Univ of Maryland
Derek Hansen, Univ of Maryland
Harry Hochheiser, Towson Univ

Additional Contributors:

Hal Eden, Univ of Colorado
Gerhard Fischer, Univ of Colorado
Art Hanson, Nation of Neighbors
Tom Malone, MIT
Gary Marchionini, Univ of North Carolina
Frank Moss, MIT
Cynthia Parr, Smithsonian Institution
Alex Pentland, MIT

National Initiative for Social Participation: White Paper: June 2, 2009

Goal: to promote dramatically increased research support and educational opportunities for technology-mediated social participation especially as related to national priorities.

Organized by:

Ben Shneiderman, Univ of Maryland
Peter Pirolli, PARC
Jenny Preece, Univ of Maryland
Ben Bederson, Univ of Maryland
Derek Hansen, Univ of Maryland
Harry Hochheiser, Towson Univ

Additional Contributors:

Hal Eden, Univ of Colorado
Gerhard Fischer, Univ of Colorado
Art Hanson, Nation of Neighbors
Tom Malone, MIT
Gary Marchionini, Univ of North Carolina
Frank Moss, MIT
Cynthia Parr, Smithsonian Institution
Alex Pentland, MIT

Wiki: http://ipartiticipate.wikispaces.com
Google Group: http://groups.google.com/group/iparticipate
For comments and suggestions contact: ben@cs.umd.edu or Pirolli@parc.com

A growing circle of people encouraged our work, attended the workshop, contributed ideas, added to the wiki, sent emails, or commented on drafts:

Attendees at April 28, 2009 workshop:	**Replied with interest but did not attend:**
Robert Bohn, National Coordinating Office, NITRD	Amy Bruckman, Georgia Tech
David Bruggeman, USACM	Jack Carroll, Penn State University
Jeffrey R. Cooper, SAIC Technical Fellow, VP Technology	Pierre de Vries, Silicon Flatirons Center
Irene Greif, IBM Research, Cambridge, MA	Greg Elin, Sunlight Foundation
Marti Hearst, UC-Berkeley	Ian Foster, University of Chicago
Haym Hirsh, National Science Foundation	Roxanne Hiltz, NJIT
Wendy Kellogg, IBM Research, Yorktown Heights, NY	Bernardo Huberman, HP Labs
David McDonald, National Science Foundation,	Sara Kiesler, CMU
Eduarda Mendes, Microsoft Research-Cambridge, UK	Joe Konstan, University of Minnesota
Natasa Milic-Frayling, Microsoft Research-Cambridge, UK	Bob Kraut, CMU
Gary Olson, UC-Irvine	Jonathan Lazar, Towson University
Catherine Plaisant, University of Maryland	Frank Moss, MIT
Bill Rand, University of Maryland	Mike Nelson, Georgetown University
John Riedl, University of Minnesota	Alex Pentland, MIT
Marc A. Smith, Chief Social Scientist, Telligent	Mary Beth Rosson, Penn State University
John Thomas, IBM Research-Yorktown Heights, NY	Jan Gerrit Schuurman
Fernanda B Viegas, IBM Research, Cambridge, MA	Jeannette Wing, NSF & CMU

Executive Summary

We believe that technology-mediated social participation can be harnessed for remarkable social benefits especially as related to national priorities. Existing social media technologies often designed for discretionary and playful activities can be redesigned and repurposed to produce profound transformations in healthcare, community safety, disaster response, life-long learning, business innovation, energy sustainability, environmental protection, and other important national priorities.

From early visions of social participation in cyberspace (Kalil, 1996) to current discussions about open government, participation, and collaboration (Noveck, 2009; Godwin et al., 2009; Federal Web Managers, 2008) there is a growing awareness of a grand opportunity. Some visionaries, inspired implementers, and bold researchers have begun to explore possibilities for transforming personal communications, organizational worklife, and online communities.

Current designs for social media such as wikis, blogs, micro-blogs, forums, social networking, media sharing, product/service reviews, and virtual worlds are an excellent starting point. However, extensive research is needed to build upon these media and tools to foster wider participation, support increasingly sophisticated interaction and accomplishments, and deal with potential dangers. We believe that effective designs can improve usability and sociability to better engage people with diverse motivations, experiences, perspectives, skills and knowledge and to create the conditions for citizens to participate, connect, and undertake constructive action. The goal is to create new architectures for the online public spaces that energize the population to contribute to vital community and national projects.

The potential dangers include privacy invasions, breakdowns during disasters and peak loads, malicious attackers, misguided rumors, undue influence from small groups, and failures to achieve universal usability. Research would help to alleviate these dangers as well as improve usability, engage a broad segment of residents, provide management tools for civic and local leaders, protect individual privacy and security, and raise reliability even in challenging situations. Other computer science challenges include scalable network analysis algorithms, effective visualizations that guide moderator decisions and community organizer activities, and universal usability to support diverse users and platforms. Then data driven visual analytics would enable tracking and ranking evolving networks, agent-based simulations, and searching for distinctive or common features in large networks.

At every point in developing technology-mediated social participation for national priorities there are deep science questions with profound theoretical impacts on the human use of technologies. There are strong research opportunities on collective intelligence, collective action, social creativity, social dilemmas, and basic ideas such as privacy, freedom, and identity that influence design decisions and social participation. Extensive research is needed to identify social roles, building on recent work to find “answer people”, “discussion people”, “reply

magnets", potential vandals, etc. Basic research is needed to develop useful metrics such as community efficacy, conversion rates from readers to contributors, intensity of engagement, degree of reciprocity, network density, small-world-ness, local/global connectedness, etc. A key notion is to expand on motivation for different participants and show how managers can influence outcomes with usability and sociability interventions, while addressing security vs freedom tradeoffs.

Further dilemmas result from the ethics and methods for research. Can interventions in existing systems be conducted while protecting privacy and ensuring informed consent? When controlled experiments are not possible, can replicated case studies provide adequate predictive power? What forms of mathematical models can offer clarity about the relationships among variables such as privacy, trust, empathy, and responsibility?

Just as NASA leads space research and NIH promotes medical research, we hope a National Initiative for Social Participation would invigorate online social media research. The case for a National Initiative for Social Participation was made in a letter published in AAAS Science (March 13, 2008, Appendix B), but our discussions have gone further with a list of goals, scientific foundations, and descriptions of six research challenges.

We feel that this is a timely topic that fits well with President Obama's call for citizen activism and open government, plus his appointment of well-informed technology advisors. We believe that technology-mediated social participation deserves much greater attention from policy makers, research funders, corporate leaders, academics, and students. We hope they might expand NSF and other government funding programs, increase business commitments, shift research priorities, and offer new courses.

This report describes a scientific foundation for thinking about technology-mediated social interaction, and then describes six potential research challenges: public security, public political participation, biodiversity, global climate issues, energy, and health.

Next Steps: Short term

We have made efforts to coordinate with National Science Foundation (NSF) staff and leadership and we will continue to work with them. We will circulate this report to colleagues and make presentations, such as these already scheduled panel sessions:

Communities and Technology Conference, June 24-27, 2009, State College, PA
IEEE Social Computing Conference, August 29-31, 2009, Vancouver, BC, Canada
ACM Creativity & Cognition Conference, October 27-30, 2009, Berkeley, CA

We plan to submit this report to promote discussion at:
--- CRA Computing Community Consortium http://www.cra.org/ccc/

--- Web Science Research Initiative http://webscience.org/
--- National Academies CSTB http://sites.nationalacademies.org/cstb/index.htm
--- USACM http://www.usacm.org/
--- ACM SIGCHI Executive Council
--- ACM SIGCHI Public Policy Committee
--- American Society for Information Systems & Technology (ASIST)
--- and other professional groups and journalists

A future meeting is being planned for Fall 2009 in the San Francisco Bay area. We may seek NSF support for a workshop that expands on the Social-Computational Systems program http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503406. A group of coordinated proposals may be submitted to this program for its September 21, 2009 deadline
.

Next Steps: Longer term

Shifting multiple disciplines to focus more on social participation will take persistent effort over many years. A few of the steps that we envision are:

Stimulate research & pilot projects within federal agencies:
OSTP - send our report for discussion
NSF - promote social and computer science research on social participation and community
DHS - disaster, crisis, crime reporting, community development to promote resilience
NIH & AHRQ - consumer health information & discussion, physician discussions
EPA - environmental reporting
Dept of Energy - energy sustainability advocacy
Dept of Education - wiki-based learning

Develop courses, curricula, and degree programs
Encourage iSchools, and Departments of Computer Science, Sociology, New Media, etc. to define courses, curricula of study, and degree programs. A list of current courses and research groups is on the wiki: http://iparticipate.wikispaces.com/Related+Courses

Expand opportunities for publication with new conferences and journals
A list of the rapidly growing set of conferences and journals is at:
http://casci.umd.edu/Publication_Venues

Develop validated guidelines or patterns for designers and managers of community and organizational social media. These guidelines would include usability and sociability, with methods and metrics for practitioners.

Work with major corporations (Microsoft, IBM, Google, Yahoo, etc.) and

smaller more focused companies (Telligent, Facebook, Twitter, etc.) to:

-- provide data for researchers

-- cooperate with government agencies in producing pilot projects

-- increase their commitment to social computing strategies

References

Federal Web Managers Council (2008). Putting Citizens First: Transforming Online Government. Available at: http://www.usa.gov/webcontent/documents/Federal_Web_Managers_WhitePaper.pdf,

Godwin, B., Campbell, S., Levy, J., and Bounds, J. (2008). Social Media and the Federal Government: Perceived and Real Barriers and Potential Solutions http://www.usa.gov/webcontent/documents/SocialMediaFed%20Govt_BarriersPotentialSolutions.pdf

Kalil, T. (1996). Leveraging Cyberspace, *IEEE Communications Magazine 34*, 7, 82-86.

Noveck, B. (2009). *Wiki Government: How Technology Can Make Government Better, Democracy Stronger, and Citizens More Powerful*, Washington, DC: Brookings Institution Press.

Webcontent.gov (2009). Social Media and Web 2.0 in Government - Webcontent.gov - Guide to Managing U.S. Government Websites. Available at: http://www.usa.gov/webcontent/technology/other_tech.shtml

Table of Contents

Scientific Foundations

Peter Pirolli (PARC)

Theory Unification

The Internet and mobile technology have become increasingly ubiquitous and social. Many examples of vibrant communities have emerged, as well as novel forms of social-computational systems. The efflorescence of online social interaction and collective action raises fundamental questions about the conditions and interaction architectures that shape the social and cognitive machinery of people. We need a theoretical framework that is rich and encompassing enough to provide practical guidance on how to design online communities across the space of possible purposes and activities. There is now an opportunity for a new approach based on synthesizing computational, psychological, organizational, economic, and social theory (and more) that can be tested against real digital traces of online communities, and that can be used to navigate the complex trade-offs needed to design socio-technical systems that improve individual and community performance. The framework must be rich and complex enough to support integrated models that support (a) decomposition of macroscale phenomena down to microscale mechanisms that are (b) relevant to the understanding and design of online communities that evolve over months to years and encompass large numbers of people and (c) predict accurately the effects and tradeoffs of design decisions made at levels ranging from moment-by-moment user interaction to long-term social dynamics.

Whether models in agent-based simulations (Nisan, Roughgarden, Tardos, & Vazirani, 2007; Ren & Kraut, 2009b), dynamical systems (Lin, Chi, Zhu, Sundaram, & Tseng, 2009), or some other approach, there is the opportunity to integrate a new unified theoretical framework. Broadly speaking, conditions are ripe for a burst of theory development that will lead towards more complex, nuanced, and integrated models of individual and social phenomena in online communities. Massive amounts of data from online communities are becoming available (Lazer, et al., 2009). These data trace phenomena at multiple time-scales that can be used to test and validate models of the interplay of psychological mechanisms, behavioral economics, social relations, network dynamics, and more. Thousands of online communities varying in purpose and architecture provide a vast natural laboratory for testing and integrating such theories, and for understanding what makes those communities work or not. These data are attracting interest from a variety of fields, and although there is interest in cross-fertilization, much work remains to develop a unified framework to provide the foundation to predict and prescribe successful communities.

One can ask: Do we need to theoretical integration? Human behavior is the result of a hierarchically organized set of systems rooted in physics and biology at one end of the spectrum

and large-scale social and cultural phenomena at the other end (Newell, 1990). The time scale for operations of each system level in this hierarchy increases by approximately a factor of 10 as one moves up the hierarchy. This hierarchical organization produces layers of phenomena at which different mechanisms and factors dominate: neural, psychological, economic, and social--just to name the more familiar. Theories are needed to understand and predict how microscale factors at the level of the individual (such as changes in usability or communication costs) percolate upwards to yield macroscale emergent phenomena at the social level (such as increased participation or improved social intelligence). Similarly, theories are needed to understand how macroscale social factors percolate downward to shape individual behavior.

