

Visions of What is Possible with Sharable Socio-technical Infrastructure

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Technological innovations resulting in socially oriented information systems and user interfaces have become ubiquitous in recent years. These systems create an extensive socio-technical infrastructure that could, and should, be utilized for the greater good, by promoting collaborative actions that focus on national priorities such as healthcare, energy and political participation. For example, existing social media technologies that were initiated for discretionary and playful activities can be repurposed and utilized to produce profound societal transformations.

Our vision of technology-mediated social participation is based on the presumption of an infrastructure that enables access for all citizens. Working with this assumption, we present a conceptual outline of the types of socio-technical infrastructure that are needed in order to promote and improve social participation, as well as the kinds of venues for social participation that may emerge from this infrastructure, and how we can encourage their emergence. Many such venues may be imagined, each associated with different communities of interest or varying policy goals. There are many precursors already in existence that make it even easier to imagine venues that could enable very broad social participation.

Our work corresponds with that of the other reports in this issue on Technology Mediated Social Participation that have discussed the theory and design of social systems for civic participation. While some of the concepts that are discussed by the different groups resonate, as design, theory and practice are interdependent, and the ties between them cannot be ignored, our report focuses specifically on the practical implementation of specific programs that will contribute to civic engagement in a variety of levels and contexts. We discuss in particular the ethical, methodological, and infrastructure challenges associated with realizing such programs.

In the following sections we describe a series of programs that are connected by the premise that socio-technical systems are fertile grounds to cultivate and optimize civic engagement. Each program stands by itself and provides an individual lens into an area of potential research, practice and civic engagement. Yet, all programs coalesce to bring civic participation to a different level. Where possible, we link these ideas to existing efforts along similar lines, and contextualize them within existing societal challenges and national priorities.

Program 1: Domain centers critical to our nation's interests

In this research program, our goal is to use social media technologies to expand and enhance efforts in a series of specific domains that are of vital interest to our country. This program would use best practices in development and use of these technologies: both applications and infrastructures. We present a list of domains we believe to be central, offering brief examples in which social media technologies could increase and improve citizen participation.

Our vision is to establish domain centers—that exist both physically and virtually—which would be far more comprehensive than data clearinghouses. We propose centers that would operate as fully-functioning collaboratories (in the sense of Finholt & Olson, 1997), with a core of experts and staff in-residence, as well as drawing on experts who are distributed around the country. The domain centers could be networked with a broader set of collaboratories on Technology Mediated Social Participation. These domain centers would house top domain experts, some as permanent staff and some as visiting researchers rotating through the centers. Academics could visit the centers during sabbaticals, Each center in this way would operate as an open system continually drawing in new state-of-the art knowledge by local and distributed experts. Social media would be instrumental in the operation of these centers. The following are descriptions of two domain centers to illustrate how social media might be used to provide services.

Healthcare. At the time of this writing, the U.S. Congress has recently passed a bill on healthcare reform. Though citizens may still be divided on the issue, we feel that we can build on the momentum of interest in improving healthcare fueled by the bill's debate, by establishing a domain center focused on healthcare. This center would involve citizens, healthcare professionals and technology experts to collaborate and use social media tools to improve healthcare knowledge and treatment outcomes. Examples of existing social media tools that could be used in such a center include social networking sites, chat tools, and audio/video links, where people can ask questions of healthcare professionals and other citizens, receive the latest medical research results, share experiences, compile and monitor personal health records, and provide support. This center could provide valuable information to people living in remote areas. For example, a person residing in Montana may desire a second opinion concerning a cancer treatment. This person may live far from a nationally renowned cancer treatment center. The domain center could serve as a central hub, connecting this person with a doctor either at the domain center or routing a patient to another site, such as Memorial Sloan Kettering.

Civan and colleagues (Civan et al., 2009) emphasize the importance of using social media to enable patients to locate appropriate expertise, offering a number of potential innovations within this space. There already exist comprehensive healthcare websites where people can find current healthcare information such as that developed by the National Institute of Health (<http://health.nih.gov/>) or the Mayo Clinic, which offers a symptom checker (<http://www.mayoclinic.com/health/symptom-checker/ds00671>). Another good

site is www.webmd.com. However, these sites are not interactive; they only publish information. Countless online medical communities fill the gap felt by patients wanting to share and discuss medical information, such as for parents of autistic children (<http://www.mdjunction.com/autism>) or for those struggling with obesity (http://www.obesity.org/login.asp?rdrtpg=forum_home.asp). WebMD provides high quality general advice. These sites tend to be interactive but lack facilitation by healthcare professionals. People can use Google Health to organize their medical records online and share them with medical providers (www.google.com/health). The site www.breastcancer.org approaches is a step toward an interactive model, allowing for discussion boards, chat room, and ask-the-expert capabilities. Yet, to our knowledge, the existing resources are disparate and no one center exists where people can access the latest medical results and also participate by sharing experiences and providing support, get information about medical trials, interact with professionals, record and archive their personal records or receive expert medical advice. Such information is currently fragmented, with no oversight by experts. We believe that a healthcare domain center would fill an important gap needed by the country.

