Journal of Information Technology & Politics
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/witp20

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Available online: 14 Nov 2011

To cite this article: W. Ben Towne & James D. Herbsleb (2012): Design Considerations for Online Deliberation Systems, Journal of Information Technology & Politics, 9:1, 97-115

To link to this article: http://dx.doi.org/10.1080/19331681.2011.637711

Journal of Information Technology & Politics, 9:97–115, 2012

ISSN: 1933-1681 print/1933-169X online
DOI: 10.1080/19331681.2011.637711

Routledge
Taylor & Francis Group

Design Considerations for Online Deliberation Systems

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ABSTRACT. Online deliberation enables structured, topical discussion about particular questions or concepts. A number of Web-based deliberation systems have been independently introduced in recent years, and reported on as single-point examples. This article reviews several of these systems, focusing on the design principles behind them and how they worked out. From this literature, we distill another iteration of design considerations that can be used to design online deliberation systems to "inform the debate." These considerations focus on the mutually reinforcing goals of attracting contributions, navigating through content, improving usability, focusing on quality content, and promoting wide-scale tool adoption.

KEYWORDS. Collaborative problem-solving, CSCW, HCI, informed debate, online deliberation

FUNDAMENTAL ISSUES

Decisions about complex policy issues are often made without fully considering all the different options available and the consequences of each. Decision-makers often do not have sufficient time, resources, or background to discover and weigh all the information they need to make an informed policy decision, even when it is already present in their societies and organizations. These limits clearly hinder organizational performance, as recognized in business and nonprofits (e.g., see Brown & Duguid, 1997; Sieloff, 1999). The effects of these limitations on government include declining trust in regulatory institutions and agencies. This situation challenges the legitimacy of those organizations and weakens their connections

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The authors would like to thank Mark Klein of MIT and Robert Cavalier of Carnegie Mellon University for directly sharing their experiences in online deliberation systems and providing guidance through the process of exploration and content review.

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with the very communities that could provide needed expertise (Noveck, 2009).

Current leaders are aware of these limits and are calling for solutions to address them. For example, Obama (2008) noted that "the challenges we face today—from saving our planet to ending poverty—are simply too big for government to solve alone. *We need all hands on deck.*" On his first day in office (2009), he sent an Executive Memo noting that:

> Public engagement enhances the Government's effectiveness and improves the quality of its decisions. Knowledge is widely dispersed in society, and public officials benefit from having access to that dispersed knowledge. Executive departments and agencies should offer Americans increased opportunities to participate in policymaking and to provide their Government with the benefits of their collective expertise and information.

Leaders at the highest level in government are challenging us to effectively gather the knowledge dispersed in our societies, find an effective way to filter and package it, and provide decision-makers with access to this knowledge.

The Internet has provided new ways to create, communicate, gather, and analyze knowledge. Online deliberation, for example, can potentially draw on a much larger body of knowledge than the contributors to a policy debate have historically been able to tap. Online deliberation is a Web-based form of reasoning that gathers and carefully considers options for action and possible consequences of each, as described in greater detail below. The Internet removes temporal and geographic restrictions on communication and drastically reduces the costs of knowledge exchange and aggregation. Online deliberation goes beyond simply gathering information, allowing for new knowledge to be explored, synthesized, and vetted. In a recent introduction to the field, Jared Duval describes the current state of this technology as applied to politics: "What is waiting for us is a whole new field—figuring out how to harness our collective wisdom and power to advance the common good in a century of unprecedented challenge and opportunity" (2010, p. 228).

In order for these benefits to be realized, online deliberation tools and their complements must be designed well. What does "designed well" mean? In recent years, a number of tools have been developed and used in the area of online deliberation, collectively forming an experience that has begun to unearth important design issues and principles in this area. This article reviews published experience with online deliberation technologies and reflects on lessons learned from their design principles and applications. What did the authors of the tool consider when building their tools, and what conclusions did they draw in hindsight? Once people started using these systems, what did they think about them and what did they do? We draw on sources such as Beth Noveck's *Wiki Government* (2009), Jeff Howe's *Crowdsourcing* (2008), and *Online Deliberation: Design, Research, and Practice* edited by Todd Davies and Seeta Peña Gangadharan (2009). We followed chains of references from these texts, the four Online Deliberation conferences,[1] and from discussions with numerous individuals who are in or near the field of online deliberation. We tracked the particular framework underlying many online deliberation technologies, from Kunz and Rittel's (1970) working paper on Issue-Based Information Systems through today's Web 2.0, examining a variety of tools designed to facilitate online deliberation and related functions (such as debate, discussion, ideation, and large scale complex project collaboration). We selected projects that were within scope as described in the next section, were sufficiently different from one another to reduce duplication, and had resources yielding insight into the system's design considerations and lessons learned. A large collection of systems for online public participation is now being maintained at ParticipateDB (http://participatedb.com), for further reference.

In addition to examining individual projects, this article also incorporates design criteria and lessons learned from smaller scale reviews, such as Easterday, Kanarek, and Harrell's (2009) "Design Requirements of Argument Mapping Software" and Klein's (2009) review of ideation

tools. The design considerations below reflect knowledge gained from a diversity of systems, which can be incorporated into the design process for future online deliberation systems or upgrades of existing ones.

DESIGN SCOPE AND GOALS: ONLINE DELIBERATION TO "INFORM THE DEBATE"

Our article focuses on lessons learned from Web-based deliberation systems designed to "inform the debate,"[2] as distinguished from systems for direct deliberative democracy that seek to produce a set of binding policy decisions. These projects provide opportunities to explore a space of complex challenges, their possible solutions, and the potential consequences of each. They aim to inform a discussion about opportunities and trade-offs. They help groups of people aggregate their members' knowledge and ideas, draw connections, explore possibilities, and make more informed decisions. On the scale provided by the International Association for Public Participation (IAP2, 2007), these systems are in the Consult, Involve, and Collaborate categories.

