How the Future of Governance can be Shaped by Cyberinfrastructure

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Abstract

How we align our policies and governance structures with our values is a choice, and with the advancement in technology, it is a choice that we should reconsider. One of the longest held traditions in government is coupling governance structures and geographic space. However, advances in cyberinfrastructure and increasing ambiguity in notions of community allow for a new approach that relaxes the constraint of geography and instead focuses on governance through individual interactions. Novel instances of such governance already exist and are regularly emerging in distributed organizations and online spaces. The result is overlapping, complex, networked structures that foreshadow the opportunity to evolve formal governance through the mindful design of cyberinfrastructure. The question posed in this paper is not why geography and policy are intrinsically linked, but rather what is the best design for a technology-enhanced governance infrastructure that serves citizen needs and preferences. The paper explores lessons from the governance structure of an online community. It documents that community's ability to leverage information technology to enable populations with different agendas to co-exist within the same "space" without unnecessary conflict, while tailoring the space to the unique preferences of each participant. It also extends the governance lessons to other potential structural "inefficiencies" based in federalism and the country's electoral system. The paper previews a research agenda aimed at advancing the use of cyberinfrastructure to improve governance.

I. Structural inefficiencies

When the U.S. government was initially designed, one goal was to maintain the ability to represent diverse values through decentralized policymaking. In federalism, a collection of strong states could act as laboratories for different approaches to governance and policy (Anton, 1989). A decentralized structure was partly intended through institutional design; however, it was also necessary because of a large geographic space and limitations in communication technology. In the 1700's the printing press was developed and some have argued it was a primary enabler of democratic forms of government both in Europe and the United States (Malone, 2004). Echoes of the relationship between communication technology limitations and governance can still be seen in some of our early conventions. For example, the initial scale of the county jurisdictions was defined as the distance a person can reasonably walk in a day. To give everyone a path to government representation despite communication limitations, hierarchies of elected officials were used to aggregate their constituent's voice within policy deliberations at all levels of government. Unfortunately, as the United States grew, the distance between an average person's voice and their representation also increased. It is no surprise considering the population of the U.S. at the time the Constitution was designed, about two million people, is similar to the current number of employees at Walmart, the U.S. prison population, the city of Houston, or the number of unique visitors to Amazon.com every day.

Other global trends besides growth are also decreasing the efficiency with which our current governance infrastructure can reflect the needs of its participants. Over time diversity in cultures, preferences, and tastes has increased; populations and individuals have become more mobile; and new technologies promote interactions that were unforeseen two hundred years ago. People's daily interface with government, businesses, and regulated markets spans jurisdictions.

Within an hour, an individual can use local services while purchasing tax-free items from across the country as gifts for their international colleagues before gambling real money in cyberspace. Such diversity in the communities that we participate highlights the challenge of a government able to represent the preferences of each individual. At the population level, increasing diversity along previously unrecognized dimensions make traditional governance structures less efficient at representing and adapting to the complex and nuanced political space where we interact.

Changing in parallel to how we interact is an underlying cyberinfrastructure that enables new individual and collective behaviors in all levels of society. Cyberinfrastructure (CI) is the collection of digital and Internet-based technologies and systems, people, policies and relationships that support the activities of work and other interactions. CI coordinates use of foundational technologies (high performance computing resources, cloud facilities, specific instruments), access to data (digital libraries, institutional data repositories, archives), and contact with communities (other individuals and communities, funding agencies, and audiences). Functioning CI is invisible in this social and technical support system because it promotes interoperability, data and metadata standards, transparency, and collaborative environments. Before exploring how advances in cyberinfrastructure (CI) can shape future governance designs, we briefly explore four dimensions of increasing structural inefficiency with our current systems of governance.