Relation of Offline to Online

There is a risk of setting the boundaries of inquiry to the 'online community' or to data solely obtained from behavior in the virtual world. Online communities and the individuals participating in them are embedded in a larger world. Research has begun to show how the "online" and "offline" social worlds are related--and how they are different (Borgatti, Mehra, Brass, & Labianca, 2009; Kleinberg, 2008). Our social and cultural worlds have evolved offline, and these worlds remain primary. However, the virtual environment is essentially a new niche for social and cognitive adaptation and evolution, because the virtual world has different constraints and affordances. To understand the evolution of new forms of social interaction in the virtual world, we need to understand their historical and continuing relations to the offline world. Echos of the ongoing activity in the offline world are reflected in the activity of the online, and consequently there is an opportunity to not only understand the new virtual social worlds, but also gain a better understanding of the dynamics of the offline social world.

Social Capital and the Tension between Diversity and Common Ground

A core assumption of the National Initiative for Social Participation is that there are better and worse forms of social participation and social connectedness that create, for individuals or groups, better or worse advantages in pursuing their ends. This is the notion of *social capital*: the resources or advantages that accrue to a group or person by virtue of being embedded in social organizations (Burt, 2005). It includes the accrual of benefits associated with increased common ground (including shared tacit knowledge, language, trust, norms, etc.) that improve the efficiency, productivity, and civility of society (Putnam, 2000). Social capital also includes the effects that accrue with diversity (improvements in innovation, decision making, problem solving, and visions of otherwise unseen opportunities). Diversity and common ground are typically in tension, yet the evidence has begun to show how the greatest social capital accrues to individuals and groups that balance the two (Burt, 2005).

Models and metrics of online growth and sustainability

Virtual communities are typically valuable when they can harness the information and insight from a large and diverse user base. Although some virtual communities have been highly successful, many of them fail. For example, the success of Wikipedia is the exception and not the rule. Of the more than 9,000 wikis using the MediaWiki platform, more than half have seven or fewer contributors. An important reason for these failures is a lack of evidence-based, scientific guidance in building and managing online communities. To be successful, virtual communities must overcome challenges that are endemic to many groups and organizations. They must handle the start-up paradox (Ren & Kraut, 2009a), when early in their life-cycle they have few members to generate content and little content to attract members. Throughout their life-cycle, they must recruit and socialize newcomers, encourage commitment and contribution from members, solve problems of coordination and encourage appropriate behavior among members and interlopers alike.

More generally, models are needed to form the basis for measurement and to identify key metrics such as community efficacy (Putnam, 2000), conversion rates from readers to contributors (Preece & Shneiderman, 2009), type and degree of cooperation (Nowak, 2006), and network structure and dynamics (M. Newman, Barabasi, & Watts, 2006).

Trade-offs in growth and sustainability

Understanding and designing for online growth and sustainability will depend on integrating a variety of mid-level (sometimes competing) theories in the cognitive and social sciences that provide partial explanations for contribution behavior and how group membership changes it. For instance, information overload theory (cognitive psychology), collective effort (social psychology), theories of public goods (economics), structural hole theory (social networks) all provide partial explanations that if combined, will probably provide a richer understanding of the complex tradeoffs that need to be navigated to grow a vibrant online community (Ren & Kraut, 2009a). Computational theories of the growth and evolution of online communities (Backstrom, Huttenlocher, Kleinberg, & Lan, 2006) will become richer as they incorporate more complex mechanisms for modeling group formation.

Security vs freedom

On the one hand, in the social networking ideal universe, anyone can connect with anyone else. In the ideal secure universe, there is insurance against that. For instance, scores of online communities in US Army have arisen as grass-roots movements to exchange information and offer support. On the one hand, these initially thrive because they have few barriers to entry. However, security rapidly becomes an issue because a lot of the information is quite sensitive

(e.g., information about day-to-day tactics is useful to the community, but dangerous in the hands of the enemy).

Online dynamics and stability conditions

In what ways do models of population dynamics of online communities differ from models of natural populations? How do computational network-theoretic models (M. E. J. Newman & Watts, 1999; D.J. Watts & Strogatz, 1998) of social interaction scale to the complexity of real online social interaction? Are online communities fundamentally chaotic or unstable? Many complex biological and non-human social ecologies do have stable equilibria, but can be become unstable if perturbed by outside conditions (McElreath & Boyd, 2007).

How and why do the structure, mechanisms, and dynamics of an online community impact aggregate social intelligence and instrumental action? What does it mean to achieve social intelligence?

A simple but useful definition of individual intelligence (Newell, 1990) is the effective and efficient marshaling of available knowledge to act in an effective and efficient manner to achieve some purpose. Collections of people, however, do not operate in the same way as individual brains. Individual cognition tends to have more coherent (and fewer) goals driving behavior, and the communication, flow, and integration of information happens fast in comparison to action. Simple sociotechnical architectures such as prediction markets are impressive in often surpassing individual expertise in part because they have a simple well-defined goal, people are motivated to rationally achieve the goal (usually by some bet), and the nuggets of unique individual knowledge are efficiently communicated and aggregated within the system (Benkler, 2005; Sunstein, 2006; Surowiecki, 2004). Most online communities have multiple purposes with less coherence, more diverse (and sometime contradictory) motivations, and hence a greater need for complex mechanisms for marshaling and using information. Novel social-computational architectures are being designed to achieve purposes that are difficult for people or computers working alone (Ahn & Dabbish, 2008), and our understanding of this space is just beginning.

What are the underlying mechanics that determine how social embedding and connections affect individual intelligence, preferences, biases, and ultimately behavior?

Individuals are situated in multiple tributaries of flowing information that comes to them through social relations. The social capital that accrues to individuals is affected by their positioning in social networks (Burt, 2005). Online communities, social networking sites, lifestreams, email, etc. have altered our social networks. Because of the richness of data available, we may now be in a position to understand some current mysteries about social network phenomena. First and

foremost is the underlying causal mechanics, from the individual and person-to-person interactions on up, that give rise to well-known social network phenomena such as idea contagion (Liben-Nowell & Kleinberg, 2008; Duncan J. Watts, 2002; Wu, Huberman, Adamic, & Tyler, 2004), the network spread of obesity, smoking, and happiness (Christakis & Fowler, 2007, 2008; Fowler & Christakis, 2008), the effects of social brokerage on innovation (Burt, 2004), the effects of network closure on trust and reputation (Burt, 2005; Putnam, 2000), and so on. Just as the internet is an abstraction implemented in the mechanics of different layers (application, transport, TCP/IP) that ultimately get realized in computers, routers, cables, and wireless, so too are social networks a theoretical abstraction that is realized by the social and cognitive mechanisms of people. How it is that unhealthy behaviors actually move from person to person? How do the signals and stories arriving over an interface about others in a community get processed by the individual mind to form a judgment of reputation or trust (Golbeck, 2008)? How does participation in diverse communities cause the individual mind to synthesize information and alter their judgment biases? We know that such phenomena exist, but we do not know how or why they work they way they do.

How does technology affect Dunbar's Number and the Theory of Mind?

This question is meant capture a richer set of questions about the impact of sociotechnical architectures on how individuals engage their social relations. Dunbar's Number (Dunbar & Shultz, 2007) refers to the relation of mean social group size to proportion of the brain volume devoted to neocortex (in primates). In humans, this number is approximately 150. There has been media interest ("Primates on Facebook," 2009) lately in whether this constraint holds true in online social networking, perhaps implicitly questioning whether social network sites actually alter the quantity and quality of bilateral social relations that a person can engage in. People engage in a great variety of longer-term bilateral social relations (the distinction between "weak" and "strong" ties being only the coarsest of distinctions), and have only finite resources to seek out, maintain, synthesize, and utilize these connections. When people trade face-to-face time for time on Twitter and Facebook what do they gain and what do they lose? How does the distribution of social relations connected to a person shift under different sociotechnical architectures for online communities? How do user profiles, social network updates, RSS feeds, etc. enhance or hinder the individual's ability to maintain and exploit mental models of their social world?

Humans may be unique in their ability to develop a "theory of mind"; that is, to imagine what the world is "like" from the viewpoint of another person. In fact, we can even imagine what person A thinks about person B's perspective on person C. However, this ability seems limited in several important ways. First, we cannot seem to extend this process indefinitely (whereas causal chains seem to be indefinitely extendable). Second, while we are generally capable of doing this with respect to physical perspective and states of knowledge, it seems more difficult with respect to people who have different believe systems (e.g., different religious beliefs; different political

ideologies). Third, some people (young children and autistic spectrum people, for instance) have difficulty with theory of mind tasks. Fourth, even when people have the capacity to use theory of mind, they often fail to do so (competency vs. performance). The question is this: Is it possible to design tools that will help extend human capacities to develop and use theory of mind?

How do incentive mechanisms drive online communities? How do norms and governance evolve? How does social transparency and provenance shape participation and production?

There is a sense among many researchers that participation and production in online communities has similarities to markets, and that online communities can be shaped by structuring incentive mechanisms. But online communities, peer-production systems, and the like capture our imagination precisely because people are not driven by monetary reward (at least not in any direct way). Social motivations, the desire for attention, reputation, credibility, have all been vastly under-studied (Benkler, 2005). How do norms and governance emerge and evolve? Why do they vary? Why and how do they adapt (or not) to perturbations? How do sociotechnical mechanisms for social transparency affect reputation, trust, and ultimately shape communal participation and action?

Related to these issues are the mechanisms that lead to optimally structured social networks (Buskens & Rijt, 2008; Kleinberg, Suri, Tardos, & Wexler, 2008) that balance diversity (e.g., bridging relations across diverse groups) and coherence (e.g., redundant relations within a group). The former is believed to foster learning, creativity, improved decision making, whereas the latter is believed to foster reputation, trust, and improved mobilization to action. Often, communities and groups grow beyond their optimal size (in terms of rewards to the individual members), which often leads members to develop mechanisms to exclude new joiners (Pirolli, 2009). The challenge is to understand the incentive mechanisms, governance, norms, and social signaling that drive online communities to have particular structures and dynamics.

Development of new protocols to study online communities

Instrumentation and methodology can provide the impetus for revolutions in science. One can argue that the cognitive revolution of the 1960's-1970's was partly driven by the ability to collect more temporally fine-grained data with computer-based reaction time recordings, and audio and video recordings of think-aloud protocols. Similarly, one can argue that neurocognition and neuroeconomics have been substantially driven by the availability of fMRI. We are now in a position to perform new kinds of data analyses and simulation to characterize existing online communities and engage in living laboratory studies that perform experiments at massive scale.

Although massive data about online communities have become available, we need methods that are capable of providing rich traces at the granularity and richness relevant to developing theory. The analog is the effect verbal protocol analysis had on the development of cognitive psychology. Detailed traces of cognitive states and dynamics made it feasible to develop and test more complex and integrated models. In addition to more detail, the protocols we develop need to reveal intentionality. Online data logs may provide detailed records of behavior, but it is important to understand the goals, beliefs, perceptions, etc. that are driving behavior.

Availability and shareability of data and tools

A major problem facing researchers these days concerns the availability of data about online communities (Lazer, et al., 2009). Currently private companies such as Yahoo, Google, and Facebook, provide data to privileged researchers, but this inhibits replication and extension, and more generally the building up of a community of practice of researchers. Private companies, and members of online communities are extremely sensitive about data privacy and security. There is no simple solution to this (e.g., anonymization is non-trivial). Consequently, it is a grand challenge.

Related to this is the challenge of developing a shared set of tools and techniques for research. Individual disciplines have their signature techniques, ranging from survey techniques, to agent-based simulations, to dynamical systems of nonlinear equations. A near-term challenge could involve the development of workshops for researcher training and the development of curricula for higher education.

Google Social Earth

Imagine a visualization of the structure and dynamics of one or more online communities that could reveal patterns at multiple levels of granularity, much like a "Google Earth" for the social world (of course it would implement the mantra of "overview, zoom and filter, and details-on-demand"). This would imply that we had sufficient modeling and measurement capabilities to create such a visualization. So the visualization is really just a concrete driver for the scientific challenge outlined above. It also requires dealing with severe issues of privacy and security (see above).

There are several analogies for this challenge. In astronomy for instance, there is the recent challenge to visualize the entire Milky Way from imaginary points outside the galaxy. The creation of such a map turns out to be technically challenging, but compelling if completed. Similarly, the Hubble and COBE were responses to the challenge of seeing as far back to the beginning of the universe as possible. NSF's many projects to visualize science are some partial attempts to visualize online (scientific) communities.