In specifying our scope, we recognize that the term "online deliberation" has been applied to an exceptionally wide range of technologies, as described in a 2009 book edited by Davies and Gangadharan (see esp. the Epilogue, "Understanding Diversity in the Field of Online Deliberation"). For this article, we narrowly define "online" to mean "Web-based." We also define our focus on tools for deliberation, which is distinguished from the complementary process of debate as described in Hodge (2004): "Deliberation is a particular form of reasoning and talking together in which we weigh carefully the costs and consequences of our various options for action, in the context of the views of others" (p. 8). Deliberation assumes that many people have pieces of an answer to a workable solution. It is a collaborative process seeking common understanding and common ground for action, as the basis for consistent policy. It reveals assumptions for re-evaluation. In contrast, debate is an oppositional process where original solutions are put forward and defended or proved wrong. The goal is to win, by defending one's own solution and attacking the opponent's.

Deliberation can be used in advance of a debate or other decision-making process to explore an issue and its possible results, craft creative solutions to complex challenges, and vet assumptions. Deliberation can inform the content of the debate (or other process) so that the debate's positions and outcome are based on a more sound understanding of the realities of the challenge, a broader search for possible solutions, and a more thorough investigation of possible consequences (intended or unintended) than they would otherwise be.

For the purposes of this article, we define a "policy decision" to mean any decision that is intended to have effects that extend well beyond the decision-maker or decision-making group—where the set of direct stakeholders in the outcome of a decision is much larger than the set of people making that decision. For the purposes of this article, a senate's vote to temporarily adjourn is not a policy decision, but its vote on emission-limiting legislation is.

We define "complex" with the *Oxford English Dictionary*: "not easy to analyze or understand; complicated or intricate." For this article, we operationalize "complex problems" as those which no single person or small group can wrap their mind around completely, or fully understand. We believe that these are the types of problems that could be most fruitfully explored through online deliberation. This is because (a) existing approaches to decision-making, which require decision-makers to fully understand a problem, do not adequately address these problems by definition, and (b) the scale and complexity of online deliberation can potentially grow much larger and faster than the capacities of any individual or group, possibly enough to reach the scale and complexity of the problems themselves. Rittel and Webber (1973) described a "wicked" subset of these problems in greater detail, noting the particular scale and complexity issues that accompany them.

This article reviews the design principles guiding various systems for online deliberation and related functions, focusing on the lessons

we can learn from them that could be applied to online deliberation tools. The design considerations that follow comprise another iteration of ideas about how we might build online deliberation tools today, knowing what we have learned from our collective experience so far.

In our selection and presentation, we are guided by the framework for building principles provided by The Open Group (2009), which is based in part on work done by the U.S. Air Force in establishing its Headquarters Air Force Principles for Information Management (June 29, 1998), and also by the framework provided by Lindström (2006). In selecting the items below, we sought ideas that are understandable, robust, likely to remain stable, and consistent with one another. We group them into categories and provide some guidance for the interpretation and implications of each, in the context of past work on online deliberation or related fields. In line with the frameworks, these are presented at a reasonably high level. For example, the consideration to "include an effective search utility" does not specify a search algorithm or database structure.

These are general guidelines that should apply to most online deliberation systems. As noted in Lindström's (2006) description of general principles for IT systems, "The principles are not imperative; they are only supposed to provide operative directions and guidance" (p. 3). We recognize that not every item below will be appropriate in every context; for example the guideline to "identify contributors" might be inappropriate for an online deliberation system where participants could face harsh punishment for their contributions, such as a dissident group in a country without free speech. We propose that each of these items should be considered during the development of an online deliberation system, hence the term "considerations."

A BRIEF HISTORY OF IBIS-BASED TOOLS

Most online deliberation tools have roots in the Information-Based Information Systems (IBIS) pioneered by Kunz and Rittel in 1970. IBIS structures knowledge into topics, issues, questions of fact, positions, arguments, and model problems, with a designated set of possible relationships among these. By 1988, Conklin and Begeman developed a computerized graphical IBIS (gIBIS) system, for capturing small teams' design rationale. This hypertext tool visualized IBIS's structured knowledge types (issues, positions, arguments, and other) as nodes in a network, with colors, filters, and other graphic cues to indicate node and link types and help designers use the IBIS model. This work evolved into the present-day Compendium open-source software. The Knowledge Media Institute leading Compendium has more recently released a related and partially interoperable tool called Cohere (Buckingham Shum, 2008).

A variety of other tools elaborated and extended the fundamental concepts of IBIS. For example, Debategraph began in 2006 and is a visualization tool for complex debates composed of information channeled into a context-customizable ontology of IBIS-informed knowledge types (Baldwin, 2010). Massachusetts Institute of Technology (MIT)'s Deliberatorium uses an IBIS-based structure to organize content, and has various other features for rating, reputation, and user communication. The Deliberatorium has been used in topic-specific groups up to a few hundred people in size (Iandoli, Klein, & Zollo, 2009).

CONSIDERATIONS FOR THE DESIGN OF ONLINE DELIBERATION SYSTEMS

The design considerations discussed here are organized into five categories (see Table 1). In order for systems to be useful, they must (a) attract contributions, (b) make the deliberation content navigable, and (c) be reasonably usable. After considering these basic categories, we present design considerations for (d) focusing on quality content and (e) promoting wide-scale tool adoption. These five mutually reinforcing goals are discussed in turn.