Natural disasters. Over the last decade, the U.S. has experienced catastrophic disasters: 9/11, Hurricane Katrina, the Red River flood, and southern California wildfires, to name a few. The Natural Hazards Center, located at the University of Colorado (<http://www.colorado.edu/hazards/>) maintains an Internet-based clearinghouse for information related to disasters, such as research publications and workshops being held. This information is a one-way broadcast from the center and does not support interactive discussions. At the same time, researchers are starting to realize the value of social media tools in enabling citizens to respond to disaster, which not only helps emergency response, but also helps citizens in being resilient (Mark and Semaan, 2008; Palen and Liu, 2007). We envision a national center that acts as a collaboratory where experts can interact with policy makers and practitioners to improve disaster response. This center would function not only as a research center and repository for information generated by academics and government officials, but could also serve to facilitate the exchange of information by citizens, especially during crises. We view social media as playing an important role in the functioning of the center. The use of social media by citizens can provide firsthand information on the state of the disaster. For example, during a disaster, Twitter feeds from citizens experiencing the disaster can be directed through the center and fed to emergency responders who can provide aid. Satellite maps can be updated by citizens to give current neighborhood and road conditions. This center can also provide online support for victims of disasters, such as by connecting them through social networks or by providing forums. Group interaction has been shown to be an important factor in helping people cope with and recover psychologically from disaster (Hoffman, 1999). Through social media, survivors can receive emotional support nationwide. This center can also serve as a notification center for early warnings and alerts, and assist in the coordination of information to aid emergency response workers. Importantly, this domain center can collect data on

the citizen and government response to disasters and these data can be used by researchers to improve rescue and survival efforts.

We have described two representative centers, to illustrate that there is a lack of comprehensive information gateways where citizens can go, to interact, receive state-of-the-art information, form social networks, where academics can collaborate on research, where professionals can share best-practices, and where policy-makers can receive comprehensive information. Other centers that we propose as candidates include those focusing on topics of:

- Energy
- Education
- Culture/diversity
- Political participation
- Environment/climate
- Citizen Science
- Economic health
- Public safety
- Globalization and development
- Local civic involvement

While in principle each of these domains could be developed independently, there are many overlapping issues for which we feel would justify the creation of a ***coordinating center***. This is inspired by a comparable coordinating center in the large NIH-Funded Biomedical Informatics research network (BIRN; see J. Olson et al, 2008, as well as www.birncommunity.org). This coordinating center would synchronize efforts to develop or select social media, ensure APIs that open up participation, create appropriate research infrastructure, help with sharing best practices, oversee IRB issues, and monitor ethical issues.

The domain-specific centers would provide a variety of broader impacts through engaging a wide variety of people in ways that can transform the U.S., such as leading to a nation that is 1) healthier, and changing health practice from reactive to proactive, 2) more energy efficient, and more aware of energy-saving practices, 3) better educated to reduce the education divide that exists within our own country, 4) more aware of cultural diversity which could lead to better relations among citizens, 5) richer in political participation at local, state, and national levels, 6) economically better off, 7) safer for the public, 8) encouraging citizen participation to mitigate effects of disasters, and 9) leading to better relations among the U.S. and foreign countries.

However, to establish such centers we first need to address several fundamental issues that are critical to their success. Some of the issues have been identified, such as: How can we increase citizen participation? What is the role of sensors? How can large data sets be effectively managed? How can we address IT literacy? What type of data infrastructure is needed to manage the information? What new laws or

policies are needed to govern such centers? Other issues are yet unknown and will unfold as the centers are conceptualized and developed.

The ethical concerns of such centers deserve special mention. These ethical challenges can themselves be research topics since dealing with data and people on such a large scale is unprecedented. A major concern involves data security and privacy: how will the data be managed and stored, and who will have access to it? How can citizens be assured that their data will be used in an ethical manner? How can researchers be assured that data is trustworthy and reliable? If research investigations are conducted, how can human subject protections be obtained and enforced, especially when dealing with data on such a large scale? A human subjects review board may need to be established as part of the coordinating center to oversee protections. These are important questions that arise with the establishment of such centers and require serious consideration.