Acknowledgements: In addition to the iParticipate group I would like to specifically acknowledge the contributions of Dorrit Billman, Ellen Isaacs, Gregorio Convertino, John Thomas and Wendy Kellogg.

References

Ahn, L. v., & Dabbish, L. (2008). Designing games with a purpose. *Communications of the ACM, 51*(8).

Backstrom, L., Huttenlocher, D., Kleinberg, J., & Lan, X. (2006). *Group formation in large social networks: membership growth and evolution*. Paper presented at the ACM SIGKDD Intenational Conference on Knowledge Discovery and Data Mining.

Benkler, Y. (2005). *The wealth of networks: How social production transforms markets and freedom*. New Haven, CT: Yale University Press.

Borgatti, S. P., Mehra, A., Brass, D. J., & Labianca, G. (2009). Network Analysis in the Social Sciences. *Science, 323*(5916), 892-895.

Burt, R. S. (2004). Structural holes and good ideas. *American Journal of Sociology, 110*(2), 349-399.

Burt, R. S. (2005). *Brokerage and closure: An introduction to social capital*. Oxford: Oxford University Press.

Buskens, V., & Rijt, A. v. d. (2008). Dynamics of networks if everyone strives for structural holes. *American Journal of Socialogy, 114*, 371-407.

Christakis, N. A., & Fowler, J. H. (2007). The spread of obesity on a large social network over 32 years. *New England Journal of Medicine, 357*(4), 370-379.

Christakis, N. A., & Fowler, J. H. (2008). The collective dynamics of smoking in a large social networks. *New England Journal of Medicine, 358*(21), 2249-2258.

Dunbar, R. I. M., & Shultz, S. (2007). Evolution in the social brain. *Science, 317*, 1344-1347.

Fowler, J. H., & Christakis, N. A. (2008). Dynamic spread of happiness in a large social network: Longitudinal analysis over 20 years in the Framingham Heart Study. *British Medical Journal, 337*.

Golbeck, J. (2008). Weaving a Web of Trust. *Science, 321*(5896), 1640-1641.

Kleinberg, J. (2008). The convergence of social and technological networks. *Commun. ACM, 51*(11), 66-72.

Kleinberg, J., Suri, S., Tardos, E., & Wexler, T. (2008). Strategic network formation with structural holes. *SIGecom Exch., 7*(3), 1-4.

Lazer, D., Pentland, A., Adamic, L., Aral, S., Barabasi, A.-L., Brewer, D., et al. (2009). Computational Social Science. *Science, 323*(5915), 721-723.

Liben-Nowell, D., & Kleinberg, J. (2008). Tracing information flow on a global scale using Internet chain-letter data. *Proceedings of the National Academy of Sciences, 105*(12), 4633-4638.

Lin, Y.-R., Chi, Y., Zhu, S., Sundaram, H., & Tseng, B. L. (2009). Analyzing communities and their evolutions in dynamic social networks. *ACM Transactions on Knowledge Discovery from Data, 3*(2), 1-31.

McElreath, R., & Boyd, R. (2007). *Mathematical models of social evolution: A guide for the perplexed*. Chicago: University of Chicago Press.

Newell, A. (1990). *Unified theories of cognition*. Cambridge, MA: Harvard University Press.

Newman, M., Barabasi, A.-L., & Watts, D. J. (Eds.). (2006). *The structure and dynamics of networks*. Princeton, NJ: Princeton University Press.
Newman, M. E. J., & Watts, D. J. (1999). Scaling and percolation in the small-world network model. *Physical Review E, 60*, 7332-7342.
Nisan, N., Roughgarden, T., Tardos, E., & Vazirani, V. (2007). *Algorithmic game theory*. Cambridge: Cambridge University Press.
Nowak, M. A. (2006). Five rules for the evolution of cooperation. *Science, 314*, 1560-1563.
Pirolli, P. (2009). An elementary social information foraging model. *Proc. ACM CHI 2009: 27th international conference on Human Factors in Computing Systems.*
Preece, Jennifer and Shneiderman, Ben (2009). The Reader-to-Leader Framework: Motivating Technology-Mediated Social Participation, *AIS Transactions on Human-Computer Interaction (1)* 1, pp. 13-32. Available at: http://aisel.aisnet.org/thci/vol1/iss1/5
Primates on Facebook (2009, Feb 26, 2009). *Economist*,
Putnam, R. (2000). *Bowling alone: The collapse and revival of american community*. New York: Simon and Schuster.
Ren, Y., & Kraut, R. E. (2009a). Impact of discussion moderation on member commitment and contriution to online community: A study using agent-based simulation.
Ren, Y., & Kraut, R. E. (2009b). Simulating newcomer socialization in online communities.
Sunstein, C. S. (2006). *Infotopia*. New York: Oxford University Press.
Surowiecki, J. (2004). *The wisdom of the crowds*. New York: Random House.
Watts, D. J. (2002). A simple model of global cascades on random networks. *Proceedings of the National Academy of Sciences of the United States of America, 99*(9), 5766-5771.
Watts, D. J., & Strogatz, S. H. (1998). Collective dynamics of 'small-world' networks. *Nature, 393*(4), 440-442.
Wu, F., Huberman, B. A., Adamic, L. A., & Tyler, J. R. (2004). Information flow in social groups. *Physica A: Statistical and Theoretical Physics, 337*(1-2), 327.

Research Challenges

These six descriptions of research challenges barely scratch the surface of the national priorities, deep science questions, and computer science challenges that could be approached by significant research investment in technology-mediated social participation. Many other topics were raised including educational environments for all ages, business innovation across many industries, environmental awareness, and international development.

1) Nation of Neighbors

Art Hanson (Nation of Neighbors) and Ben Shneiderman (University of Maryland)

Toward a Nation of Neighbors

Expanding on the successful Watch Jefferson County project (Jefferson County, WV, http://watchjeffersoncounty.net), Nation of Neighbors seeks to revolutionize the way community members and law enforcement interact to prevent crime and strengthen communities by facilitating real-time Neighborhood Watch via citizen reporting and fostering social participation within communities.

Nation of Neighbors accepts and scores anonymous reports. The report system sends real-time email or text message alerts to members whose alert criteria match the incoming report. Reports can also be aggregated by Community or Law Enforcement jurisdiction. Additionally, members can add their community to Nation of Neighbors and use the website to discuss reports within the community, participate in community discussion, share news, photos or documents or manage upcoming events.

Establishing Need

The idea behind Neighborhood Watch has existed as long as humans have banded together for common comfort and safety. In the United States, formal Neighborhood Watch efforts date back to the Town Watch in colonial America. The modern version of Neighborhood Watch endorsed by the National Sheriffs' Association was developed in the early 1970s. While there are many forms of Neighborhood Watches in use in the United States and around the world, they all share a common focus: to deter crime by strengthening community relationships.

Many Neighborhood Watch programs and their promoters cite Dennis Rosenbaum (Rosenbaum 1988) when making a case for Neighborhood Watch or similar efforts: ". . . if social

disorganization is the problem and if traditional agents of social control no longer are performing adequately, we need to find alternative ways to strengthen informal social control and to restore a 'sense of neighborhood'". The actual research conducted by Rosenbaum and others creates a murkier picture. While Neighborhood Watch has been proven effective at lowering crime (Bennett et al., 2008; Holloway et al., 2008) it is most effective in homogenic areas with low existing crime and least effective in areas that could most benefit (Skogan, 1986). The lack of benefit has been attributed to community fear and mistrust, lack of participation, and ineffective or lacking social interaction, among other factors (Skogan, 1988; Rosenbaum, 1988).

Whether or not traditional Neighborhood Watch can effectively restore a sense of neighborhood is the subject of debate. According to one often cited study (Baker, 1999), the requirements for establishing a successful Neighborhood Watch Program are neighborhood involvement, partnership between law enforcement and community members, a common understanding of the problems to be addressed, motivation and organization, and continuation of effort once the initial problem has been resolved. These hurdles are exacerbated by our modern lifestyle that often finds community members commuting long distances to work and working odd hours, leaving little time for building traditional neighborhood social networks. Neighborhood Watch programs also tend to decrease in effectiveness over time as key group members or law enforcement liaisons leave and community interest wanes. Additionally, there is often frustration among volunteers due to the one way flow of information or delays in the sharing of reports and information due to the hierarchical structure of most Neighborhood Watch programs.

Our current economic realities are dictating reduced funding for community policing and, at the same time, creating an enhanced concern about criminal activity on the part of community members. We believe these conditions, along with the recent success and large scale acceptance of online social collaboration, make now the right time to revisit Neighborhood Watch and perhaps improve upon it by simultaneously increasing social participation and allowing anonymity via Nation of Neighbors.

Scientific Foundation

Many of the challenges posed by Nation of Neighbors are the same as those posed by any other ambitious social media project. How do we get people to care, should they care, how do we scale it, how do we maintain quality, balance privacy and openness, display the data, etc. However, there are several issues that, while not absolutely unique to Nation of Neighbors, probably require more care and a deeper understanding than with most other social participation projects. Specifically, the balance of privacy vs. freedom, anonymity vs. trust and the role of government vs. private enterprise all take on new levels of importance.

Privacy vs. Freedom: While this challenge is encountered by every social media project, it takes

on a whole new level of significance with Nation of Neighbors. If your boss finds out you weren't really 'sick' via your Facebook page, that's unfortunate. If a drug dealer knows you reported him, your life may be in danger. Where do you draw the line between preventing crime and becoming 'Big Brother'?

Anonymity vs. Trust: One of the ways Nation of Neighbors addresses the previous challenge is by restricting access to sensitive information to trusted accounts. We do this on a small scale by speaking with potential members in person. New members are also vouched for by an existing member from their community. We currently have 600 members. How could this same level of trust be achieved at a scale of millions? Can it work? Because we need to establish trust, we collect sensitive personal information about our members including phone numbers and addresses - and crime or activity they report. We need to protect them from retribution from the 'bad guys' while providing sufficient information to establish credibility with other community members and law enforcement.

*Government vs. Private Enterprise**:*** What is the role of a 'company' in collecting suspicious activity information? There are laws prohibiting private companies from profiting from public data. Does that apply to Nation of Neighbors? Nation of Neighbors blurs the line between government and citizen responsibility and is bound to present interesting legal questions. While science can speak to these questions, it can not definitively answer them. These questions also involve law, politics and public opinion.

Research Challenges

While these questions need to be discussed in the public arena in the context of our society and its underlying laws and values, science can help point us in the right direction and guide the discussion. We believe there are some very specific research challenges that can be addressed to help us better understand these fundamental questions. Study in these areas would provide immediate benefit to Nation of Neighbors and also be easily applicable to other efforts, especially efforts involving cooperation between private individuals and government.

Matching possibly related reports of crime, suspicious activity or other events by content analysis: The ability to match related reports across time and language would provide an obvious benefit to law enforcement, first responders and community groups. Nation of Neighbors will currently combine related reports into an 'incident' and display the affected region spatially as the extent of the locations referenced by the individual reports. However, this is currently based on report category and is only rudimentary at best. Research has been conducted looking into trends in crime data and even prediction. Can the same methods be applied in real-time to incoming anonymous reports?

Building and maintaining a large scale trust network: How do we best build a large scale national network of trusted individuals – while protecting identities and controlling cost? While an open-ended and ambitious question, research would have a far reaching impact.

Scoring the trustworthiness of anonymous input: Nation of Neighbors assigns a trustworthiness index to incoming reports, much like a credit score for submissions. The current system likely has much room for improvement. Research on a large scale could determine the factors most likely to affect report credibility. Published proven methods for establishing credibility of anonymous content could potentially have far reaching impact for both government and private industry.

References

Baker, T. E., Baker, J.P., and Zezza, R. (1999). Neighborhood Watch: A Leadership Challenge. *FBI Law Enforcement Bulletin Volume:68* Issue:2 Dated:February 1999 Pages:12 to 18 abstract: http://www.ncjrs.gov/App/Publications/abstract.aspx?ID=176789

Bennett, T., Holloway, K., and Farrington, D. (2008). "The Effectiveness of Neighborhood Watch". In: The Campbell Collaboration Reviews of Intervention and Policy Evaluations 2008 (C2-RIPE)
Available at: http://db.c2admin.org/doc-pdf/Bennett_NeighborhoodWatch_review.pdf

Holloway, K., Bennett, T. and Farrington, D. P. (2008). *Crime Prevention Research Review No. 3: Does Neighborhood Watch Reduce Crime?* Washington, D.C.: U.S. Department of Justice Office of Community Oriented Policing Services, 2008.
Available at: http://www.cops.usdoj.gov/files/RIC/Publications/e040825133-res-review3.pdf

Neighborhood Watch (2009). A manual for citizens and for law enforcement. National Sheriff's Association. www.usaonwatch.org/pdfs/WatchManual.pdf accessed 15 May 2009

Rosenbaum, Dennis P. (1988). Community crime prevention: A review and synthesis of the literature. Justice Quarterly, Volume 5, Issue 3 September 1988, 323 – 395.