TABLE 1. Considerations for the Design of Online Deliberation Systems

Design to Attract Contributions	Maintain low entry barriers for contributions of value
	Make contributions immediately visible
	Divide and conquer
	Self-selection of roles
	Well defined tasks and questions
	Overcome or accept access bias
	Accommodate but identify content bias
	Link in outside resources
	Loosen up on structure
Design for Navigability	Relate solutions to one another
	Allow hyperlink exploration, but not as the only option
	Organize content topically, rather than temporally
	Minimize or eliminate duplication
	Use visual aids to navigation
	Include an effective search utility
Design for Usability	Build clear affordances
	Stick with the principles of Robert's Rules
	Open windows to the content in many places
	Interoperate with other systems, e.g. through APIs
	Attach unchanging URLs to specific content
	Automate nonsemantic operations
	Use stable, functional, secure, responsive technology
Design for Quality Content	Identify contributors
	Maintain accountability for decision-making outcomes
	Institute an effective rating and reputation system
	Allow iterative "horizontal" interactions between users
Design for Adoption	Improve the decision-making process; don't overthrow it
	Have a "plausible promise" and achieve it
	Open opportunities for communities to form
	Open up the design process

Design to Attract Contributions

The value of an online deliberation system depends on its ability to attract participants and content. The system's design can impact the probability of receiving diverse, high quality contributions. Because diversity of thought increases the probability of finding excellent solutions to complex challenges (Page, 2008), these principles are important for bringing in not just more but different contributions.

Recent advances in automation technology have reduced the time required to do the mundane tasks of daily life, resulting in a huge "cognitive surplus" (Shirky, 2008, 2010). There is a tremendous resource of those who have time and a demonstrated interest in publicly sharing their knowledge and experience. How can we direct that energy toward informing policy decisions and attract contributions?

Maintain Low Entry Barriers

Low entry barriers are important for attracting new participants and increasing the efficiency of regular contributors' work. Many tests of online deliberation systems so far have used pre-existing groups of people, who have already overcome barriers to entry in that group. Larger-scale public examples have generally required or strongly encouraged users to complete a registration and login process before posting, as protection from vandalism. Less successful projects have had higher barriers, like the Open Source Political Party (Goffman, 2007), which required a $15 registration fee, agreement with a preset seven-point platform, and a continuing participation commitment: Any collective outcome required an affirmative vote of 75% of all registered users. Barriers such as financial cost and time requirements keep participants away,

while forced agreement with a platform reduces diversity of thought.

Wikipedia provides an example of how to discourage vandalism while making it easy for users to contribute with minimal time-and-effort cost. Vandals who spend considerable time posting deleterious content can see it all vanish in a blink through easy reverts by watchlist[3]-empowered regulars. Other options to differentially raise barriers to vandalism include temporary locks on certain content and/or users while emotions cool or vandals move on. A co-founder of Wikipedia recommends strong use of disruption-blocking technology as an important design consideration for future systems (Sanger, 2006).

Although a relatively small number of editors have contributed most of Wikipedia's edits, low entry barriers allow a large and growing amount of its content to come from individuals who have made a relatively small number of contributions (Kittur et al., 2007). No registration is required, the "edit" button is reasonably discoverable, and contributors do not need to identify the IBIS type of their contribution or even place it properly in the encyclopedia. This is in contrast to Nupedia, which was to be a free collection of articles written by experts and curated through a carefully crafted seven-step review process. The process was difficult to understand and made for slow progress, which the writers and editors recognized as a problem. "We had a huge pool of talent . . . going to waste" (Sanger, 2006, p. 315). After 18 months and about $250,000, Nupedia had just over 20 articles. At this time, most staffing attention was shifted over to Wikipedia. Built on the principles of "openness" and "ease of editing," Wikipedia announced 20,000 articles just after its first anniversary (Sanger, 2006), and five years later, made low entry barriers for contributions of value the number one priority in its strategic plan (Chen, 2011).

Make Contributions Immediately Visible

A system's visible and immediate response to a user's actions increases usability (Norman, 1988), and promptly displaying the users' work makes them more likely to continue contributing. Making even new users' contributions immediately visible lowers perceived entry barriers. In contrast, the Deliberatorium's model of requiring moderator approval (Klein, 2007) reduces overall posting activity (Rhee & Kim, 2009; Schuler, 2009).

Debategraph provides evidence that low entry barriers and content visibility increases the quantity of contributions. Each node in Debategraph has a short heading, a brief summary, and a longer body of details. The short title of an entry is all that is shown in the debate map, is the easiest to enter, and must be entered before either of the longer text areas. The summary is of intermediate visibility, appearing over nodes during mouse hovers and visible under headings in "tree view." These differentials in both visibility and barriers to contribution are present, while other factors affecting contribution (topic, site, interface, etc.) remain constant between the node's three text areas. Browsing through the Debategraph site reveals that most nodes only have the short heading, some have the brief summary, and few contributions from regular users have full details.

Divide and Conquer

The most common system design recommendation from the literature is to divide large tasks into many small, discrete tasks that individuals can choose to take on (e.g., Baldwin & Clark, 2000; Howe, 2008). For example, the successful open source operating system Linux is broken down into many small function-focused modules. Wikipedia is divided into many discrete articles and article sections that can be separately edited, in addition to offering maintenance tasks such as spelling correction.

"Atomizing" the work into manageable, discrete tasks allows participants to choose the specific areas they feel they can best contribute. In Peer-to-Patent, "The opportunity to self-select was essential to boosting involvement" (Noveck, 2009, p. 174). Self-selection of roles is an important element in building regular, devoted contributors (Jefferson, 1816). People often accept opportunities to do what they love to do. Divide the work so that each specific, discrete problem can be addressed by those who are most motivated to do so.

"The more specific the question, the better targeted and more relevant the responses will be" (Noveck, 2009, p. 171). In the context of Peer-to-Patent, the primary tasks are finding "prior art" (content predating a specific patent application), and explaining its relevance. In the context of Wikipedia, the well-defined tasks are to find and post verifiable, objective, topic-relevant information. Editors can create "stub" articles, outline a topic into sections, or annotate and request clarification of particular facts, in each case leaving very well-defined, specific questions that others can take up. Wikipedia's division of labor into millions of tiny pieces, along with its clear outlines and rules, has produced the planet's most comprehensive encyclopedia. MacCormack, Rusnak, and Baldwin (2006) provide evidence that this principle is key to a free software project's success. Online deliberation systems need to similarly allow users to define specific questions and tasks that they think would help inform a particular discussion. Other users can then see the "holes" in the presented knowledge and fill them in.