Inefficiency 1: Policy tied to fixed geography that does not represent the interaction of people

Currently many policies use a fixed scale of a jurisdiction for a fixed period of time. Traditional geographic distinctions are being challenged along three dimensions: within, between, and across the spaces. In regards to the ***within*** dimension there are minority groups that might have some

geographic density, but are not sufficient enough to be accurately represented by current representation systems. For instance, a liberal university community in a conservative region might have stark differences with the values of their surrounding community, but have little influence in the policies under which they are governed. In regards to the ***between*** dimension, many resource and transportation policy challenges cross state boundaries. The concept of megapolitan is an example of addressing such trends. Managing water resources along the Colorado or Mississippi Rivers or the Great Lakes region illustrates challenges that are inherently inter-jurisdictional. Another mismatch between geography and interactions is evident in barriers to the adoption of a regional rail system because of the lack of appropriate government structures to proactively plan and negotiate alliances. In regards to ***across*** spaces, many communities are communities based defied not by their location, but through their interactions or similarities. Some examples are research collaborations, business franchises, and religious organizations. While there might be an association between a space and the activity, the identity transcends local, state, and national boundaries. Uncoupling policy discussions from specific geographically bounded governmental units allows for consideration appropriate to scale, shared best practices between geographic areas, and more cooperation on dispersed geographic scales.

Inefficiency 2: Unrepresentative aggregation of diverse people into one voice

To accurately understand the diversity and potential of American, we have to divorce ourselves from the notion that the United States are really united. The enduring fabrication of the will of the people by the media and policy makers created institutional frameworks that unnecessarily tried to unite us through processes designed to create an artificially unified voice (Catlaw, 2007).

This inevitably led to the disenfranchisement of minorities, immigrants, the poor, and our youth. Our rule of law is both a reflection and enabler of culture and when it goes beyond basic human protection and service, it unnecessarily imposes the characteristics of one culture on another. A winner take all election does not reflect the diversity of cultures or approaches to problems that exist in the country. The challenge does not stop at looking beyond the current majority. Most of the time when we talk about majority and minority, the minority in question is simply the second largest majority of the region, but not a balanced view of all the fall outside of the immediate attention of the media. A political example might illustrate this point.

While a democratic win might frustrate the republicans, it can outright marginalize people that identify with third and fourth parties. What if, in our last election, the people who voted for Obama would get Obama and all his policies, and the people who voted for McCain would get him and his policies and the people who voted for Nader or Paul would get those people and policies? That our vote was not a signal for who we wanted to win, but that our vote was each of us opting into the types of policies that govern of lives and that we were financially accountable for our decision. While it might sound absurd, think about a world where the policies of Obama, McCain, and others could co-exist. For instance when individuals that decry taxes could choose to decline the proposed education benefits for a tax credit. The notion that we need one best policy is a consequence for how we have chosen to organize politically. While such mechanisms made sense in the past and currently make for good TV, it is an inefficient way to design policy that has very significant consequences for civic participation. Technological improvements give us the power to allow policy options to coexist without unnecessary friction or conflict. We increasingly have the ability to participate in the deliberation of specific policies

that were crafted with an understanding of the tradeoffs of costs, privileges and responsibilities inherent in all policy choices.

Inefficiency 3: Bundling of disparate values into broad political parties

As a consequence of the winner take all electoral system in the United States, gaining a majority of votes requires the strategic shut out of third parties (Lijphart, 1994). The two party political system, by its very design cannot accurately represent an individual's political diversity nor maturation of preferences. Indeed, not even the leader of the Republican Party agrees with all of the tenants of the republican platform. What chance do any of us have to find a party that matches our beliefs and how much individuality do we give up just to be heard? A recent article lamented that no one represents America's center (Feehery, 2009), but it would be more accurate to say that our current system of representation is designed so that no one can be completely represented. While the advantages and disadvantages of plurality elections are debated, its suprastructure does not need to limit the decision-making mechanisms used in other organizational forums of public action. For example, preferential voting where citizens rank their selections among a number of options can allow for a more nuanced expression of policy preferences than a simple dichotomous choice. Preferential voting is currently used for some political elections, most notably in Australia (Grofman & Lijphart, 1986). However, the ease with which these more intricate "ballots" can be designed and tabulated increases when implemented through a CI.