Skogan, W. (1986). Fear of Crime and Neighborhood Change. In *Communities and Crime, Crime and Justice: A Review of Research. Vol. 8*, edited by A.J. Reiss, Jr. and M. Tonry, 203-29. Chicago: University of Chicago Press.

Skogan, W. (1988). Community Organizations and Crime. *Crime and Justice: A Review of Research. Vol 10* Edited by M. Tonry and N. Morris. 39-78. Chicago: University of Chicago Press.

2) A National Deliberative Process

Harry Hochheiser (Towson University)

Compelling National Need

Political discussions at all levels are often characterized by a lack of broad-based participation and engagement. Many citizens believe that their input is unimportant, or unwelcome, to perceived elites who are not interested in truly democratic governance. This perceived futility of engagement threatens the vitality of our electoral democracy while robbing policy-makers of the perspectives of citizens who may be able to make valuable contributions to policy decisions. Tools that allow ordinary citizens to engage in meaningful policy discussions with neighbors, peers, and policy-makers may generate both increased confidence in decision-making processes and innovative solutions to difficult problems.

The change.gov website administered by then President-elect Obama's transition team during the last months of 2008 was the most visible example to date of an emerging form of participatory democracy. Building off of established web antecedents including digg.com, change.gov allowed users to submit ideas that others could then vote upon. Popular ideas would presumably rise to the top, for consideration by the incoming administration.

Although change.gov effectively closed with President Obama's inauguration, tools operated both by the Obama administration and others outside of the government continue to explore related ideas. The National Academy of Public Administration recently hosted an "Open Governmnet Dialogue", colllecting 900 submissions and 33,0000 votes on ideas for making government processes more open (National Academy of Public Administration, 2009). The privately-run site Whitehouse2.gov combines user-submitted proposals that can be endorsed with tags, and tag clouds generated from these that illustrate prominence of issues, personalized talking points on priorities (based on user submissions), discussions, and tools for managing and exploring user influence on discussions.

Whitehouse2.gov demonstrates opportunities and challenges facing broad-based discussion and deliberation efforts. Tools that support the ability to suggest, discuss, and endorse specific policy proposals provide a basic framework for broad-based discussion and debate of important issues. This debate might be informed by talking points and discussions can be used to build collections of evidence in support of positions. Votes endorsing or opposing positions can be used to gauge the viewpoints of the community as a whole. Reputation systems that rate participants, talking points, and comments provide guidance to discussants struggling to decide who should be believed.

Informal reviews of proposals and discussions on whitehouse2.gov also plainly illustrate the challenges presented by the ambitious goal of moving these models from "toy" discussions to meaningful frameworks for substantive discussions (Although change.gov is no longer functioning, many of the same issues appeared to arise there as well).

Scientific Foundations

The foundations for an online national deliberative process would be based on experiments with progressively larger groups, ranging from local groups of a few dozen to nationwide deliberations involving thousands.

In the first years of the project, several small communities would use prototype tools to conduct ongoing deliberation of one or more topics that are relevant and meaningful to diverse stakeholders. For these early efforts, relatively homogeneous groups in a single geographic location would be selected based on their commitment to trying the experiment and the presence of a concrete need for deliberation. Participating groups should be chosen to represent a diverse range of participants and concerns from community and/or school groups, neighborhood associations, student groups, and other similar associations. Quantitative and qualitative analysis of interactions, log data, and outcomes would be used to identify difficulties, evaluate interfaces, and guide revisions to the design.

Subsequent efforts would expand in scope to include problems covering broader ranges of geographical coverage, types of participants, and scales of problems. Traditionally oppositional groups such as college students and residents of surrounding neighborhoods might be asked to work to resolve differences. These efforts would inform further redesign, with an eye towards scaling up to national problems.

Research efforts would address understanding of the interplay between the dynamics of the discussions and the design of the tools. Interviews and analysis of participation trends might help understand motivations for engaging in deliberation and reasons for withdrawing. Models of the processes involved in discussing potentially controversial topics and their resolutions might help inform the design of tools that might help participants work towards success. Communication breakdowns and failures might provide insight as to how future deliberations might avoid self-destruction. Interviews or surveys of stakeholders who decline to participate might provide additional insight.

Research Challenges

1) *Improving the quality of discussion:* How can deliberative systems encourage meaningful and substantive debate? Many of the proposals and discussions on whitehouse2.gov are consistent with a political culture that has been described as being completely polarized. As participants talk use "party-line" arguments to talk past each other without documenting claims, directly refuting counter-arguments, seemingly "robust" discussion of controversial topics may in fact be mere recitations of well-known, pre-established positions.

Finer granularity of stated positions on controversial issues might be helpful. The initial choice between endorsing, opposing, or (implicitly) being neutral with respect to a given proposal is inherently polarizing. A more fine-grained set of options, particularly with respects to aspects of a discussion, could let people see the relative strength of conviction. Histories of viewpoints - both individually and in the aggregate - would let others see how views change. Annotations on revised opinions could be used to help participants understand how their peers had been convinced to revise their views: "Jane said this post helped convince her that her original viewpoint was ill-informed."

The widespread use of ratings of participants and comments in online conversation provides a starting point for exploration of design alternatives. Richer ratings schemes - going beyond thumbs-up or thumbs-down - may be augmented by more nuanced approaches that consider the source of an assertion and the trustworthiness of the person making it.

2) *Evaluating Information*: High-quality, comprehensible information is necessary for promoting civic involvement (Knight Foundation, 2009). Deliberative discussions will necessarily involve the use of external information to provide context, document claims, and inform discussion. This information will likely come from a broad range of sources, including traditional or online news sources and discussion groups (Robertson, 2005). Appropriately-constructed simulations can be particularly useful for illustrating possible consequences of alteranative solutions to specific problems (Borning, Friedman, Davis, & Lin, 2005). Regardless of the form they take, these information sources will be viewed critically by deliberation participants.

Although the introduction of external sources for supporting arguments may improve the quality of discussion, these sources may simply add a level of indirection, as participants will need appropriate tools for understanding the quality and believability of diverse information providers: information from highly-regarded organizations or peer-reviewed academic publications may be more credible than reports from unknown entities. Ratings for sources along with comments on their trust, reliability, perspectives, and history, can all be useful. Links to high-quality external data sources, such as the District of Columbia Data Catalog (District of Columbia, 2009), the forthcoming federal data.gov, and independent efforts like those run by the

sunlight labs (Sunlight Labs, 2009) might be used to encourage the use of publicly-available government data sets whenever appropriate.

3) *Gaming of Priorities and Votes*: Both whitehouse2.org and change.gov allow any users to make proposals. Votes on these proposals may be used to indicate perceptions of priorities: ideas that generate few votes are possibly not high on the list of anyone's concerns. Conversely, relatively high-interest levels may not be an indication of the levels of interest in or support for a given position. As illustrated by NASA's recent contest for naming a portion of the space station (Klotz, 2009) concerted online efforts can generate seemingly substantial support for positions that may in fact be somewhat marginal.

Weighted endorsement schemes that give greater consideration to users with reputation ratings indicative of a long history of thoughtful consideration might be used to discount electronic "ballot-stuffing". Visualizations of voting trends, including identification of voting clusters, might help participants identify votes that may be more indicative of group membership than considered opinions.

4) *Evaluation of participants:* The process of deciding which proposals to endorse or oppose, and which comments or discussion points might inform that decision, involves an ongoing process of evaluating materials. Just as reputation systems on sites like eBay help wary buyers and sellers decide who to do business with, reputation systems in support of deliberative discussions help participants determine the credence that should be given to various individuals or data sources.

As internally consistent evaluations of participants, these tools may add substantial value, but additional measures will be needed to strike a balance between full-disclosure of external interests that may indicate conflicts and possibilities for appropriate anonymous contributions.

Reputation systems might be designed to support open disclosure. Registration with a full name (as opposed to a pseudonym) and endorsements from other participants (based on "real-world" dealings) might improve reputation. Verifiable disclosure of financial and employment details that might pose conflicts of interest would provide additional increases in reputation. Posted opinions and comments might link to these disclosures. Support for visualization of relationship between participants (perhaps based on employment or affiliations) might be used to infer alliances behind various positions (see littlesis.org as an example effort aimed at demonstrating connections between business and government leaders). To allow people to change their views over time, mechanisms are needed to allow a participant to show this evolution in their thinking, rather than having their views perceived as represented by isolated statements.

Facilities for "outing" participants with undeclared conflicts of interest might be used to expose

participants acting as shills for undeclared interests. Participants who wish to disclose relevant information about another would disclose their intentions to the alleged bad-faith actor prior to posting them publicly, allowing for rebuttal. Reputation systems would help users evaluate the relative merits of the conflict claim and rebuttal.

Anonymity will likely be a concern in evaluating participant contributions. Rewarding reputation points to those who choose to reveal their full name while participating may also be seen as discriminating against those who choose to remain anonymous. Anonymous participants might use appropriately anonymized endorsements from highly-reputable individuals to overcome these limitations. These statements might act as "reputation escrow". Investigation of the implications, utility, and design issues associated with more nuanced identity management models will be necessary.

Many deliberations will present questions regarding constituency. Who should be allowed to participate in deliberations? Although some discussions may be local in nature, limiting participation to residents of a given neighborhood or municipality may not be desirable or technically feasible. Other deliberations focused on specific subpopulations present similar concerns: how can a national deliberative system help determine who can "vote"?

5) *Multiple means of evaluating content/comment:* Multiple streams of information about specific proposals, together with meta-information rating relevant individuals and data sources, present significant challenges in usability. Designing universally usable interfaces for exploring and interpreting these data sets will be a substantial challenge.

6) *Supporting active, sustained, engagement in ongoing, evolving discussions:* Policy-makers and stakeholders may be faced with the challenge of interpreting and synthesizing large volumes of ongoing discussion, potentially involving multiple streams of inter-related topics. Debate and discussion will need to support evolution of views and specific proposals. Appropriate tools for coordinating this evolution, investigating histories, and summarizing discussions will be needed. Effective participation will mean that individuals are able to contribute to discussions and understand their progress without becoming overwhelmed. Furthermore, mechanisms are needed to facilitate the incorporation of ideas from people who join the conversation at different points in time, to get late-comers up to speed and avoid having them restate issues that have already been hashed out in the discussion.Tools for navigating large volumes of conversation, summarizing trends, gauging opinion, and identifying relationships between participants and discussions will be needed.

Appropriate visualizations of these processes will be necessary. Visualizations of wikipedia edits (Viégas, et al. 2004) illustrating discussions of controversial topics provide some inspiration, but broadly-based deliberative processes will present significant scaling challenges for thes displays:

with potentially dozens of related discussions on different facets of a complex topics, participants will face the challenge of both identifying specific conversations of interest and then understanding the context and content of those discussions.

7) *Representativeness of Results:* Given the likelihood that only a small minority of citizens will engage in such deliberations, any outcomes should not be oversold. When available, demographic information might be used to demonstrate a range of diverse voices taking a given position. Similarly, votes or attempts at consensus must be carefully structured: what is the necessary quorum for a large, distributed, online-only, transitory group? Building on earlier work examining the possibility of using displays indicating the value of contribution (Rashid, et al., 2006), deliberative interfaces might be fine-tuned to encourage participation by members of under-represented groups.

8) *Working toward consensus or agreeing to disagree.* Discussion, moderation, and voting may be helpful, but other means of assessing opinion may be useful. Participants might be able to prioritize items, choose between binary alternatives, assign monetary values to choices, or use any of a variety of other mechanisms to express their views. Other approaches might separate discussion from decision-making, perhaps having discrete times for various forms of participation. Which of these approaches work, and under what circumstances?

Consensus may not be always be a desirable or achievable outcome, particularly when contentious matters may leave little common ground. When this happens, the relevant question might change from "how can we agree on a solution to a shared problem?" to "how can we best accept that this debate may have 'winners' and 'losers' without harming chances for future deliberative successes?" Design alternatives that might support this process include support for clear narratives that explain and illustrate decision-making processes, with an eye towards illustrating clearly who "won" and who "lost". Participants on the "losing" side of these debates might be given incentives for continuing to participate in other discussions - as opposed to choosing to disengage entirely. One possibility would be to increase prestige ratings for participants who respond constructively to losing votes.

Visualization is can play an important role here as well. Computer-supported argument visualization tools might provide a range of displays aimed at helping participants understand the progression of an ongoing deliberation. Possible visualizations include overivews, chronological maps of dialogs, and argument visualizations that link alternative decisions to pro- and con-arguments (Renton & Macintosh, 2007) . Scaling these tools to support large numbers of alternatives, arguments, and participants remains a challenge.