Tasks may be as simple as constructively summarizing other users' points, to further discussion and help contributors feel listened to. Kriplean, Toomim, Morgan, Borning, & Ko (2011) describe the value of reflective contributions, along with software to support them, demonstrated on Wikimedia's Strategic Planning Initiative and Washington State's Living Voters Guide.

Collaboration on the task of task definition can lead to more precise and balanced questions, even on contentious topics. When the questions and tasks are fixed by the original poster, as in Debatewise, they can deter contrasting contributions. Editable headings and question text, as on Debatepedia or Stack Exchange, are often more neutral and effective at attracting diverse contributions. At the time of writing, featured questions on Debatewise included "Space exploration is a waste of money" and "China has turned Tibet into a hell on earth" with graphic representations to match. Debatepedia's featured titles included the more neutrally presented "Underground nuclear waste storage," "U.S. renewable electricity standard," and "Airport security profiling."

Seeding a deliberation is another specific task that can help attract contributions. A work in progress is more well-defined than a new initiative, so people are much more likely to join the work in progress than to start something themselves (Shirky, 2008).

Finally, the available tasks need to be clear: "The technology should always be designed to reflect the work of the group back to itself so that people know which role they can assume and which tasks to accomplish" (Noveck, 2009, p. 19).

Overcome Access Bias

Online deliberation systems may be systematically less accessible to certain segments of a population, even those that may be most affected by a policy outcome. For example, an online discussion about extending Internet access to rural communities is much more likely to include telecom industry representatives than citizens of the communities being discussed. This bias would be more of an issue if the deliberation tool included a binding online vote than if the deliberation *supplemented* other decision-making processes.

Alexander Meiklejohn (1960) notes that demographically balanced representation "may ensure inclusion of all affected interests, but does not necessarily result in an airing of all ideas worth hearing." A discussion intended to "inform the debate" about any particular topic may attract the "microelite:" the few or few dozen people who understand a very specific topic well and who are passionate about getting involved in that topic (Oram, 2007). Diversity and quality of contributions can be more important than demographic balance if the goal is to understand an issue, formulate a broad set of ideas to address it, and consider the consequences of each option (Page, 2008).

Accommodate but Identify Bias

Individuals do not need to be both informed and unbiased in order to have fruitful deliberation. Ramsey and Wilson (2009) note that "informed" and "biased" often come together, recommending that online deliberation systems

call attention to potential biases, encourage critical evaluation of information resources, and include multiple interpretations of information so that biases might cancel out and leave decision-relevant information that has been tested and vetted against opposition (Howe, 2008).

Link in Outside Resources

Allow users to link in relevant outside resources, which can add information and make complex data easier to understand. Applicable resources include static, dynamic, or collaborative documents, presentations, images, videos, Web pages, interactive maps, graphs, charts, and other visualizations of even live data (e.g., see Tufte, 1991). Compendium stands as an example of this design principle (Open University, 2007).

Certain external resources may also help users share mental models and communicate more clearly. Sketches and gestures in face-to-face conversations can help illustrate concepts and share mental models, making verbal communication more effective. Just as in 1968, "Perhaps the reason present-day two-way telecommunication falls so short of face-to-face communication is simply that it fails to provide facilities for externalizing models" (Licklider & Taylor, 1968, p. 23). Letting people link in external tools for model-sharing can be especially important for a system designed to help large, diverse groups solve complex policy challenges.

Loosen up on Structure

Easterday et al.'s (2009) review of design requirements for argument mapping software describes this as one of the six key elements in successful design. They cite the importance of "flexible construction," the ability to enter elements in any order, consistent with a mapper's flow of thoughts. This flexibility helps divide the work: One person may enter information and another may organize it. A design lesson from Cohere (Buckingham Shum, 2008) teaches the importance of using an emergent rather than predefined structure.

Strictly typed argument mapping technologies have taught us that an overly rigid structure can raise barriers to contributions. Especially in the early phases of formulating a set of contributions, a user may be unsure of whether each particular piece of knowledge is an issue, idea, supporting point, opposing point, or other specific allowed type. Forcing a user to consider the "type" of his contribution may prompt him or her to think more deeply about the content and how it fits in, but it interrupts the user's natural flow of thoughts and may be a frustrating requirement. Some users see the distinctions between different "types" of knowledge as arbitrary and ambiguous, with multiple plausible structures and the "correct" one not necessarily clear.

Design for Navigability: Finding Content

Once an online deliberation site has attracted contributions, those contributions should be organized so that people seeking information (e.g., relevant to a policy decision) can quickly find it, and potential contributors can easily locate where their contributions fit in. This section focuses on design considerations related to content organization.

Relate Solutions to One Another

Easterday et al.'s (2009) basic design requirements include (a) allowing the user to link reasons and elements of an argument in a way that makes logical and semantic sense, and (b) allowing the user to view multiple concept maps simultaneously, so they can compare different discussions and bridge knowledge across them. Users should be able to cross-link between topics, and even between fields of knowledge, rather than imposing a hierarchy or other rigid structure. Positions can address more than just one issue, and arguments can support some positions while opposing others. This point is missed by online debate technologies that enforce a strict pro/con format, such as Debatewise and Debatepedia (Lindsay, 2009). Cohere further teaches us that links can and should be more expressive than simple URLs or lines about the relationship between those content entries (Buckingham Shum, 2008).

