Enabling Crowdsourced Visualizations to Support Large-Scale Civic Engagement

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Cities and local municipalities have become petri dishes for exploring new strategies for engaging the public in massive decision-making processes to address some of the highly complex and controversial challenges such as climate change [e.g.1-7]. These platforms are important for at least two reasons: First, they democratize access to important decision-making processes. Second, they promise to improve the pace and quality of change by leveraging the immense diversity of perspectives and experiences of tens of thousands of contributors. In addition, the diverse knowledge of community members can led to more innovative solutions. While these civic engagement platforms typically succeed at collecting large numbers of opinions from citizens, they often offer little support for making sense of the thousands of ideas and comments contributed by the community. Furthermore, they do not help the public pinpoint key disagreements among stakeholders or innovate negotiated solutions. Our goal is to design a transparent sensemaking approach that not only help policymakers to make sense of thousands of contributions, but also empower citizens to understand different viewpoints, and identify point of disagreements to enable stakeholders to collaboratively co-create alternative solutions that attempt to bridge diverse viewpoints.

While the Internet and citizen deliberation platforms open up an opportunity to innovate on governing structures [8], designing and developing effective deliberation and decision-making at scale remains a challenge [9]. This includes issues such as knowledge gathering, composition and sharing (with argumentation features to support deliberation) in large distributed settings [10]. Furthermore, the diversity of backgrounds, expertise, and objectives of stakeholders is often the most important barrier for reaching consensus on important decisions (e.g. the city plans to create high density bike friendly neighborhoods in a neighborhood where locals want to preserve the historical value of the existing site). When large groups cooperate, differences in perspective can result in conflict. Managing diverse views is a persistent problem in cooperative group work [11]. Briggs et al.' argued that identifying disagreements is a key point for consensus building, their theoretical model of consensus building suggest that members should share and discuss proposals, diagnose conflicts, and use strategies to bridge disagreements, typically by uncovering the underlying rationale for members' opinions [12]. Prior research has shown the potential of collaborative visualization to influence perspectives around issues such as climate change [e.g. 2, 3,13,14,15]. However, collaborative technologies often fail to identify the crux of disagreements between stakeholders or to generate solutions that creatively negotiate more inclusive outcomes. To address conflict resolution in complex decisions with multiple latent criteria, we designed, and developed ConsensUs [16], a novel visualization tool that highlights disagreements in comparative decisions. The tool facilitates groups to specify comparison criteria and to quantify their subjective opinions across these criteria. ConsensUs then highlights salient differences between members.

ConsensUs

Building on research that emphasizes the benefits of presenting group preferences only after group members have articulated their own [17], ConsensUs structures group decisions around these two key phases: 1) capturing independent opinions, and 2) representing group opinions. In ConsensUs' independent opinion interface, users rank alternatives relative to each other on a number of criteria. As depicted in Figure 1 (Left), users can click and drag the colored circles representing the different alternatives on to each criterion line. The criteria are organized as rows and can be customized to list as many criterion as the decision merits.

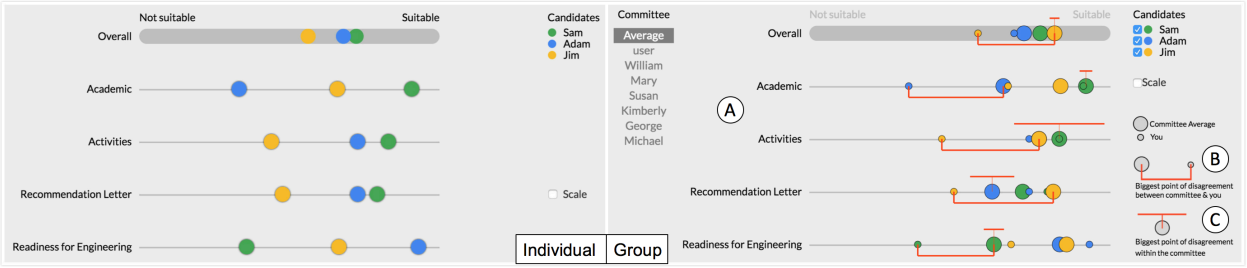

Figure 1. (**Left**) The ConsensUs independent opinion interface where users rank alternatives relative to each other on multiple criteria. (**Right**) The ConsensUs group visualization interface. (A) Average ratings of the group. (B) Legend of disagreement between the user and the rest of the group. (C) Legend of disagreement within the group.

In ConsensUs' group visualization interface, users see an aggregation of all group members' opinions from the individual interface. The interface displays both written arguments and the average ratings for each criteria of the decision (see Figure 1 (Right) (A)). ConsensUs highlights two different types of disagreement: the variance present within the group as a whole (see Figure 1 (Right) (C)) and the explicit disagreement between the user and the rest of the group (see Figure 1 (Right) (B)). ConsensUs is interactive, allowing users to explore for more details. By clicking on the large group dots, users can explore how different group members rank alternatives relative to each other.

Our results show that providing visual support helps participants identify points of disagreement and leads to final assessments more aligned with the randomly selected group of confederate voters. The results demonstrate the value of utilizing visualization to externalize and identify points of disagreement.

Conclusion and Future Work

ConsensUs, is one approach that can be applied in civic issues to support consensus building process. However, ConsensUs is designed for small groups making a decision about a multi-dimensional problem with specific criteria. Currently, we are designing studies with real-world groups to more deeply understand the value of a tool like ConsensUs. Real-world decision-making processes will be more complicated and thus have more factors that will affect the results. For example, rather than having a default set of criteria, real-world groups need to first build consensus on potential criteria before considering alternatives. How groups delegate, weight and choose different criteria can

also be important for the decision results. In addition, we aim to address scalability of ConsensUS by evaluating it with larger groups. We will employ lessons learned from these studies to extend ConsensUs to support large-scale deliberation on civic issues. We believe that the visualization approach embodied by ConsensUs has potential to support asynchronous communication for distributed groups. However, as we extend our approach to more complex problem spaces, we will investigate alternative visualizations.

Furthermore, our research on current approaches and technologies to engage citizen shows that most online platform follow a forum discussion format to gather citizens' opinion around issues. While, these online platform address accessibility issues and enable citizens to provide their feedback on proposals offline, following all the comments and making sense of a large thread of discussion is not a trivial task. This affect both stakeholders who need to understand each other's point of view on large repositories of proposals as well as policymakers who need to make sense of these scattered comments and opinions. We are conducting studies to gain a better understanding of technology support for sensemaking of large discussion threads. One possible solution to address the complexity of large scale decision making systems is employing machine learning techniques, such as topic modeling to improve issue classification and clustering [e.g. 18, 19, 20].

Finally, to ground our research in real issues, we will forge local partnerships. We aim to build community engagement by partnering with the San Diego Design Forward Alliance [21], a non-profit organization dedicated to transforming southern California into a creative hub for entrepreneurship. This partnership— along with local observations of community engagement strategies and current shortcomings of these approaches—will help us to launch a platform to bring together local designers, civic leaders, industrial innovators, and citizens to discuss and prototype proposals for civic change.

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