9) *Supporting moderation and oversight:* Particularly for controversial topics, tools for oversight and moderation will be needed. Appropriately trained and responsible individuals will need facilities for responding to interpersonal problems, moderating heated discussions, maintaining an appropriate level of focused, on-topic conversation, and identifying any behavior that maybe

illegal, threatening, or otherwise harmful. Although the emerging study of the evolution of rules in online spaces such as Wikipedia (Butler, et al. 2008) provides some useful guidance, more research will be needed to understand how appropriate administration of deliberative sites can provide accountability, flexibility, and transparency.

10) *Building confidence:* deliberative processes will not work unless participants feel that all actors are working in good faith, and that the process can have meaningful impact. Deliberations that are ignored by policy-makers will not encourage further participation. Combining large-scale deliberations with clear and transparent decision-making processes that disclose the full range of voices that influenced decisions may help build trust in these processes.

11) *Supporting appropriate flexibility of tools and processes:* As deliberative processes evolve over time, technological capabilities required to support them evolve as well. Inappropriate tools can place undesirable constraints on the process, deliberation tools will need to have both a range of flexible capabilities for managing both consensus and disagreement, along with appropriate support for helping participants determine which capabilities are needed at any given point in a deliberative process (deMoor and Aarkhus, 2006). Effective strategies will support appropriate end-user customization of both the underlying process and relevant user interfaces.

The change.gov experience illustrates the problems associated with deliberative input into public policy-making. Allthough change.gov, the White House Office of Science & Technology Blog (OSTP, 2009) and related efforts solicit citizen input into government policy activities, the influence that this input has is not yet clear. Good faith demonstrations of sustained engagement policy makers with these processes will be necessary to motivate continued citizen involvement: if participants aren't confident that policy-makers are listening, they may stop talking. Recent governement efforts aimed at reconsidering online services (Federal Web Managers Council, 2008) and using social media for communications with citizens (Godwin, et al. 2008, Webcontent.gov, 2009) are a good start in this direction, but widespread deliberation might benefit from more specific and direct indications of policy-maker engagement. These indicators might range from active participation in discussions to direct attributions that link elements of policy proposals, legislation, and/or regulation back to specific deliberations.

References

Adler, B.T., and de Alforo, L. (2007). A Content-Driven Reputation System for the Wikipedia. *Proc. 16th International Conference on the World Wide Web*.

Borning, A., Friedman, B., Davis, J., and Lin, P. (2005). Informing Public Deliberation: Value-Sensitive Design of Indicators for a Large-Scale Urban Simulation. *Proc. 2005 ACM European Conference on Computer-Supported Cooperative Work*, September 2005.

Butler, B., Joyce, E., and Pike, J. (2008). Don't look now, but we've created a bureaucracy; the nature and roles of policies and rules in wikipedia. *Proc. ACM SIGCHI Conference on Human Factors in Computing Systems*.

deMoor, A., and Aarkhus, M. (2006). Argumentation support: from technologies to tools. *Communications of the ACM*, 49(3), pp. 93-98.

District of Columbia (2009). Data Catalog. http://data.octo.dc.gov/, Accessed May 15, 2009
Federal Web Managers Council (2008). Putting Citizens First: Transforming Online Government. Available at: http://www.usa.gov/webcontent/documents/Federal_Web_Managers_WhitePaper.pdf,
Godwin, B., Campbell, S., Levy, J., and Bounds, J. Social Media and the Federal Government: Perceived and Real Barriers and Potential Solutions. http://www.usa.gov/webcontent/documents/SocialMediaFed%20Govt_BarriersPotentialSolutions.pdf
Introne, J. E. (2009). Supporting group decisions by mediating deliberation to improve information pooling. *Proc. ACM 2009 International Conference on Supporting Group Work.*
Klotz, I. (2009). NASA in Colbert conundrum over Space Station Reuters, March 30, 2009. http://www.reuters.com/article/newsOne/idUSTRE52T5TN20090330, Accessed May 15, 2009.
Knight Commission (2009). The Knight Commission on the Information Needs of Communities in a Democracy: Draft Report. Available at: http://www.knightcomm.org/files/kcconsolidatedfirstdraft160409.pdf .
National Academy of Publication Administration (2009). Open Government Dialogue. http://opengov.ideascale.com/, Accessed June 1, 2009.
OSTP (2009). The Office of Science and Technology Policy OSTP Blog. http://blog.ostp.gov, Accessed May 15, 2009
Rashid, A. M., Ling, K., Tassone, R., Resnick, P., Kraut, R., Riedl, J. (2006). Motivating participation by displaying the value of contribution. *Proc. ACM SIGCHI Conference on Human Factors in Computing Systems.*
Renton, A., and Macintosh, A. (2007). Computer-supported argument maps as a policy memory. *The Information Society* 23(2), 125-133.
Robertson, S. (2005). Voter-Centered Design: Toward a Voter Decision Support System. *ACM Transactions on Computer-Human Interaction* (12)2, June 2005, 263-292;
Sunlight Labs (2009). The Sunlight Labs Wiki, http://wiki.sunlightlabs.com/index.php/Main_Page .
Viégas, F., Wattenberg, M., and Dave, K. (2004). Studying Cooperation and Conflict between Authors with *history flow* Visualizations. *Proc. ACM SIGCHI Conference on Human Factors in Computing Systems.*
Webcontent.gov (2009). Social Media and Web 2.0 in Government - Webcontent.gov - Guide to Managing U.S. Government Websites http://www.usa.gov/webcontent/technology/other_tech.shtml

3) Encyclopedia of Life

Jenny Preece (University of Maryland) & Cynthia Parr (Smithsonian Institution)

A web page for all 1.8 million species

This ambitious project to create web pages for all 1.8M living species on the earth, called Encyclopedia of Life (EOL), presents many challenges for the developers who expect highly participatory contributions (see http://www.eol.org) . Their hope to integrate citizen scientists with professional scientists has generated tension, so finding strategies that enable such collaborations might be helpful to many other collaborative ventures. The volume of information for each species is potentially large with text, data, images, videos, messages from observers, references, etc. so searching across species, finding common attributes across species, etc. are all major technical challenges. Dozens of projects tied to the Encyclopedia of Life would span topics such as educational tools for environmental awareness for citizens, data for land use planners, focused conservation projects to help endangered species, scientific taxonomies, activities for K-16, etc. Each of these projects would require interdisciplinary teams of technically sophisticated implementers, scientists, and social scientists.

The compelling national and international need

The *need* for this project cannot be stated too strongly. With hundreds of species disappearing daily due to habitat loss and climate change, preserving the flora and fauna in the United States would set the model for worldwide conversation efforts. EOL provides a unique opportunity to catalog the world's species and educate citizens. In its simplest form EOL will provide a record of the world's species. The goal is, however, to go beyond this to provide information on the changing demography of species across the world. Such changes might include naturally expected cycles and cycles that are abnormal due to climate change, extreme weather conditions, disease, and loss of habitat. In this respect EOL is a barometer for evaluating the impact of these events on species. Similarly changes in environmental protection policies will be reflected in EOL recordings. For example, protecting or not protecting wolves will create population changes in prey species. Likewise, changes in the way people live (e.g., mining in new areas, changes in fishing practices, increase in ship traffic through the inner passage) may impact the presence of species as well as the abundance of organisms.

Our planet is crowded and every day new figures are produced demonstrating how of the Amazon rainforest has been burnt to make room for cash crops or roads. Keeping a record of species is essential not just for scientists but also to make every citizen aware of the natural treasures that we are losing. The need for environmental education across the world continues to be enormous. An important feature of EOL is that it engages everyone, from school children, to

retirees, amateur scientists to professionals. Involvement in science is more motivating than reading about science.

Use cases

Uses cases serve both professional and citizen scientists. Ecologists can use EOL to accurately identify the organisms they are studying; without such identifications, many areas of ecological study are compromised (Bortolus 2008). Moreover, ecological modelers need access to information about species to build models with stronger predictive power and more accuracy. For example, without easy-to-use and accessible information about species, plants may get treated as one group with single values for photosynthetic and growth rates in the model. Most biologists know that different types of plants can be physiologically different and, thus the model ideally should include separate parameters for each species. Public health and safety relies on the ecological study of harmful species such as toxin-producing algae that can cause shellfish poisonings (Hargraves and Maranda 2002).

The IUCN Red List (http://www.iucn.org) reports the conservation status of organisms based on the analysis and opinions of more than 7,000 experts. With a fully developed EOL and integrated datasets (species distributions, protected area coverages, maps of large-scale environmental threats), not only could the production of the Red List and Red Data Books be accelerated, the results could be translated into concrete recommendations for decision-makers.

Conservation biologists pondering the causes of decline in a particular species will be able to obtain information from EOL about the morphology, ecology, and behavior of the target species, as well as the characteristics of its close phylogenetic relatives, its mutualists, pathogens, competitors, predators, or ecological equivalents. The comprehensive data collected, at least in part by citizen scientists and curated by scientists, and available at EOL will thus greatly improve the efficiency of comparative biodiversity analyses by providing instant access to rich contextual information about any species of plant, animal, fungus, or microbe.

Citizen scientists involved in Audubon Christmas Bird Counts, Butterfly counts or Bioblitzes can take advantage of EOL's free online resources to better identify and understand the organisms they are discovering. A major part of EOLs vision is to support and spark new monitoring efforts in areas of the tree of life that haven't received attention before because of lack of visibility. For many organisms, there are so few trained scientists and so little funding that otherwise fascinating and important creatures are overlooked in citizen science efforts. Imagine a global

Research Challenges

There are many *computer science research challenges*. Developing a huge multimedia database

containing millions of records that can be searched and edited by scientists and citizens poses technical and user interaction design challenges. What kinds of data formats and metadata will be most flexible? What kinds of visualizations and other sense-making techniques are needed to support users with different goals, skills and scientific knowledge? What kinds of privacy protection should be available to users so that users do not inadvertently or purposely destroy or compromise each other's work? How will ownership of media be controlled? What specialist features are needed for different types of users – children of different ages, citizens, scientists?

An *overarching research question* is what functionality, usability and sociability (i.e., software features and social support) are needed for a healthy EOL community comprising scientists and citizens of all ages? Some subquestions are suggested by the reader-to-leader framework that suggests the way participants' behavior changes as they gain experience within a social space (Preece & Shneiderman, 2008):

> What motivates participants to come to the site and read?
>
> What motivates them to contribute?
>
> What motivates them to collaborate with others?
>
> What motivates them to become leaders?
>
> What keeps participants motivated and the community growing in the face of competing opportunities?

Related to all of these are the questions "how important are cooperation, competition, and trust in individual participation trajectories" and also "What are good ways to organize multiple participation opportunities?" EOL offers many opportunities to participate:

i) uploading photos
ii) adding text
iii) tagging, which may include "tag-fest events"
iv) commenting
v) rating
vi) curating
vii) mining text from scanned publications
viii) proofing automatically mined text

Trying out different roll-out scenarios to see how they impact the reader-to-leader process will provide valuable data.

For each question we need to establish a baseline: How many people participate in EOL? How do they move through the stages of the reader-to leader framework? What attracts others to join?

Why do some people leave? Are there any patterns that reoccur and are predictable.

Having established baseline data we can try different kinds of interventions, for example, software functionality/usability changes (e.g., introduce different kinds of rating systems), introduce facilitators/moderators, or ask a certain group of participants to frame their messages in a certain way (i.e., message conversation style).

It will be important to support development of niche groups – for example, a local conservation group that is cleaning up an area of the Chesapeake Bay and wants to chart the organisms that they see over the same 24-hour period each year. Children from a school in Chicago have a class project in which they are challenged to use EOL in conjunction with local fieldwork trips to learn more about the wildlife in their local park. An international group of Nematode scientists debate whether EOL's data is reliable. Ornithologists working with citizen scientists have similar concerns but after years of interacting with the citizens systems for verifying sightings are well established.

All of these examples, and many more that we have not described have to be supported with appropriate functionality, usability and sociability.

Research methods

Novel research methods would need to be developed to enable reliable triangulation of qualitative and quantitative data. Possible techniques include:

- Interaction logging (analysis by examining no. of logins, contributions etc. over time, changes in social networks)
- Message content analysis (to elucidate underlying motivation in observed social network behavior)
- Interviews with selected participants to validate and refine automated analyses

Difficult issues remain to be resolved such as privacy vs. the need for demographic data about information providers, reward structures for professional and citizen scientists, and development cycle that supports initial information providers as well as a sustainable model that helps reach complete coverage.