Exemplifying this design principle, Ashoka's "mosaic" process outlines the key barriers and ideas around specific social challenges, using a matrix to visually map innovations and innovation gaps. The mosaic-building process yields understanding of a field in its entirety and focuses attention on what's missing, framing clear discrete questions (Noveck, 2009). Observers credit this mosaic process with remarkable outcomes: Between 49 and 60 percent of "changemakers" Ashoka elects to its Fellowship have changed national policy within five years of being selected through and into this process (Drayton, 2006).

Allow Hyperlink Exploration

Once concepts are related to one another in the online deliberation system, visitors should be able to explore the network via hypertext links. This principle is exemplified in gIBIS/Compendium (Conklin & Begeman, 1988) and Debategraph (Baldwin, 2010). Debategraph offers multiple visualization perspectives on the same debate content. Its default view mirrors the Visual Thesaurus (visualthesaurus.com), where users visually navigate through a web of titled nodes until they find the topic they are looking for. They can hover over a node for a short description, and click on it for more details.

This may be a good way to navigate through a debate and help users find content they are looking for, which some people find useful (as evidenced by the volume of activity on Debategraph). However, it relies on a "navigator" model user who follows a fairly direct path to the information he or she is seeking, occasionally returning to a central hub and branching out in ordered fashion. This model user contrasts with the "explorer," who appears to have a less direct path toward a specific goal, exploring many side trails, visiting a wider variety of domains, submitting more search queries, and demonstrating high variance in his or her search trails. In describing these styles, White and Drucker (2007) specifically note that the "explorer" style may be more appropriate than the "navigator" for complex sense-making tasks.

The design of Debategraph also assumes that users navigate between resources primarily by hyperlinks, although Web surfers move between pages via links only about 62–70% of the time (Gleich, Constantine, Flaxman, & Gunawardana, 2010). This distribution was considerably lower (around 0.3) for Wikipedia, despite the site's emphasis on internal links to aid exploration. When looking for information about a particular topic, users prefer to jump directly to the information they are looking for and they do not often follow hyperlinks for further elaboration. Hyperlink exploration should be one option for navigating through content, but not the only one.

Organize Content Topically, Rather than Temporally

This makes it easier to locate specific topics, particularly when multiple concepts are being discussed simultaneously. Current online deliberation approaches that use e-mail lists, Web forums, blogs, or comment chains on blog posts and news articles often organize content according to the sequence in which it was added. This can make specific contributions hard to relocate. Temporal organization also prompts some contributors to repeat their points many times.

Minimize or Eliminate Duplication

Organizing content topically is necessary but not sufficient to minimize duplication. Cohere, most ideation tools, and one-way interaction tools such as Regulations.gov have issues with significant duplication of content, often because similar content cannot easily be discovered, linked, or merged together.

Search utilities can help users discover existing content similar to their contributions during the content preview and posting process, a duplication-reducing approach emphasized in software bug trackers (e.g., Bugzilla, bugzilla.org) and community support systems (e.g., Facebook Help). These utilities can also help a user link his or her contributions to related content, and discover new areas of interest.

A content structure that contributors can easily understand also helps to reduce duplication. Despite the tremendous volume of total content,

the very large number of unique contributors, and the lack of a rigid (e.g., IBIS) structure, Wikipedia has a reasonably clear content structure, and very little duplication. The position of each contribution within the content structure should also be modifiable, so that users can have "failure for free" (Shirky, 2008) and adjust the structure as inconsistencies are discovered or more contributions are added.

Use Visual Aids to Navigation

Easterday et al. (2009) identifies specific control over layout and visual properties to communicate concepts and relationships as a core design requirement for argument mapping tools. The use of colors, shapes, space, filters, and other graphical cues to differentiate between types of knowledge was a fundamental design requirement of gIBIS/Compendium (Conklin & Begeman, 1988). Cohere proclaims the importance of a clean, uncluttered look using "Web 2.0 design principles" (Buckingham Shum, 2008) and best practices for user interface design details, as explored in the field of human-computer interaction (e.g., Krug, 2000; Nielsen, 2000). Noveck (2009) cites "visual deliberation" (p. 71) and effective visual aids as essential in attracting contributions, providing clear navigation, reflecting the work of a large group back to the group, locating holes in order to frame questions for further work, and understanding complex topics. Visual aids can include activity maps to help users identify active topics, or comprehend different portions of a multifaceted resource. As one example, IBM's Many Bills Visualize (manybills.researchlabs.ibm.com/) color-categorizes legislative text, making complex bills more understandable and navigable.

Search

An online deliberation tool should follow the Web norm of including a keyword search utility over its visible content. Design considerations in this area come from paradigms and innovations implemented by major search engines, as well as user experience with existing online deliberation search utilities. Result relevance-ranking metrics may incorporate a user's past activities on the site, social networking profiles, and document content. Useful user interface paradigms such as instant preview and sort order controls (e.g., relevance vs. date) may be borrowed from other search implementations.

Design for Usability

Previous sections have focused on design recommendations to attract and organize contributions. This section describes design considerations for maximizing ease of use.

Build Clear Affordances

The design of a tool should help a user figure out what he or she can do next and how, and provide confirmatory feedback when she has done something (Norman, 1988). gIBIS/Compendium has from the beginning been rich with "tool tips" that appear when needed to help a user understand her options for action from any point in the debate structure.

Stick with the Principles of Robert's Rules

In policy discussions of legislatures and other organizations, Robert's Rules of Order (Robert, Evans, Honemann, Balch, & Robert, 2000) are used to govern synchronous discussions. The principles behind Robert's Rules include "participants should feel that the discussion is fair," "majority rules," and "a tiny minority should be heard but not dominate the discussion, no matter how loud it is," while "a strong minority can force the majority to consider an issue in detail and defend its position."