We envision these centers as permanent, and continually evolving. With a staff for each center of about ten senior professionals including administrative staff and technical support and programmers, along with about a dozen graduate students, it could cost about \$5-10 million per annum. The centers could also fund academic research, awarding grants. Each center would have the goal of changing the nature of practice and understanding in each domain. We would expect each center to engage a large number of participants from many walks of life: academics, practitioners, and the general public. We would expect each center to be dynamic, able to adapt to changing circumstances and models of participation.

Program 2: National initiative in media literacy

Our second program involves establishing a national initiative in media literacy. We focus here on the ethical and infrastructure issues involved. Why is media literacy important? Media literacy is defined as the ability to access, critically analyze, and create information across a variety of forms (Aufderheide, 1993). Media literacy is a pre-requisite for active and informed civic participation through a social media infrastructure. To achieve the national goals set in the previous and following programs, we need to ensure that citizens are educated in the effective use of media. The options available for types of media keep increasing. In our current digital information age, it is critical that we educate our citizens to be able to have critical thinking skills regarding how media and information can be sought out, compared and contrasted, combined and used. This program aims to do that.

Media literacy can have a broader impact beyond the individual. The Grunwald Declaration (UNESCO member countries, 1982) recommends establishing comprehensive media education programs at all education levels¹. Supporters see media literacy as a means for people to engage in "*participation, active citizenship,*

¹ http://www.unesco.org/education/pdf/MEDIA_E.PDF

competence development and lifelong learning" (Martinsson, 2009, p. 3). According to a World Bank Report in 2009, media literacy *"can strengthen the public interest to improve socio-political conditions, enable citizens to participate actively in public discussions and deliberations to affect change, and empower citizens to fulfill their rights and obligations. It also contributes to the governance reform agenda by identifying corruption and demanding transparency and accountability"* (Martinsson, 2009, pg. 5). The current use of social media by Iranians to challenge governmental policies in Iran is a good case in point.

There are some precedents for media literacy initiatives such as The Center for Media Literacy which originated in 1977, the Massachusetts Coalition for Media Literacy formed in 1995, the National Media Literacy Conference held in 1996, and The National Association for Media Literacy Education (formerly AMLA), established In 2001. The Media Literacy Clearinghouse is a website that offers resources for K-12 teachers (<http://www.frankwbaker.com/default1.htm>). Interestingly, there is no interactive feature to this website. Despite the various initiatives to promote media literacy, these efforts are ad hoc and there is no centralized authority that exists to mandate or develop media literacy programs. K-12 school districts develop independent curricula and are thus diverse in their approaches on how they teach media literacy (Hobbes, 1998). Our view is that media literacy needs to be taught not only in K-12 grades, but also in higher education institutions and in the broader community, extending, for example, to employees and senior citizens. Media literacy involves not only developing critical skills in interpreting and creating media but also an awareness of laws and practices, e.g. copyright laws, illegal downloading from the Internet, malicious behavior, or Internet censorship by governments and institutions.

We propose the creation of a national initiative in media literacy. Such an initiative would have a number of elements, such as education in social media, e.g. on what data to share and what are the consequences of such sharing and the ensuing over-exposure (Tidwell & Walther, 2002). It would also cover effective teaching tools, different cultural perspectives and diversity (a magic mirror), and curriculum development in K-12. This initiative can influence the general social survey to include these media factors, and can include the creation of a social media division in the Department of Education. The Obama administration already has a Federal Communications Commission Diversity "Czar", who can take an active role in facilitating this program.

As part of a media literacy program, it is critical to educate the public on ethical behavior of media use. For example, students in K-12 and in universities might be required to do a tutorial that addresses issues of plagiarism, deception, false identity, malicious Internet behavior, media-sharing, use of copyrighted material, data privacy, spamming, and so on. We advocate that Internet Service Providers should offer tutorials on ethical behavior to their customers. People could also be educated on legal issues concerning Internet use. In the physical world, crimes are

tried in the jurisdiction where they were committed. But with Internet use, where exactly is the jurisdiction?

Our envisioned goal would be to create media literacy activities in every middle school in the U.S. Mindful of the fact that K-12 education is largely under the control of individual states, we would expect to create demonstration programs at a select few schools, with the intent of showing others the value that such a program can have. We also envision media literacy instruction as a required part of university curricula. A media literacy initiative could spark the development of more research in the ethical use of media. The University of Washington School of Information already has a research program on Ethics and Information Policy. A possible future extension could include adult education programs.