References

Abadie J-C, Andrade C, Machon N, Porcher E. (2008). On the use of parataxonomy in biodiversity monitoring:a case study on wild Flora. *Proc. International Congress for Conservation Biology, Convention Center, Chattanooga, TN*, Jul 10, 2008.

Balmford A, Bennun L, ten Brink B, Cooper D, Côté IM, Crane P, Dobson A, Dudley N, Dutton I, Green RE, Gregory RD, Harrison J, Kennedy ET, Kremen C, Willianms NL, Lovejoy TE, Mace G, May R, Mayaux P, Morling P, Phillips J, Redford K, Ricketts TH, Rodriguez JP, Sanjayan M, Schei PJ, van Jaarsveld AS, Walther BA (2005). The Convention on Biological Diversity's 2010 target. *Science:Vol. 307*. no. 5707, (14 January 2005), 212-213.

Bortolus, A. (2008). Error cascades in the biological sciences: the unwanted consequences of using bad taxonomy in ecology. *AMBIO: A Journal of the Human Environment* 37(2):114-118.

Butcher, G.S., Fuller, M.R., McAllistor, L.S., and Geissler, P.H.. (1990). An Evaluation of the Christmas Bird Count for Monitoring Population Trends of Selected Species, *Wildlife Society Bulletin,18* (2): 129-134.

Hargraves, P. E. and L. Maranda (2002). Potentially toxic or harmful microalgae from the northeast coast. *Northeastern Naturalist 9* (1):81-120.

Hines, C. (2008). *Systematics as cyberscience: Computers, change, and continuity in science*. Cambridge, MA: MIT Press.

Majka, C.G. and Bondrup-Nielsen, S. (2006). Parataxonomy: a test case using beetles. *Animal Biodiversity Conservation 29*:149–156.

Preece, Jennifer and Shneiderman, Ben (2009). The Reader-to-Leader Framework: Motivating Technology-Mediated Social Participation, *AIS Transactions on Human-Computer Interaction (1)* 1, pp. 13-32. Available at: http://aisel.aisnet.org/thci/vol1/iss1/5

Wheeler, Q. Ed. The new taxonomy. Systematcs Association Special Volume Series 76.

Wilson, Edward O. (2003). The encyclopedia of life. Trends in Ecology and Evolution 18, no. 2: 77-80. Available at http://www.sciencedirect.com/ science/article/B6VJ1-47C8RDN-3/2/befac60e32dd59e55ff8bfc75f9848c6. ISSN 0169-5347, DOI: 10.1016/S0169-5347(02)00040-X. 307:212–213

4) Climate Collaboratorium

Thomas Malone (MIT)

Many people believe that global climate change is the most important problem currently facing humanity. If we don't solve this problem, our other problems may not matter much, because we may not be here to have them. This problem is also unusual in the degree to which it is truly a universal problem: it affects every one of us and is affected by all of our actions. If ever there were a problem that called for harnessing the best collective intelligence our species can muster, this may be it.

And fortunately, in just the last decade or so, a new way of solving global problems has become possible. Examples like Wikipedia and Linux illustrate how it's now possible to combine the work of thousands of people in ways that would have been completely impossible only a few years ago.

Left to their own devices, scientists, journalists, politicians, businesses, and consumers will certainly do something about this problem. But the inefficiencies, delays, and distortions of traditional mass media, political decision-making, markets, and scientific publication mean that the results will almost certainly not be as good as we might hope.

We believe it is possible to do better, and the goal of this proposal is to create a global, on-line community to help do so.

At a minimum, such a community can help educate the general public about the issues involved in climate change. Bur our more ambitious hope is that it can facilitate a far more productive global conversation than would otherwise have occurred among scientists from different disciplines, policy makers, businesspeople, and ordinary citizens of countries around the world.

More specifically, we believe that, if properly structured, such an on-line conversation can lead to the creation, analysis, and ultimately selection of detailed plans for what we humans can do about climate change. And we hope that with thousands of people constructively involved, the plans that emerge from this process will be better than anything we would have developed otherwise.

Among other things, we believe that such a Climate Collaboratorium should include the following kinds of software capabilities:

- *radically open computer modeling* where many people can see and change models of the actions humans might take and the social, economic, and physical outcomes of these actions,
- *on-line deliberation* where people can see and modify summaries of the key issues, positions, and arguments related to climate change, and
- *collective decision-making* where people can rate the plausibility and desirability of various actions, assumptions, and outcomes.

A nascent community of researchers is now forming to tackle this challenge. Early prototypes of a system like what is proposed here have been developed at MIT. A number of other researchers with expertise in human-computer interaction, cooperative work, and related disciplines are enthusiastic about tackling the challenges implicit in this endeavor. And several respected climate scientists have expressed interest in being involved.

Scientific questions

This project involves scientific questions at many levels. First, it will require involvement of experts in many scientific disciplines relevant to climate change, from upper atmosphere physics, to ocean chemistry, to the economics of carbon taxes and the psychology of consumer decision-making. The goal of this project is not to *do* this science, but it is, in part, to facilitate multi-disciplinary collaboration of all these different kinds of scientists (Olson et al., 2008). We believe that the software capabilities listed above have the potential to do this in new and interesting ways, and there are many research questions about how this process could work.

For example, there are a host of social and computer science questions about how to design effective computer-mediated communities that include not only many different kinds of scientists but also many kinds of non-scientists. Here are just a few of the questions we believe are relevant:

What kinds of social, psychological, economic, and other incentives will effectively motivate the different kinds of participants needed (scientific experts, policy makers, climate activists, businesspeople, software developers, ordinary citizens)? (Preece and Shneiderman, 2009)

Can playful motivations (like contests) be used to attract more people? Will the inclusion of media such as user-created video and fan fiction help make the site more engaging?

Will the structured on-line representation of arguments about controversial issues lead group deliberation about these issues to be more constructive? And what forms of representation are most effective?

What kinds of community norms and rules will lead to effective interactions?

Can globally distributed "citizen scientists" collect data about global warming that is scientifically useful?

What kinds of micro-level user interfaces are needed to make the systems usable (and used)?

How can voting systems be designed to avoid intentional manipulation of outcomes by small numbers of highly motivated partisans?

How can voting systems be designed to avoid undue influence of the results by the opinions of early voters? (Salganik et al., 2006)

Do the individual contributions and opinions of many people create a collective product that is, indeed, greater than the sum of its parts?

Computer science challenges

In addition to the questions just listed, there are many computer science challenges involved in developing the systems to support this kind of on-line community. For example:

What tools can effectively visualize large argument maps in ways that are understandable and engaging? (Conklin and Begeman, 1988; Conklin, 2003; Klein and Iandoli, 2008)

How can belief (or confidence ratings) be automatically propagated through argument maps in ways that people find useful and intuitive? (e.g. Introne, 2009; Lowrance et al., 2008)

What practical methods will work to authenticate voters so that (a) it is difficult for people to vote multiple times, and (b) votes can be credibly tallied separately for different kinds of people (e.g., scientists on scientific questions and residents of different countries on questions involving national interests)?

How can "radically open modeling" work as the number, types, and locations of models increase? For instance, how can users manipulate and combine models in intuitive ways? How can large families of models be maintained in such a way that interoperation is facilitated but not required? How can acceptable response times be maintained if the models are hosted on different machines?

Next steps

We envision several near-term activities to help this project move forward. First, the researchers interested in this project will try to organize a one-day meeting as soon as possible to clarify visions, approaches, and roles. In parallel, the MIT researchers will continue work on prototype

systems based on the ideas described here. Second, we will actively solicit funding from government agencies, corporations, and foundations to support the parts of this project for which it will be most difficult to engage volunteers (such as developing the core software infrastructure).

A possible--but extremely ambitious--medium-term goal is to have a robust enough system and community in place by Fall 2009 to help provide broad-based community input to the United Nations Climate Change Conference in Copenhagen in December 2009. Since they will be attending the successor to the conference at which the Kyoto Protocol was developed, the participants in this meeting are *exactly* the kind of policy-makers we hope could benefit from our work. The primary question in our mind is whether our system and community can be robust enough in time for this conference.

In any case, we hope the number and types of people involved in this community will grow significantly over the next few years. For instance, if the project is successful, it should involve at least hundreds of people in the coming year, thousands of people in the following year or two, and eventually, perhaps, tens of thousands more.

Of course, there are numerous potential barriers to the success of this project, including many kinds of technical, organizational, financial, and political risks. But we believe that the problem is important enough to warrant proceeding, even though success is by no means guaranteed. And even if the project does not succeed in its grandest ambitions, we believe that many scientific and educational benefits will come from even very limited successes.

If the project is successful in its grandest ambitions, however, it will lead to the creation in a few years of a societal institution that is comparable to (though perhaps somewhat smaller than) Wikipedia. It will be an on-line community used routinely by scientists, politicians, journalists, and anyone with a professional interest in climate change. It will also be a standard resource for educators, students, and any citizens who want to learn about climate change. And it will be a place where any citizens who care can either express their opinions about climate change directly, or delegate their "proxy" to others who will vote on their behalf. In short, it could become a combination of a kind of Sims Online for climate change, Wikipedia for controversial topics, and an electronic democracy on steroids.

Notes: Portions of this project description are adapted from Malone, T. W. & Klein, M. Harnessing collective intelligence to address global climate change (Invited Lead Essay). *Innovations: Technology | Governance | Globalization*, Summer 2007, *2* (3), 15-26. See also current project description at http://cci.mit.edu/research/climate.html.

References

Conklin, J. (2003). Dialog Mapping: Reflections on an Industrial Strength Case Study. In *Visualizing argumentation: software tools for collaborative and educational sense-making*, ed. P. A. Kirschner, S. J. Buckingham Shum, and C. S. Carr, 117-136. Springer-Verlag. http://portal.acm.org/citation.cfm?id=779336.

Conklin, J., and M. L. Begeman (1988). gIBIS: a hypertext tool for exploratory policy discussion. *ACM Transactions on Information Systems (TOIS)* 6, no. 4: 303-331.

Introne, J. (2009). Supporting Group Decisions by Mediating Deliberation to Improve Information Pooling. In . *Proceedings of Group 2009*, Sanibel, FL: ACM Press, May 10.

Klein, Mark and Iandoli, Luca (February 20, 2008). Supporting Collaborative Deliberation Using a Large-Scale Argumentation System: The MIT Collaboratorium. MIT Sloan Research Paper No. 4691-08. Available at SSRN: http://ssrn.com/abstract=1099082

Lowrance, J., I. Harrison, A. Rodriguez, E. Yeh, T. Boyce, J. Murdock, J. Thomere, and K. Murray. 2008. Template-Based Structured Argumentation. In *Knowledge Cartography: Software Tools and Mapping Techniques*, ed. A. Okada, S. J. Buckingham Shum, and T. Sherborne. Advanced Information and Knowledge porcessing. Springer.

Olson, Gary M., Ann Zimmerman & Nathan Bos, Editors.(2008). *Scientific Collaboration on the Internet,* MIT Press, 2008.

Preece, Jennifer and Shneiderman, Ben (2009). The Reader-to-Leader Framework: Motivating Technology-Mediated Social Participation, *AIS Transactions on Human-Computer Interaction (1)* 1, pp. 13-32. Available at: http://aisel.aisnet.org/thci/vol1/iss1/5

Salganik, Matthew J., Peter Sheridan Dodds, and Duncan J. Watts (10 February 2006). Experimental Study of Inequality and Unpredictability in an Artificial Cultural Market, *Science* **311** (5762), 854.

5) Energy Initiative: Socio-technical systems supporting reflective communities

Gerhard Fischer and Hal Eden (University of Colorado)

Challenge and Aims

A mindset change is needed to take advantage of new technologies and approaches represented by "*innovative solutions to the challenge of renewable and sustainable energy*". This new Energy Initiative (EI) mindset will impact citizens by changing the way energy end users (both as individuals and as communities) think and learn about how to fulfill their energy needs as well as requiring new generation of young minds who are educated and engaged in new areas of research to support this process. Traditional models of education fall short, requiring new innovative learning environments (e.g.: exploiting the Long Tail (Anderson, 2006; Brown & Adler, 2008) and the Wisdom of Crowds (Surowiecki, 2005), supporting reflective communities (Arias et al., 2000; EI-CU, 2009) and fostering cultures of participation (Benkler, 2006; Fischer, 2009)) to meet this challenge.

The aims of this project are to develop 3 facets aimed at laying socio-technical foundations to address this challenge. These facets are:

Facet 1: Exploiting Collective Intelligence with Cultures of Participation

Facet 2: Modeling and Visualizing the Energy Ecology in Collaborative Environments

Facet 3: Educating the Next Generation

The first two facets we explore in this research will be explored by developing socio-technical environments to support the respective activities. The third will occur through the involvement of students in processes related to the first two.