Robert's basic rules are useful considerations for the design of online deliberation systems, although they do not all apply. Distributed asynchronous conversations do not have the same need for turn-taking between voices and issues, as long as the technology can handle concurrent edits to the same content (as, e.g., Google Docs can but Wikipedia currently cannot). Also, the core principle of "majority rules" may be less important if the goal is to "inform the debate" than if the goal is to reach a final action, as there is less emphasis on arriving at a single final result.

From their basic principles, Robert's Rules have evolved into over 800 pages of complex

rules and resolutions, usually supplemented by additional body-specific rules (Robert et al., 2000). This complexity reduces usability and increases the entry barriers (amount of time needed to learn the rules). Even the U.S. House of Representatives commonly votes to suspend the rules, to process a significant amount of its workload more efficiently (see Bach, 1990, for a history).

Douglas Schuler's "e-Liberate" and Shanks and Dahlstrom's "Parliament" are two online deliberation systems that implement Robert's Rules or extensions of them. This is useful for organizations that already use Robert's Rules to conduct in-person meetings, where participants have already learned them. Still, the computer's strict application of rules is not always agreeable to users (Schuler, 2009). Though this module could be used "as a platform for testing fine-grained modifications to a group's process" (Shanks & Dahlstrom, 2009, p. 305), strict application of complex and/or changing rules can reduce usability and interrupt "flow" of work in online deliberation.

Online deliberation system designers should consider the concepts currently used in Robert's Rules and implement a usable subset of these as a clear set of moderating affordances.

Open Windows to the Content in Many Places

Debategraph and Cohere can be embedded in other sites, to reach potential contributors where they are, with no moderator bottleneck. Edits made on one site are immediately reflected on all other sites.

Interoperate

A key feature of Cohere is its ability to share data through Web feeds, easy embedding, public APIs, and other ways of allowing others to use and share the data or combine it with external sources to produce new knowledge (Buckingham Shum, 2008). Interoperation and free extendibility can help a tool reach a wider, more diverse audience, driving adoption and attracting contributions, as illustrated by many open source software projects.

Permalink

Offer an unchanging URL that links to each particular node or view, and make it easily available upon user "request" with no human intervention required. For example, Debategraph offers a "friendly URL" option to create more readable, descriptive links, such as those used in the References section below (Price, 2010).

Automate

Automating nonsemantic operations, such as maintaining a node's arrows and connections when moved, is a core design requirement identified by Easterday et al. (2009). Automation can help lower barriers to contribution by, for example, redirecting users back to their intended action after login, or auto-summarizing a new contribution to suggest titles and shorter versions (e.g., in a Debategraph-like setup).

Make it Work

Cross-platform compatibility, technical stability, data security (e.g., for passwords), and fast responsiveness are important in any Web tool, and are particularly identified as design requirements by both Easterday et al. (2009) and Buckingham Shum (2008).

Design for Quality Content

Users of an online deliberation system need to be able to distinguish high-quality, accurate information from noise. The system that supports this quality distinction should at the same time incentivize users to make higher-quality contributions, and help them learn how to improve the quality of their contributions, both by example (seeing others' contributions) and feedback. This section describes design considerations for identifying and increasing content quality.

Identify Contributors

As a design principle, Cohere clearly identifies the owner of each idea, with a hyperlink to the user's profile (Buckingham Shum, 2008). Peer-to-Patent labeled posts with contributors'

real names, and only 6% of first-year contributors indicated that they were using pseudonyms (Noveck, 2009). Clear identification limits the deleterious effects of deindividuation and anonymity, which are well documented in the social psychology literature (see Myers, 2006, for a guide). However, this principle must be balanced with the idea of "low entry barriers," discussed above, when deciding whether or not to allow anonymous editors.

Allowing anonymous contributions has been experimentally shown to produce quantitatively greater engagement and attract more participation, both in a set of discussions related to a national general election (Rhee & Kim, 2009) and in a closed corporate social message board, where the effect size was at least 25% of total posting volume (Leshed, 2009).

Identity matters more when the goal is to gather opinions rather than facts. If the system goal is just to gather facts, or if the people providing facts and opinions do not have a stake in the outcome (such as in a question-answering site like those on Stack Exchange), fully anonymous participation should not pose a problem, as provided references and ratings would back up the contributions. Anonymous participation would be less appropriate in a voting setup that measured relative prevalence of opinions, because participants would have an incentive to use multiple anonymous accounts to support their positions. In many online deliberation systems, participants could potentially hold a stake in the outcome of a decision, and opinions may be solicited where facts are not available. It is more important to identify contributors in these cases than in others (Atwood, Wilkinson, West, Karger, & Bonnemann, 2011).

Maintain Accountability for Results

Keeping the final decision-making authority with a specifically identifiable body (e.g., the current decision-maker), rather than vesting power in an online vote, helps maintain accountability for the results. An online deliberation system designed to "inform the debate" rather than "make the decision" can avoid the decreased accountability issues associated with diffusion of responsibility.

Rating and Reputation

Users should have the ability to rate one another's posts, and each user should earn a reputation (for better or worse) based on the overall quality of their contributions. "As the project grows, community members may come to be known for the high or low quality of their reasoning or research" (Noveck, 2009, p. 90). This design principle has four important results:

(1) It provides a feedback loop, so that users can improve their skills and knowledge.
(2) It allows users to exercise some degree of social control over each other, and foster a sense of community: "Designing a reputation-backed system provides feedback to participants, conveying a sense of belonging to a group and fostering collaboration" (Noveck, 2009, p. 71). Social control through community evaluation and self-policing discourages abuse. By giving users appropriately expressive tools to use their pre-existing knowledge of social control, the system can facilitate development of real communities. A sense of community and self-control were important design concepts for Peer-to-Patent (Noveck, 2009).
(3) A content rating system can be combined with a view filter to hide spam, rants, and other unhelpful content, increasing the signal-to-noise ratio for good content in an open discussion system. "The ability to rate and filter will become essential [at scale]" (Noveck, 2009, p. 88). It supports the Robert's Rules principle of preventing a tiny but loud minority from dominating the discussion.
(4) It provides peer recognition as a motivation to participate, which can be a very important motivating factor (e.g., see Pink, 2006). A good rating and reputation system can provide hard-to-fake signals of expertise and community contribution, which are valuable enough to motivate some people to contribute their best efforts.