Inefficiency 4: Stifled policy innovation by limited variation and slow feedback cycles

Although the federalist system allows for policy experimentation at the state level, the current structure offers limited opportunities for innovation that could better match citizen preferences.

Policy experimentation and variation are necessary ingredients for the evolution of robust policy options that are adaptive to changing problems (Cohen & Axelrod, 2000). Yet variation among states represents just a fraction of the potential variation in policy solutions. Outside of jurisdictional boundaries, solutions could be proposed at the organization level, such as in community-based nonprofit programs or in online social collectives. For instance, a recent state health program allowed communities to approach the problem definition, the solution and the implementation in various ways. The social implications, the financial burdens, the institutional support, and the official policies devised were unique from one area to the next, let alone the difference from programs in other states like Vermont, Utah, and Puerto Rico.

If variation were allowed to expand past conventional boundaries, policy innovations would still be unnecessarily crippled in the current structure. For policy systems to benefit from the efficiency and effectiveness of evolutionary dynamics, fast and accurate feedback on how the policy intervention affected the problem is necessary (Cohen & Axelrod, 2000). There are several ways that policymakers and citizens gather feedback on a policy intervention, the most formal being legislation that includes an evaluation component to directly assess the program/policies impact. However, the incremental nature of policy implementation and evaluation means that feedback and communication of that feedback is slow (Lindblom, 1959). With different organizational units experimenting with solutions and gathering information on the effects, overlapping, complex, networked governance structures are necessary and are now made possible with CI.

These are four dimensions of the United States governance structure that appear inefficient in light of technology that has changed the way we live and changed the potential for communication. Recognizing these inefficiencies is facilitated by understanding how online

communities are structuring their space to promote participation and to better represent participant preferences.

III. How some online communities are leveraging cyberinfrastructure to reduce inefficiencies

Governance in one form or another exists in many contexts outside of traditional government settings. Online communities, a community of people that interact primarily or exclusively through the Internet, have developed governance structures that function primarily through this central component of the country's emerging cyberinfrastructure. We argue that new governance capabilities are possible through CI because mechanisms that can process large amounts of information are harnessed and applied with an individual focus. In this section the design of Slashdot.org is used to demonstrate some new approaches to participation and governance, which reduce the inefficiencies described in the previous section.

As the cost and ease of communication decreases, we can collect and share more information than ever before. However, we are limited by how much information we can attend to, creating a form of attention economy where mechanisms for allocating scarce attention resources are highly valuable (Goldhaber, 1997). New technologies are being developed to collect, process, and make relevant, as much information as possible, as efficiently as possible. To provide a website user added value for the attention they have invested to participate in an online community, there is an incentive to be receptive to their needs. Additionally, online communities have a key feature that clearly differentiates them from traditional communities. If an online community is not meeting the needs of its participants, the participants can leave and join a competing community. The marketplace in the attention economy is thus challenged to

better reflect the needs of its participants and in doing so, new mechanisms for responsive governance have emerged.

Slashdot.org is an online community dependent on user-generated content to provide "news for nerds, stuff that matters." It has 5.5 million unique users per month (Kirkpatrick, 2006). Slashdot posts a new story nearly every half hour and while the content is interesting, what makes the website unique is a combination of its enormous and highly educated user base who post comments on every story and the CI the site uses to meet its community's needs. A popular story on Slashdot will average hundreds of comments, an unrealistic number for any user to read. To address this challenge, Slashdot deployed a *distributed moderation system*. Unlike a centralized moderation system where site administrators evaluate the quality of comments based on established criteria, the system allows a diverse population of experienced participants to rate the quality of the posts they read, pushing each one higher or lower in the queue. As high quality posts are rated up, it is easy to spend your attention reading only those posts by browsing through just the first few comments.