Facet 1: Exploiting Collective Intelligence with Cultures of Participation

Addressing the general overload inherent in the flood of information for learning innovative technologies as well as the difficulty of finding of specific information within that flood for the new tasks and problems these innovations make possible will require ways to connect with others facing the same problems and a shift in mindset from a consumer culture to cultures of participation.
Specifically, we propose to utilize next generation computational environments (for example, Wikis, Blogs, Forums) to create a viable, informed community around the EI initiative. We envision three levels of participation: a) EI initiative affiliates, b) Boulder population at large

(smart grid requires participants and decision makers, not just passive consumers, and c) blogs/experience reports from participants in the Smart Grid project and the ClimateSmart Initiative.

Facet 2: Modeling and Visualizing the Energy Ecology in Collaborative Computational Environments

Learning and understanding the dynamic systems represented by innovative energy technologies requires more than passive media. Dynamic media and simulations that support exploration and computational decision making (e.g., regarding strategies for managing appliance use, how demand affects pricing at different times of day) are needed to cultivate human decision-making based on understanding.

Specifically, we propose to develop tools for Eco-Visualizations and Human-Centered Computing in EI. These tools will support various modes, for example: creating dynamic feedback from data-driven artwork for a better understanding of resource consumption patterns or using visualization of a carbon footprint to increase conservation behavior in resident populations. This project will support ways to identify factors that affect an individual's ability to curtail energy usage; create non-monetary incentives that affect an individual's commitment to conserve resources; and develop effective visualization strategies to communicate energy consumption data.

Some initial ideas to be explored include: 1) creating dynamic feedback from data-driven artwork for a better understanding of resource consumption patterns, 2) producing visualizations of a carbon footprint to increase conservation behavior in resident populations, 3) providing tools that help an individual identify factors that motivate and impact personal curtailment of energy usage, 4) developing non-monetary incentive schemes that encourage individual and community commitment to conserve resources, and 5) the development of face-to-face visualization and decision-making tools to allow neighbors to gather together to make decisions that impact smart-grid use at the community level.

Facet 3: Educating the Next Generation

As described earlier, we need a new generation of young minds who are educated and engaged in this research. Based on our background from numerous NSF research grants in LifeLong Learning and Design over the last 20 years (including: learning on demand, collaborative learning, social creativity) along with experience with our Undergraduate Research Apprenticeship Program and innovative courses, we propose to engage undergraduate students in the development of the above systems to create a unique and innovative education opportunity centered on EI at University of Colorado at Boulder.

Research Collaborations

This research will involve several forms of collaboration. We will engage in interdisciplinary work with

- Tiffany Holmes (Chicago Art Institute) on eco-visualizations (Holmes, 2007);
- Jenny Preece and Ben Shneiderman (University of Maryland) on richer ecologies of participation in 2.0 environments (Preece & Shneiderman, 2009);
- Tom Malone (MIT) on collective intelligence (Malone, 2008);
- National Renewable Energy Laboratory (NREL; Golden, Colorado) on innovations for our energy future (NREL, 2009);
- CU's Energy Initiative, the City of Boulder
    - ClimateSmart Initiative and
    - Smart Grid Project in collaboration with Xcel;
- Corporate "Green IT" efforts (e.g., from: NCSA, IBM, SAP) having the goal to become "green" themselves (as large organizations);
- University of Costa Rica on environmental sustainability;
- Fraunhofer Institute (FIT), Bonn, Germany on action research, data collection, ethnographic studies, and in planning a joint (international) symposium.

Evaluation and Assessment

Assessment of a reflective community must involve an open process of design and evaluation that is woven into the fabric of a community's evolving practices and activities (Carroll & Rosson, 2007; Miskelly & Fleuriot, 2006). As a result, we will assess the use and impact of our environments in the context of the everyday practice and real-world settings of our collaborating communities over (and beyond) the research timeframe.

Our design approach is based on the assumption that technology development is not sufficient to make a community more reflective (Mumford, 2000). We will devise "breaching experiments" (Crabtree, 2004)—a combination of technical and social infrastructures meant to trigger change into the relationship between communities and their patterns of interaction (Brown et al., 1994). We will triangulate *quantitative* and *qualitative* data by combining *usage data* (e.g., log files on frequency of use, features used, data sets opened or saved), direct observation (i.e., focus groups per community every four months, supported by video recording), pre- and post-questionnaires, and unstructured interviews (as needed).

Significance

Reflective communities require new knowledge, new tools, and new processes for the integration and co-evolution of social and technical systems that have the potential to transform design,

working, collaborating, learning, and discovery for all people. The developments will create new levels of support for effective computer-mediated human-human interaction and new computational mechanisms for social knowledge construction. The authentic and long-term use and detailed assessment of the proposed research will serve as a *scientific model* that shows how fostering and supporting reflective communities is desirable, how it can be enhanced, and how their strengths and weaknesses can be identified.

Reflective communities have an important role to play in public life. The proposed research will contribute to the objectives of the *human-centered computing program* by: (1) supporting the *co-evolution of communities, systems, practices, and tasks*; (2) promoting and enhancing *interactions and interdependencies among information, technical infrastructures, and social systems*; and (3) constructing mixed-reality environments facilitating *collaboration across communities by addressing problems of mutual interest*.

Expected Outcomes

This research has the potential to transform the Energy Initiative community into a force that will have a broader impact on our country's future energy use patterns and behaviors by better integrating new technologies.

References

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

Arias, E. G., Eden, H., Fischer, G., Gorman, A., & Scharff, E. (2000). "Transcending the Individual Human Mind—Creating Shared Understanding through Collaborative Design," *ACM Transactions on Computer Human-Interaction,* 7(1), pp. 84-113.

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

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

Brown, J. S., Duguid, P., & Haviland, S. (1994). "Toward Informed Participation: Six Scenarios in Search of Democracy in the Information Age," *The Aspen Institute Quarterly,* 6(4), pp. 49-73.

Carroll, J. M., & Rosson, M. B. (2007). "Participatory Design in Community Informatics," *Design Studies,* 28(3), pp. 243-261.

Crabtree, A. (2004). "Design in the Absence of Practice: Breaching Experiments." In *5th International Conference on Designing Interactive Systems*, Cambridge, MA, pp. 59-68.

Dick, H., Eden, H., & Fischer, G. (2009). "Increasing and Sustaining Participation to Support and Foster Social Creativity." In *Proceedings of the International Conference on Creativity and Cognition (C&C'2009), Berkeley, Ca, October*, p. (submitted).

EI-CU (2009). *Energy Initiative: Transforming Our Global Energy Future (University Ofcolorado, Boulder),* available at http://ei.colorado.edu/.

Fischer, G. (2009). "Cultures of Participation and Social Computing: Rethinking and Reinventing Learning and Education." In *Proceedings of the International Conference on Advanced Learning Technologies (Icalt),* IEEE Press, Riga, Latvia, p. (in press).

Holmes, T. (2007). "Eco-Visualization: Combining Art and Technology to Reduce Energy Consumption." In *Proceedings of Creativity & Cognition,* ACM, Washington, DC, June, pp. 153-162.

Malone, T. W. (2008). "What Is Collective Intelligence and What Will We Do About It?" In M. Tovey (Ed.), *Collective Intelligence: Creating a Prosperous World at Peace,* Earth Intelligence Network, Oakton, Virginia, pp. 1-4.

Miskelly, C., & Fleuriot, C. (2006). "Layering Community Media in Place," *Digital Creativity,* 17(3), pp. 163-173.

Mumford, E. (2000). "Socio-Technical Design: An Unfulfilled Promise or a Future Opportunity." In *Proc. IFIP TC9 WG9.3 International Conference on Home Oriented Informatics and Telematics, "If at Home: Virtual Influences on Everyday Life": Information, Technology and Society, June 2000*.

NREL (2009). *National Renewable Energy Laboratory,* available at http://www.nrel.gov/.

Preece, J., & Shneiderman, B. (2009). "The Reader-to-Leader Framework: Motivating Technology-Mediated Social Participation," *AIS Transactions on Human-Computer Interaction,* 1(1), pp. 13-32.

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

6) Enabling Healthy Living

Derek Hansen (University of Maryland), Gary Marchionini (University of North Carolina), Frank Moss (MIT), and Alex Pentland (MIT)

Promoting Health

Our healthcare system is in crisis. Many factors are to blame, but two stand out from the rest: increasing demand and a mindset based on treating disease rather than preventing it in the first place. Chronic ailments have increased dramatically in the last 20 years in our nation, and the percent of the GNP devoted to health care exceeds 16% (as compared to the 8% spent in many other countries). Yet entrenched political interests and a lack of personal ownership of health continue to block change to either the healthcare system or its payment model. What is needed is a radical reformulation of the health*care* system into a *health* system: a network of organizations and tools that enables people to take ownership of their health and well-being throughout their lives, informed by the best evidence from health research.

The rudimentary elements of such as health system are beginning to form, but progress is slow and piecemeal. An injection of innovative approaches to empowering patients have emerged under the banner of health 2.0 (http://health2con.com/). Sites such as RevolutionHealth (http://www.revolutionhealth.com/) act as health portals for individuals, helping them to make sense of everything from diseases to health insurance through access to content, phone operators, and communities of peers. Health literacy challenges are substantial (Institute of Medicine, 2009) and social networks that use media such as voice may lower barriers to understanding and informed action. Initial forays into the health system by Google (Google Health) and Microsoft (HealthVault) have demonstrated the potential for transformative technologies, as well as some of the inherent challenges. Novel peer communities such as PatientsLikeMe and Inspire enable those with a common disease to not only support one another via conversations, but also through sharing health information. General social network services like Facebook have hundreds of groups organized by characteristics such as disease type, geography, and belief. Meanwhile, the majority of medical practices and insurance companies have been notoriously slow at adopting innovative technologies and social strategies to empower patients. What is becoming clear is that a successful health system will be centered around individuals, families and small groups rather than medical establishments. Those individuals will be encouraged to take ownership for their own health and the health of those around them and will have at their disposal a network of tools and organizations to enable them in this endeavor. Theorists have described this as a move from intermediation, a system where healthcare providers and funders stand as gatekeepers to healthcare services, to apomediation, a system where tools, people and organizations stand "beside" individuals to help them make informed decisions (Eysenbach 2008).

Unfortunately, the US healthcare system and research funding models are strongly entrenched in the existing paradigm. Approximately 95 percent of the money we spend on health goes to direct medical services, while just 5 percent is allocated to populationwide approaches to health improvement. This in spite of the fact that around 40 percent of premature deaths could be avoided by changes in personal behavior compared to only 10-15% that could be avoided due to better availability or quality of health care (McGinnis, et al. 2002). While some government agencies clearly understand the needed focus on health rather than healthcare (e.g., HHS's Healthy People 2010 and upcoming 2020 initiatives), funding priorities have the same overemphasis on developing medical treatments.

Research that blends a deep understanding of social and behavioral motivations with a deep understanding of technological capabilities is particularly promising. There is already a strong foundation of research on social and behavior change (Smedley & Syme 2000), which has been successful applied to in reducing smoking, although significant work remains (Schroeder 2007). Unfortunately, despite almost universal agreement that technologies will have a transformative effect on the future of health (e.g., Smith 2004), relatively few medical journals and conferences are dedicated to exploring and helping shape that future. Although some innovative US funded research has begun to explore ways of empowering healthy living, much of the best government sponsored research in this area is conducted abroad. Compare for example, conference themes and journal articles associated with the American Medical Informatics Association with international conferences such as Medicine 2.0 and rising journals such as the Journal of Medical Internet Research that fill voids left by too strong a connection to existing practices and mindsets. There are notable exceptions including the Health 2.0 movement and initiatives discussed in places such as Patients.Net, but those involved in these efforts often feel marginalized by the existing healthcare system. If the US wants to remain a leader in health innovation, funding agencies and policy makers will reevaluate their priorities and existing relationships. They will put efforts that empower individuals to live healthy lives at the forefront, not backstage. They will see individuals as the primary providers of their own healthcare, not as passive recipients (ePatients White Paper). They will realize the potential of social-technical approaches. They will see the health system as centering around the home and individuals via mobile devices, not the hospital and clinic, and they will embrace children, adults, and seniors as lifelong learners and practitioners of healthy behavior.

Scientific Questions

Addressing a number of scientific questions will help to propel this vision of a health system into a reality and assure that it is founded on sustainable principles. Below are a few examples of questions that should be addressed:

How can individuals and apomediaries assure that confidential health information is responsibly dealt with?

How can peers, medical professionals, and researchers collaborate together effectively to gather, analyze, and interpret health data on people with specific illnesses?

How can disparate evidence and beliefs about health be integrated and evaluated?

How can complex health issues be represented for low-literacy individuals and groups?