Noveck describes a British e-petitions Web site without a rating and reputation system:

> There are no reputational gains to be had . . . The lack of reputational feedback based on outcomes is the reason that the project attracts so much frivolous participation . . . at the very least, the ability to acquire reputation in a professional community could create an impetus to increased participation. (2009, pp. 89–90)

Design details for a rating and reputation system have a body of literature worth a review article of their own (for an overview, see Jøsang, Ismail, & Boyd, 2007). Drawing on this, the following paragraphs briefly introduce some considerations for rating and reputation in online deliberation systems.

Specific, objective questions can measure content quality more reliably than vague questions. With questions like "How well does A support B?," "How credible is C?," or "Is D clearly stated?," this design mirrors eBay's Detailed Seller Ratings system, which evolved after many iterations and large volumes of test data. Rating systems need to balance the question count and answer granularity with the amount and specificity of information a typical rater can give and the time cost of rating each post.

Ratings should be aggregated to produce an overall user reputation, but the aggregation metric should recognize the domain-dependent nature of expertise and the time-variant nature of user behavior. Demonstrating one solution, Stack Exchange gives users a different reputation score in each domain of knowledge, but carries a portion of active users' reputation into new knowledge communities when they join. Dell's IdeaStorm uses a "vote half-life" to discount the weight of older feedback (Dell, 2007). Dingledine, Freedman, and Molnar (2001) specifically list "weight toward current behavior" as a requirement for good reputation system.

Finally, effective rating systems will require some defense against abuse. Protections may limit, cut off, or discount the weights of spikes in a user or group's rating activity, particularly if they are not correlated with other activity in a topic, if they come from the same IP address, if they come from direct links to the rating/content page, or if they come from a group of users whose ratings are well-correlated in content and/or time (Pentland, 2008), such as a possible "Bury Brigade" on Digg (Saleem, 2007). Robustness against attacks is another key design requirement identified by Dingledine et al. (2001).

Other design considerations for rating and reputation systems, with details for each, can be found in Dingledine et al. (2001). For greater insight into details of this design consideration in the context of active design, see also Open Government Initiative et al. (2010).

Allow Iterative "Horizontal" Interactions Between Users

On one end of a spectrum, U.S. federal agencies currently implement "notice and comment" rulemaking. After a policy has been developed to nearly final form, it is posted for public comments, usually in plaintext or PDF on Regulations.gov and in the *Federal Register*. Further communication is direct between the agency and the author of each comment. Commenters cannot easily find or collaborate with one another to exchange perspectives or propose a potentially more effective alternative.

In early 2011, The White House tried an "Advise the Advisor" series, also in notice-and-comment style, but with short videos of open-ended policy questions instead of completed regulations. After each video, thousands of viewers submitted comments via a one-way Web form. A White House team reads each of them and writes an overall response highlighting the Administration's initiatives and agenda items (e.g., Plouffe, 2011). The advisors seem to have been overwhelmed with their task of reading thousands of submissions, many of them duplicates or near-duplicates, and some of them "rather colorful" (Goolsbee, 2011). Submitters could not learn from one another or work together to refine particular ideas. Guaranteeing that each submission would be read, these top advisors also had to deal with a much lower signal-to-noise ratio than they might have gotten with a system that allowed collaborative refinement and rating/filtering. "Advise the Advisor" was a weekly series for only its first two weeks,

and in the following four months only three additional sessions occurred.

"Ideation" (idea generation) tools allow some horizontal interactions, allowing users to vote on (but not modify) others' ideas and submit their own. This approach has been used to bring citizen questions to political leaders (e.g., "Ask The Speaker"), improve products (e.g., "Google Product Ideas") or come up with new ones (e.g., Dell's "Idea Storm"), and direct philanthropy dollars (e.g., "Pepsi Refresh Project," "Brighter Planet"). These tools attract many participants and appeal to their values of democracy and meritocracy.

However, these sites suffer from a number of issues, summarized by Klein (2009). First, the ideas that gain a few more votes early on rise to the top of the list, where they are more likely to get additional attention and votes, magnifying the disparity. IBM noticed this order effect in their WorldJams forums (Halverson et al., 2001). Salganik, Dodds, and Watts (2006) experimentally demonstrated the divergence of ratings for music, when sorted by rating: Quality does not necessarily correlate with voting or ratings in these systems, because of the subtle implementation details (such as ordering results strictly by number of votes) that widen noise-level disparities.

Ideation tools' one-way interaction paradigm often results in considerable duplication, with no visible association between similar proposals. To reduce some duplication and establish conceptual links, content could be automatically clustered, and users should be able to link proposals and concepts that they believe are related.

Further user interaction may produce new, creative solutions. *The Wisdom of Crowds* (Surowiecki, 2005) teaches us that a crowd of independent, diverse sources can produce very valuable information in aggregate. Page (2008) asserts that diverse groups can regularly outperform collections of like-minded experts: diversity often trumps ability. While certain aggregation methods, such as prediction markets, rely on assumptions of "independent errors" and users who do not communicate with one another, diverse crowds do much better at complex problem-solving when their members can communicate directly.

When Robert Cavalier built an online deliberation tool specifically to model James Fishkin's Deliberative Poll, enabling brief side conversations was a basic design principle. This design decision came after a year-long study in human–computer interaction and concentrated efforts to identify and retain the benefits of a face-to-face deliberative experience. The system, project PICOLA, was tested successfully with a random representative sample of 571 local citizens working toward policy solutions about critical issues facing the city public schools (Cavalier, 2009).