In the online community, CI was designed to create a form of distributed governance that enabled populations with different agendas to co-exist. Slashdot does this by allowing users to tailor their profile to represent their individual values or reasons for participating in the community. For example, a user can increase or decrease their rating of stories that are funny, informative, interesting, and provocative, in any combination that represents their interests. As a result of user preferences interacting with the distributed moderation system, each user perceives that the community represents his or her own interests. Our previous research on Slashdot found, using cluster analysis, that there were indeed different types of users present in the same space (Lampe, Johnston, & Resnick, 2007). Based on how users tailored their profiles, we categorized

four types of users as *gem seekers, rating suppressors, free thinkers,* and *muck rakers*. Users that were interested in funny comments read, evaluated, and were shown the funny comments. If Slashdot was centrally moderated and just focused on funny comments, or had a winner take all policy to decide what type of comment to give preference, it would risk disenfranchising the other types of users that visit the site. In this example, the information seekers, free thinkers, or muck rakers would find less value from the site and would probably stop participating. Consequently, the CI design on the site was a novel governance structure that reduced unnecessary conflict, adapted to individual users and subgroups, and embracing healthy deliberation. A user's incentive to participate in the community was closely aligned with their experience in the community and Slashdot has remained a uniquely healthy and sustainable online website.

There are other technology-based governance features within the Slashdot community that are worth noting and investigating. One is that participation through voting is earned in the community. While everyone can read and post comments, Slashdot administrators created a *Karma* system to determine who could vote on the quality of others' comments. If a user posts a comment that is ranked up by others, their *Karma* increases. If a user reads a large number of stories, their *Karma* increases. Once the *Karma* increases to a level set by the site administrators, the user can vote on the quality of other users' comments. An earned participation approach would challenge our working assumptions of the social contract and have some interesting consequences if applied to traditional elections.

A second interesting feature is that the site design is user focused and dependent on the emergent properties of the community to function. The founders of Slashdot quickly realized that the site would grow beyond what they could manage independently. Instead of hiring additional

administrators, they decided to allocate the tasks of finding, categorizing, and moderating new content to the community at large. Some local, state, and national government projects are also attempting this approach with exercises in participatory budgeting (Vaz, 2008), open source problem solving (Schweik, Evans, & Grove, 2005), and open government brainstorming (National Academy of Public Administration, 2009), just to name a few.

The dynamics described in the Slashdot community are only possible because of the cheap cost of communication, advances in individual information tracking, and increases in computational power to process all this information. The resources on the site (which comments are shown to each user) are tailored specifically to allocate the comments that best reflect each user's interests based on a computer algorithm and the information the user provided, much like insurance companies that calculate policies based on continually refining computational models of risk. Managing the earned participation process requires monitoring, recording, and processing all the previous behaviors of an individual on the site. Similarly, casinos are now tracking individual gamers' behaviors by tying all of their activities to individual gaming cards that must be presented to play any game or use any service in a casino. Our ability to track and communicate small behaviors changes what is possible in terms of policy. An application in health care might be to preventative health incentives of people that chose use a government offered health care program. By attending a health club 10 times a month an individual might earn a healthy tax credit.

A final dynamic of note in the Slashdot.org system is that the system administrator's role is to create and manage the architecture and CI of the space, not to pass value judgments on the content within the space. By giving up control over the specific content of the site, the values that play out are more directly related to the values of the participants and not as much guided by

the administrators. Such examples call into question the future role of public administrators within an increasingly networked world.

IV. Next steps - a multi-staged research agenda

The central aim of this paper is to challenge our current design assumptions with findings from existing research and to suggest a research agenda to understand how we can mindfully leverage advances in CI to relax those assumptions for new forms of participation and governance. To progress in our research we have identified some next steps. Through a series of surveys, we will establish the baseline of structural inefficiency based on the identified categories in section two of this paper so that we can attempt to quantify differences between approaches.

1. First, we build on existing theory on the relationship between governance and institutional design through our interactions at the 5TAD conference and a submission this fall in the *Public Administration Review* special edition on public administration in 2020.