How can smart mobile devices and social media tools be used to encourage health behavior such as weight loss and exercise?

How can a payment and incentive infrastructure be developed that will enable healthy competition among those working in the health arena?

What physical and psychological ailments can peers provide effective support for, and which do they support poorly?

How can health information be aggregated and visualized in order to recognize trends?

How can we develop interfaces that help consumers make more informed decisions and risk assessments?

How do people develop and monitor trust in health care providers? In their social networks?

Computer Science Questions

There are also a number of computer/information science and engineering challenges that must be addressed. Some of them include:

How can unobtrusive personal sensing devices that monitor various aspects of our health be developed and implemented?

How can smart devices be embedded in our clothing, (bodies?) homes, workplaces, and neighborhoods to monitor health threats?

How can protocols be established to ensure the privacy of health information, while still benefiting from its exchange and meaningful aggregations?

How can large datasets of health information be mined for consistent patterns?

How can personal health information be integrated with institutional medical records?

How can personal health information be preserved over a lifetime and multiple generations?

Next Steps

The time is right for concerted action to leverage the social-political energy that has arisen to change our thinking about health and to leverage the technical developments that enable scalable human participation and communication. Some specific next steps include:

NSF, NIH, and other government agencies can initiate research initiatives that bring interdisciplinary teams together to address the general and CS questions above.

Political, academic, and industry leaders can advocate for human-centered research and development that engages the broadest participation from all elements of society.

Individuals can use social network technologies to form groups to bring peer-to-peer support to those in need; share information with others with common interests; and advocate for heath education, accurate and freely available health information, and emphasis on heath as well as disease.

Researchers can give additional attention to working with the public to understand needs and desiderata.

References

Board on Population Health and Public Health Practice and Institute of Medicine (2009). *Health Literacy, eHealth, and Communication: Putting the Consumer First*, Workshop Summary, Washington, DC: National Academies Press.

ePatients White Paper: http://www.acor.org/epatientswiki/index.php/Main_Page

Eysenbach G. (2008). Medicine 2.0: Social Networking, Collaboration, Participation, Apomediation, and Openness. *J Med Internet Research* 2008;10(3):e22 URL: http://www.jmir.org/2008/3/e22/ doi:10.2196/jmir.1030

McGinnis, J. M., Williams-Russo, P., & Knickman, J. R. (2002). The Case For More Active Policy Attention To Health Promotion. *Health Aff*, *21*(2), 78-93. doi:10.1377/hlthaff.21.2.78.

Schroeder, S. A. (2007). Shattuck Lecture. We can do better--improving the health of the American people. *The New England Journal of Medicine*, *357*(12), 1221-1228. doi: 10.1056/NEJMsa073350.

Smedley, B. D. & Syme, S. L. (2000). *Promoting Health: Intervention Strategies from Social and Behavioral Research* (1st ed.). Committee on Capitalizing on Social Science and Behavioral Research to Improve the Public's Health. National Academies Press.

Smith, R. (2004). Can IT lead to radical redesign of health care? *BMJ*, *328*(7449), 0-f. doi: 10.1136/bmj.328.7449.0-f.

Appendix A: Workshop Summary

Workshop for the National Initiative for Social Participation

April 28, 2009, 10am - 4pm, College Park, MD
Univ of Maryland, Hornbake Library, SOUTH Wing, Second Floor Conference Room 2116
Travel info: http://www.cs.umd.edu/hcil/contact/travel_to_hcil.shtml

Photos at: http://www.flickr.com/photos/7137220@N05/sets/72157617547556041/
More photos at: http://www.flickr.com/photos/marc_smith/sets/72157617551332795/

Press coverage:
Chronicle article, Jeff Young, May 4, 2009
In addition to the article Jeff Young started a blog that generated some comments:
http://chronicle.com/wiredcampus/article/3749/should-computer-scientists-make-social-networking-research-a-higher-priority?commented=1#c014376
ACM Tech News did a follow up story:
http://technews.acm.org/archives.cfm?fo=2009-05-may/may-06-2009.html#410484

Agenda
10am: Introductions
11am: Presentations: Ben Shneiderman presents background and goals [Slides 10MB]
11:30am: Peter Pirolli gives talk on foundational science issues:

Theory-Driven Research to Promote Social Participation

- Abstract: User interfaces and information systems have become increasingly social in recent years, aimed at supporting the decentralized, collaborative production of user-generated content. Increasingly these efforts focus on national priorities such as healthcare, community safety, life-long learning, and business innovation. A theory that predicts the impact of interface and interaction designs on participation rates is likely to be useful. This talk extends Information Foraging Theory towards making predictions about the motivating/inhibiting effects of diversity, privacy, recognition, reward, etc. on participation rates, generalized reciprocity, and willingness to lead/follow. This talk pushes past the notions of only gathering information or forming collective intelligence – it is more closely aligned with promoting collective action, increasing social capital, resolving social dilemmas, and encouraging generalized reciprocity.
- Peter Pirolli is a Research Fellow in the Augmented Social Cognition Area at the Palo Alto Research Center (PARC), where he has been pursuing studies of human information interaction since 1991. Prior to joining PARC, he was an Associate Professor in the School of Education at UC Berkeley. Pirolli received his doctorate in cognitive psychology from Carnegie Mellon University in 1985. He is an elected Fellow of the American Association for the Advancement of Science, the Association for

Psychological Science, the National Academy of Education, and the Association for Computing Machinery Computer-Human Interaction Academy. His recent book is titled "Information Foraging Theory: Adaptive Interaction with Information." He is Associate Editor of Human Computer Interaction.

12:30pm: Lunch (our treat, Chinese, including vegetarian)

1:30pm: Breakout sessions to work on Research Challenges and White Paper
2:30pm: Discussion of Research Challenges and White Paper
3:30pm: Future plans
4:00pm: Departure
6:30pm: Dinner for those who are around
- Garden Restaurant at the Marriott Inn & Conference Center

Note: We've been concerned about the increased carbon footprint generated by people flying in to this meeting. Upon reflection the hosts (Jenny Preece and Ben Shneiderman) have purchased carbon offsets to cover all attendees from www.carbonfund.org
- No action is needed on your part. This was our initiative and I hope you will consider reducing or offsetting for your future travel plans.

National Initiatives for Social Participation
Participants on April 28, 2009

Organizers who attended
Ben Shneiderman, University of Maryland
Peter Pirolli, PARC
Jenny Preece, University of Maryland
Ben Bederson, University of Maryland
Derek Hansen, University of Maryland
Harry Hochheiser, Towson University

Attendees
Robert Bohn, National Coordinating Office, NITRD
David Bruggeman, USACM
Jeffrey R. Cooper, SAIC Technical Fellow,
VP for Technology, Chief Innovation Officer
Irene Greif, IBM Research, Cambridge, MA
Art Hanson, WatchJeffersonCounty.net

Marti Hearst, UC-Berkeley
Haym Hirsh, National Science Foundation
Wendy Kellogg, IBM Research-Yorktown Heights, NY
Tom Malone, MIT
Gary Marchionini, University of North Carolina
David McDonald, National Science Foundation,
Eduarda Mendes, Microsoft Research-Cambridge, UK
Natasa Milic-Frayling, Microsoft Research-Cambridge, UK
Gary Olson, UC-Irvine
Catherine Plaisant, University of Maryland
Bill Rand, University of Maryland
John Riedl, University of Minnesota
Marc A. Smith, Chief Social Scientist, Telligent
John Thomas, IBM Research-Yorktown Heights, NY
Fernanda B Viegas, IBM Research, Cambridge, MA
Jeff Young, Chronicle of Higher Education

Replied with interest but did not attend:

Amy Bruckman, Georgia Tech
Jack Carroll, Penn State University
Pierre de Vries, Silicon Flatirons Center
Greg Elin, Sunlight Foundation
Gerhard Fischer, University of Colorado
Ian Foster, University of Chicago
Roxanne Hiltz, NJIT
Bernardo Huberman, HP Labs
Sara Kiesler, CMU
Joe Konstan, University of Minnesota
Bob Kraut, CMU
Jonathan Lazar, Towson University
Frank Moss, MIT
Mike Nelson, Georgetown University
Alex Pentland, MIT
Mary Beth Rosson, Penn State University
Jan Gerrit Schuurman
Jeannette Wing, NSF & CMU

Appendix B: Letter in AAAS Science

Science 13 March 2009: Vol. 323. no. 5920, pp. 1426 - 1427
DOI: 10.1126/science.323.5920.1426

Letters: A National Initiative for Social Participation

The transformative power of the Internet is more than access to information; it is increasingly about contributing, collaborating, and participating. Metaphors based on information highways are giving way to community visions that capture the remarkable enthusiasm for user-generated content and social media. At the same time, President Obama is calling for civic service and personal responsibility to rebuild America. Combining these ideas could promote the shift from playful, discretionary Internet usage to larger, more serious projects aligned with national priorities such as health care, community safety, education, and innovation.

The good news is that there are many promising social action networks, but these nascent explorations could be greatly accelerated by an organized research program. This program would systematically study the emerging phenomena, determine the sources of success or failure, and disseminate best practices. The payoffs are large enough to warrant an intense national effort akin to NASA's space program or the National Institutes of Health.

Health discussion groups have long been one of the Internet's success stories. Now, clever entrepreneurs are exploring new social participation ideas with projects such as the www.PatientsLikeMe.com Web site, where users offer their medical experiences in the hope of learning about treatment outcomes from one another. At the same time, these users are building a remarkable resource for medical research and discovery. Physicians have already discussed 30,000 cases at www.sermo.com, where they can offer insights about innovative treatments as well as detect unusual disease patterns. Large corporations also recognize the opportunities and are inviting users to store their medical histories in the Microsoft Health Vault or at Google Health.

Although social networking plays only a small role in national security, community safety could be enormously improved by expanding resident reporting systems, such as www.WatchJeffersonCounty.net, which collects reports of unusual behaviors. These reports provide important clues for civic officials to prevent crimes, control teenage gangs, or simply fix potholes. A huge success, now run by the U.S. Department of Justice, is the Amber Alert reporting system for abducted children. Beyond the 430 cases they claim to have helped solve, the awareness generated among 7 million participants may have prevented many more abductions. Web sites for reporting extreme weather effects, such as Storm Watchers typically run by local radio and television stations, are being joined by reporting schemes for earthquake damage, influenza outbreaks, food poisoning, and other community problems. The micro-blogging tool Twitter is now rapidly spreading, as users from Orange County fire-fighters to Mumbai police post their 140-character messages about where they are and what they are doing.

Reading Wikipedia articles is now a common tactic for learners of all ages, but the stronger boost to education comes when students start writing Wikipedia articles. They become engaged

in the social process of commenting on each other's work, arguing over quality criteria, and discussing what needs to be added. E. O. Wilson's dream of the Encyclopedia of Life, with a Web page for each of Earth's 1.8 million species, is on its way to becoming a citizen science success story that raises environmental awareness. Even YouTube, whose success was spiked by playful videos, is becoming the go-to educational resource and the place for students to post their term projects. These and many other initiatives are based on the collect-relate-create-donate mantra that suggests education happens when students start by collecting information, then move on to working in teams to create ambitious projects for the benefit of someone outside their classroom.

Innovation itself is getting turbocharged by going social. Open-source software projects are now taken seriously by big companies who claim greater reliability for programs that have been tested and read by millions of eyes. Open innovation is gaining similar credibility as corporate research directors who post their problems on www.Innocentive.com get hundreds of serious solutions from diverse creative types. Bloggers are influencing every profession as these self-appointed information gatekeepers post hourly updates about what's new, thereby stimulating rapid progress on emerging problems and getting a jump on the news media.

The benefits of social media participation are well understood by Obama's staff--during the campaign, they engaged 4 million donors and volunteers. To replicate their success, a National Initiative for Social Participation could stimulate effective collaborations in many professions, restore community social capital, and coordinate national service projects. The challenge is to understand what motivates participants, such as altruism, reputation, or community service. Researchers would have to develop fresh strategies that increased the conversion rates from readers to contributors from the currently typical 100 to 1 to much higher rates. Getting contributors to collaborate for ambitious efforts and to become leaders or mentors are further challenges. Coping with legitimate dangers such as privacy violations, misguided rumors, malicious vandalism, and infrastructure destruction or overload all demand careful planning and testing of potential solutions.

The huge research effort required for a National Initiative for Social Participation would tap the skills of computer scientists to build scalable and reliable systems, interface designers to accommodate diverse user needs, and social scientists to study successes and failures. The risks are substantial, but the payoffs could be enormous.

Ben Shneiderman
Department of Computer Science
University of Maryland
College Park, MD 20742, USA
E-mail: ben@cs.umd.edu

Note

1. To participate in this initiative, join the Facebook group named iparticipate.