This subsection began with a description of the U.S. federal government's notice-and-comment approach to public participation. When they decided to pursue development of a tool for a "next generation citizen consultation" tool (draft-titled ExpertNet), the Open Government Initiative instead sought out feedback through a wiki. The wiki preserved both the initial drafts that the government had posted, and another version that was publicly editable. On discussion pages, users responded to one another's posts, asking and answering questions and interacting with each other's suggestions. Spam posts were generally ignored. Members of the OpenGov team also interacted with users in the discussions, acknowledging good points and visibly reaffirming the value of users' contributions. (For an example discussion, see Stern et al., 2011.)

Design for Adoption

This section contains design considerations focused on increasing the likelihood that an online deliberation tool will be adopted beyond its initial testers.

Improve the Decision-Making Process; Don't Overthrow it

Policy-makers and contributors content with existing decision-making processes are more likely to participate in an online deliberation system that supplements, rather than usurps, those processes. When leaders regard the online deliberation system as valuable instead of threat-

ening, they will use and promote the service. This principle was key to the success of Peer-to-Patent, designed to "inform the debate" regarding particular patent applications:

> What ultimately convinced the USPTO to come on board was the fact that Peer-to-Patent would leave the final determination of patentability in the hands of its professional staff. The public would offer information that the examiners would be free to use or discard. . . . We wanted to work within—to redesign, not route around, decision-making practices. (Noveck, 2009, p. 94)

Groups that gain a voice in policy decisions through online deliberation would likely support the system, as another path to wide adoption. However, efforts to gain political power through online deliberation have not been effective. For example, the "Open Source Political Party" (Goffman, 2007), along with similar efforts such as "The Free Government Project," "Diggocracy," and "OurProgress," all tried to use online deliberation to replace one or more elements of current political systems, within the past few years. None of these projects are still active, although efforts on the Open Source Political Party have occasionally reactivated (Goffman, 2011). Online deliberation holds a great deal of promise for being able to improve the quality of decisions, but it is still an emerging field and is not presently a proven method of large-scale social governance.

Reach the Goal and Count Success

Having a "plausible promise" is important for building participation and driving adoption (Carruthers, 2008; Senyard & Michlmayr, 2004). Where an online deliberation system has the relatively modest goal to "inform the debate," observers have reasonable expectations and a plausible promise for what the new system can accomplish, and it can succeed even at startup scale, adding real value and attracting broader use. More ambitious system goals such as "make the best possible decision" might not be plausible especially in early stages, limiting possibilities for wide-spread adoption.

Open Opportunities for Communities to Form

A highly effective online deliberation tool must enable communities to form around particular topics. These "communities of practice" (e.g., see Wenger, 1998) include people who know about the topic and can collaborate to inform the debate in a high-quality way. Tools that enable communities to form around any particular piece of information have a powerful potential to revolutionize specialized-interest, goal-oriented collective action (Shirky, 2008). For example, SeeClickFix (seeclickfix.com) allows people to identify and discuss changes they would like to see in their local neighborhoods, and work with each other to find and implement solutions.

Cohere (Buckingham Shum, 2008) opens opportunities for community formation through its social media tools and the ability to share or embed any particular node or link in a deliberation map. Social networking tool integration can promote community formation by connecting people through the artifacts, interests, and existing connections they share. The network data they produce can also be mined to suggest contacts, evaluate perceived expertise, or direct users to unexplored areas that may be of interest to them.

Open up the Design Process

Although a detailed discussion about how to build a team and software suite for online deliberation is beyond the scope of this article, some aspects of the design process can impact future adoption. Like the work the tool aims to support, the design process should be open, transparent, and represent the many diverse interests of those likely to be impacted. An open, iterative process should bring together a diverse group of people with "a sense of empowerment, freedom, & play, . . . willing to contribute productive, creative, original, visionary thinking about how to test a set of ideas" (Noveck, 2009, p. 175, 197; Pink, 2006), committed to "rough consensus and running code" (Clark,

1992, slide 19, p. 543). The design process must involve programmers, users, decision makers, and media-connected individuals who can promote the results (Noveck, 2009).

CONCLUSION

Online deliberation is a field in its infancy. Many individuals have independently identified limitations of current decision making practices and leveraged Internet-based technologies to address them. Many have reported on the guiding principles behind their online deliberation systems, and the results of their initial tests, usually as single-point evaluations of their particular design combinations. As Davies and Gangadhara (2009) note, "The vast space of possible tool and deliberation process designs seem to justify case studies, impressionistic sharing of experience, intuitive arguments, and the like in the early stages of the field" (p. 9).

We agree with this assessment and answer this call for finding patterns in results across a variety of online deliberation systems. We strive to take a step beyond case studies by surveying the literature and its many single-point evaluations, examining them for common themes, and deriving a set of design considerations that can be used for the next iteration of online deliberation tools. These considerations are derived from the online deliberation literature, and we have described the justifications offered for each of them.

An online deliberation system does not need to perfectly match all the guidelines presented here, but its designers should consider these points when making their design decisions, as a way of learning from the work that has already been done in this field. According to Noveck, "The newness of these technology-fueled approaches to governance requires an explicitly evolutionary approach" (2009, p. 182).

We hope that this work will broaden the reach and improve the quality of future online deliberation systems by enhancing their usability, utility, and ability to attract and organize quality contributions. We also hope that through further experimentation and exchanges of experience, future work will systematically test each of these design considerations to produce a solid foundation of proven design principles leading to high quality online deliberation and further development of this field.

NOTES

1. See http://online-deliberation.net for links to each conference Web site. This site is maintained by Todd Davies.

2. "Inform the debate" is a tagline or trademark that concisely identifies the goals and design scope of the tools on which this article focuses.

3. A "watchlist" displays a list of all recent edits to all articles that an editor has chosen to "watch." Some editors have also built custom tools to help them characterize, identify, and revert vandalism quickly and easily.

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