2. A second component of the research agenda is to better understand how citizens view their participation and preference opportunities in the current governance structure. This will help establish a baseline to determine the extent to which CI can improve the match between policy and citizen preference. We propose two surveys that help quantify inefficiencies and reveal how other mechanisms for participation and preference expression affect those inefficiencies. The first survey determines how much citizens give up in terms of their policy preferences in different issue areas when they are limited to choose between two bundles of political parties positions. It also tests how various preferential voting approaches impact the end policy result. The second survey determines how citizens could use the government budget to

judge whether their participation, in the form of paying taxes, results in an accurate representation of their preferences.

3. An agent based modeling approach can be used to supplement empirical data while it addresses the set of limitations related to the difficulty of observing dynamic processes in field studies. Models of group interaction have regularly been used to test process interventions and consequences of environmental differences on group outcomes (Axelrod, 2001; Katz & Shapiro, 1985; Nan et al., 2005; Ostrom, 2000). Decentralized interactions among autonomous actors in these models can lead to system-level regularities (Holland, 1995, 1998). Results of multi-agent modeling have the potential to generate a reliable set of core design features, which subsequently can empower those involved to understand of consequences of different design tailored governance architecture to align the needs of the community to the values and participation of a diverse collection of individuals.

4. Online communities are test beds for bottom-up governance challenges. A series of prominent online communities have struggled with a backlash from the participants when administrators change user policies. For instance, in Spring 2009, Facebook users pushed back when the site changed the end user license agreement and claimed that anything a user ever posted on the site became the permanent property of the site. In 2007, another site with an active user base, Everything2.com, had a similar furor around proposed changes to their terms of use. Administrators recommended a new policy, and users both assumed the worst intentions on the part of the administrators, and organized to maintain the status quo. During the course of these discussions, it became clear that the heterogeneous user population also had diverse ideas about the goals and social contracts of the site. We will be studying both Facebook and

everything2.com to see how crisis or breakdowns reveal the underlying CI, social norms, and community identity that is sometimes planned, and sometimes developed over time.

5. We propose that online discussion systems can be built that will help citizens deliberate with one another over complex issues, and that the discussions themselves can be distilled into meaningful, contextualized information for policy makers. Researcher has shown that users participating in online political discussions can experience deliberative outcomes, that asynchronous discussions in political forums can be managed using tools like discovery agents and reputation systems, and that evaluation of a credible process during deliberations are correlated with program outcomes years later (Hicks, et. al, 2008). Drawing on some our early work in this area, we examine the development and use of the Great Lakes Wiki, a site designed with the Knight Center for Environmental Journalism that was intended to bring citizen groups, policy makers, and commercial enterprises into the same discussion space. This site was also designed to allow "citizen journalists" to report on environmental stories in their areas. Using log data, interviews with users, and content analysis of talk pages we will describe how adoption was impeded in these sites, and how these lessons can be generalized and applied to other deliberation design efforts.

6. We propose to study policies that are focused on individuals rather than geographic spaces are not new. The debate between school vouchers and open enrollment in Arizona is one example. However, the ability for mass customization of nearly everything, including policies, changes what is possible and improves how previous concepts can be implemented to better realize their potential.

V. Conclusion

Technology, especially communication technology, continues to augment society's ability to alter the basis on which we organize, interact, and govern. As we think about the future of governance, we are challenged with how to lead in contexts that are increasingly decentralized and rely on communication technology for coordination. We will witness, but should also participate in the transition from questions about how to manage government institutions to questions of how to design governance systems with the appropriate incentives and rules to harness and coordinate the enthusiasm and capabilities of those governed. Consequently, our proposed research focus also shifts from governance systems built on institutions (be they markets, hierarchies, or networks) to systems built on interaction processes.

The movement towards new forms of governance is inevitable, but the timeframe and the path are unknown. Instead of stumbling toward this goal and reacting with ad hoc governance approaches as we progress. The above research agenda is a first step toward refocusing policy and governance from geographic spaces and back to people. In doing so we can treat governance as a process of community building instead of a competition, and we can enable people and communities to opt into policies that represent their values.

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