We feel that this program has many broader impacts. The current generation of students, sometimes termed “Digital Natives” (Palfrey & Gasser, 2008), are entering a world that is defined by online social participation, yet many of them lack the critical skills needed to safely and constructively navigate this online world. This program will train a whole new generation of students to be able to effectively and ethically use social media. The nation can use such literacy to facilitate the future economy. Citizens would have a better understanding about informed consent decisions and the implications of their participation in social media projects. Information would become more accessible and understandable across all generations. Responsible and effective social media use can increase education on a global level. Savvy media use could reduce the amount of irrelevant information including spam. Media literacy can empower users to make better choices and can facilitate peer education. High media literacy could perhaps even increase the standard of living of many citizens.

Program 3: Person-to-person diplomacy to promote peace, reduce violence, prevent crime

In our third program we plan to develop an initiative based on the assumption that person-to-person diplomacy, or so-called “soft diplomacy,” could be an effective way to achieve such important civic goals as peace, and reduced violence and crime. Soft diplomacy concerns people’s ability to shape others’ preferences so that they want to seek shared objectives (Nye, 2004). Our view is that social media can be important tools that citizens can use to engage in international discussions concerning diplomacy and peace. Through social media, people can share cultural experiences and political views which can break down social and cultural barriers.

This initiative can use social media for conflict resolution at the local, or even national levels. According to the Global Peace Index, in 2009 the U.S. ranked 83rd out of 144 countries based on a composite metric of peace which considers both

internal violence and participation in wars². The fact that 82 countries are ranked more peaceful indicates that the U.S. has vast room for improvement.

At the international level, the U.S. government has already started to promote soft diplomacy initiatives using social media. The U.S. State Department's Educational and Cultural Affairs Bureau engages in soft diplomacy through blogging and the use of Facebook, and through sponsoring a public contest using YouTube videos to answer the question, "Democracy is..."³ Another example is the U.S. Institute of Peace which has a Center of Innovation for Media, Conflict and Peacebuilding which hosts a clearinghouse for resources related to conflict resolution (<http://peacemedia.usip.org/>). Still another example is the Peace and Collaborative Network Development, which is a clearinghouse for information on conflict resolution and related topics, including blogs and forums, that targets an international audience (<http://internationalpeaceandconflict.ning.com/>). Stanford University has established the peace dot network where organizations can share information relating to peace initiatives (<http://peace.stanford.edu/>).

Though these examples are a fine start we envision an initiative with far more communication and data sharing than clearinghouses offer. We envision a web-based system where individuals could find others and engage in dialogue at a global level. We would like to create a social media enterprise that would encourage person-to-person interactions across a diversity of economic, ethnic, and national boundaries. From the U.S. perspective, the hope of such an initiative would be to alter the perception of Americans abroad. Such an initiative would have several important broader impacts such as improved international relations, increased trade, potentially less defense spending, reduced domestic crime, and a lower level of violence at local, national, and international levels. It would also be important to explore emerging tools to support linguistic and cultural translation and education.

Program 4: A continuous national snapshot

The goal of this program is to design infrastructure to allow individual citizens to post census-like information. Unlike the actual census, which gathers such information once every ten years in the US, this activity would be continuous and ongoing. The information that could be collected is quite broad. National perceptions can be captured such as the mood of the nation (see www.wefeelfine.org), the economic and political outlook of the nation or feelings on national security. Trends can be captured such as the health or diet of the nation, or what the country is reading or buying at the moment. Demographic and statistical data can also be captured such as concerning disease outbreaks, population, ethnicity, employment, and income. There are of course daunting issues, such as how to protect privacy and pitch this to citizens so they do not fear "big brother"

² <http://www.visionofhumanity.org/gpi/results/rankings.php>

³ <http://www.google.com/hostednews/afp/article/ALeqM5gUJy-NE8XUQeOjtq1N0ZUlmZcEkw>

issues. Issues of accuracy and timeliness would also need to be addressed. But much information could be gathered in an appropriately anonymized, aggregated fashion to minimize privacy concerns. Human subject protections would have to be designed and enforced. People already enter significant amounts of such information on sites like Facebook, Google, Yahoo Fitness, and Amazon. This effort would need to find a way to work cooperatively with such sites, while maintaining appropriate privacy filters. Another challenge would be how to manage the enormous amounts of data that such an effort would generate. Similarly, policies for accessing such information by researchers, policy makers, and government would need to be worked out. We foresee a mix of explicitly shared data and information that can be inferred from activities. There clearly would be a need to ensure that participants understand the range of kinds of information that are being collected.

Let's briefly examine the example of We Feel Fine (Kamvar & Harris, 2009). They gathered user-generated, publically available text from such sources as [LiveJournal](#), [MSN Spaces](#), [MySpace](#), [Blogger](#), [Flickr](#), [Technorati](#), [Feedster](#), [Ice Rocket](#), and [Google](#).. They then looked for phrases that included words like "I feel" or "I am feeling", and then catalogued what was referred to in these phrases. They find between 15,000 and 20,000 such phrases each day. The resulting analysis of such phrases gave them a broad sense of the emotional climate of those who chose to comment about things on line. They catalogued everything from reactions to public figures to feelings about the economy, religion, and personal moods. In this case no new data were collected. Furthermore, while they published a snapshot in their recent book (Kamvar & Harris, 2009), the project is ongoing, so they are gaining a continuous stream of impressions of the mood of the country (www.wefeelfine.org shows the updates). This project provides a concrete idea of what might be possible.

While it is unlikely that such a program would result in an exhaustive sample of all citizens, appropriate statistical principles could be invoked to correctly weight the information collected so that a reasonably accurate portrait of the citizenry could be constructed. Such statistical sampling methods have been discussed with respect to the decadal census, though it has been controversial, and critics have argued that the Constitution requires an "actual Enumeration"⁴. However, this ongoing "snapshot" that we envision would not replace the constitutionally required decadal census, but would rather supplement it and give a moment-by-moment snapshot of the citizenry.

There are serious issues about who would have access to such information. One could imagine such information could be used for nefarious purposes, by identifying vulnerable regions in the country or issues ripe for exploitation for ideological or even terrorist purposes. Clearly, extensive ethical and moral discussions would need to take place on an ongoing basis for this project.

⁴ [Article I Section 2 Clause 3](#)

The broader impacts of such an ongoing snapshot of the citizenry are numerous. If already existing data sources such as Facebook or other sites were used, supplemented with opt in information, such a continuous snapshot would be relatively inexpensive to create. Applications could be created for mobile phones. Data could also be captured with sensors. Assuming a broad range of data sources would be tapped, information about manner of social trends could be obtained, including things like epidemiological information. Resources could potentially be allocated more effectively, and interventions necessitated by, for instance, epidemics could be based on real time data.

One of the major challenges is in managing and storing the data. If we imagine that 100 pieces of data is gathered each day from 300 million Americans, this could result in upwards of $\frac{1}{4}$ petabyte of data per day. Funding programs could be designed following a model of a “protocol stack” to address different levels of the data that correspond to NSF programs. For example, there could be a program to address the low level to research plumbing, data storage, and transmission: (CNS); a program at a slightly higher level to address archiving: (IIS / III); at the intermediate level to address efficient data management and distributed query processing architecture: (GRID), (CISE / CCF), and at the high level concerned with metrics, scales, privacy, data mining: (HCC, SBE).

This envisioned national snapshot could provide detailed information with a high level of accuracy. For example, it could provide knowledge of the economy at the same level of accuracy as can be derived about the economy in the virtual world, Second Life. While this project could potentially be expensive, say in the range of \$1B, it would only be 1/10 of the cost of conducting the decennial census, which is \$10B every ten years. The information gleaned from this continuous snapshot could save the country money through fast response to trends and improved allocation of resources.

Program 5: Role of network factors and how they relate to success; one focus can be innovation

This proposal would be for a large-scale research project on how characteristics of networks relate to innovation and success. Too often we tend to focus on individual creativity as a source of innovation. But collections of people can also innovate, though we do not yet sufficiently understand what characteristics of such collections create the most hospitable environments for innovation. The effort would not just focus narrowly on innovation, but would look at how social networks bring innovations into practice. We would want to examine this in the context of global networks, as increasingly entrepreneurial activities span the world. This is also a time when many things at the global level are in flux, as countries like China and India have become important sites for innovation.

There are interesting challenges in such an effort. There are issues of value systems, such as the primacy of individual performance in academic advancement. Could a change be brought about that would highly value participation in cooperative ventures? Similarly, we would want to engage students, from which will emerge the next generation of entrepreneurs. Some initial attempts to encourage student creativity through contests have had some success (Madrilejo, in progress). This effort is an ideal place for the National Science Foundation to take some initiative.

The broader impacts of this program would be to accelerate the pace of innovation and to encourage much wider participation in innovation, especially among young people and students.

Conclusion

We have reviewed a series of programs that could facilitate a wide range of participation by citizens. While there are a number of social, technical, and policy issues to work out, there are enough early encouraging signs to suggest that with focused efforts many of these could be realized. Obviously, there are many research issues involved. But the potential payoffs to enable technically-mediated social participation could be substantial.

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