OurStory

Dispute System Design Technology for Stakeholder Inclusion

By Bridgit Claire Mendler

Submitted to the Program in Media Arts and Sciences,
School of Architecture and Planning, in partial fulfillment
of the requirements of the degree of

MASTER OF SCIENCE IN MEDIA ARTS AND SCIENCES
at the MASSACHUSETTS INSTITUTE OF TECHNOLOGY
May 2020

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Abstract

Sometimes we find ourselves within institutions of which we have no influence, witnessing avoidable mistakes, harms and failures. Or sometimes we are in positions of influence in such institutions, surprised by the discontent of those we lead. When knowledge and experience is not shared, institutional systems do not learn and adapt as well as they should, nor gain the necessary buy-in from those they are designed to serve. A process for gathering stakeholder input and putting it to use is necessary to create responsive and resilient systems. One such process that has demonstrated effectiveness is Dispute System Design (DSD). DSD is a process for redesigning ineffective dispute systems or designing new ones from scratch. This process upholds the value of stakeholder participation and has seen successful results across varied use cases from international peace process negotiations to redesigning dispute resolution procedures in large private enterprises. However, there are still many institutional systems that would stand to benefit from such a process that do not yet because it is taxing on time and requires specific expertise. Technology can play a role in making it easier to participate in DSD processes remotely and making the complex work more comprehensible through visualization techniques for mental model alignment. These improvements would enable more stakeholder inclusion in DSD which in turn will improve epistemic outcomes and improve buy-in for design solutions. In this thesis, we design, build, and evaluate a tool that aims to improve stakeholder inclusion in the DSD process. To address existing constraints on stakeholder inclusion in the DSD process, this tool enables remote participation in DSD focus groups and provides an interactive visual reference map of dispute systems to facilitate mental model alignment. We tested our tool within a DSD context and a non-DSD context to evaluate our hypothesis that through the use of novel supportive technology, DSD processes can reach a broader audience.

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Acknowledgements

Thank you to my advisor Deb Roy for the many ways in which you have offered support and freedom to pursue unconventional ideas. You have not set any limits on what I can do given my history in entertainment. Thank you for your curiosity, wisdom and enthusiasm.

Thank you also to my readers – Martha Minow and Ceasar McDowell. You have been abundantly generous with your time, and patient throughout the evolution of this project. Prof Minow, your thorough and insightful perspective has been essential to forming these ideas. Prof McDowell, thank you for our many meetings. From the first seeds of this project until the end you have been an irreplaceable guide.

I would also like to thank the Dispute System Design Clinic at Harvard Law School and specifically Prof Rachel Viscomi and Sara del Nido Budish for believing in the idea, generously contributing their time and knowledge, and trusting my project with their students and client. We have had many laughs and brainstorming sessions and I hope to have many more. Also, thank you to our unnamed student and client who were open-minded and willing to test out the tool.

I am so fortunate to be a part of the Lab for Social Machines, an eclectic family of warm and talented people that have taught me everything I know about research and inspire me to use technology in service of others. Thank you to Andrew Heyward, Ann Yuan, Anneli Hershman, Alex Siegenfeld, Belén Saldías, Brandon Roy, David McClure, Dimitra Dimitrakopoulou, Doug Beeferman, Eric Chu, Eugene Yi, Heather Pierce, Ivan Sysoev, Juliana Nazaré, Kathy Cramer, Keyla Gomez, Lauren Fratamico, Maggie Hughes, Marc Exposito, Martin Saveski, Nabeel Gillani, Nazmus Saquib, Peter Beshai, Prashanth Vijayaraghavan, Russell Stevens, Sam Carliles, Sarah Ballinger, Shayne O'Brien, Sneha Makini, Soroush Vosoughi, Will Brannon and Winston Chen. Thank you to those who helped me write my first lines of code, to those who proofread my thesis, to offsite retreats, great volleyball games and walks along the Charles.

Thank you to the expansive Media Lab family that always inspires me with their kindness and insane smarts. Thank you to the Director’s Fellows, my first Media Lab family. Thank you to my mom, dad, brother, and husband for supporting me in this adventure. And thank you to my aunt and uncle, Janot and Pablo for introducing me to the Media Lab in the first place!

Table of Contents

List of Figures

1. Introduction

1.1. Motivation

We all have unique pieces of knowledge about the world around us. As we navigate the varied institutions in society: elementary schools, colleges, jobs, hospitals, or whatever else crosses our path, we are left with experiences that inform our thoughts and perceptions about those places. These thoughts and perceptions are part of our “mental models,” or our causal maps of how these institutional systems operate. Our experiences in an institutional system may be painless and carefree, but more often than not, because all systems are imperfect, we have some experience in a system that is less than positive and worth correcting.

Sometimes we find ourselves within systems of which we have no influence, watching avoidable mistakes, harms and failures with a sense of inevitability. Or sometimes we are in positions of influence in such systems, taken totally off-guard with a catastrophe and no warning signals to predict it. We are unsure of how to use our authority to find the right knowledge to make the system resilient. This is because sharing knowledge is not always straightforward.

There are many barriers to sharing our knowledge with others. Some of these barriers are bureaucratic. Perhaps a man witnesses what he understands to be mistreatment at a hospital. He may try to report it but the process to do so is circuitous and burdensome and he gets discouraged. Some of these barriers are a matter of communication. Perhaps a new government regulation is instated that impacts a woman’s business but she isn’t aware of the opportunity for public comment or finds the legal language to be unintelligible so she misses her chance. And some of these barriers are interpersonal. Perhaps a few employees have an unwelcome perspective at work and they are intentionally ignored. Often it feels frustrating to have information about a system that could make it better, yet there is no place to share that knowledge let alone see that information acknowledged or better yet, acted upon. In so doing, institutions lose touch with the very people they were built to serve.

In an ideal world, stakeholders would be able to seamlessly contribute their knowledge to an ever-improving institutional system. This system would be responsive to stakeholders through

a process built to receive and apply their knowledge. While nothing perfectly represents this ideal today, there are examples of existing processes worth building upon. This thesis is inspired by a process built specifically to improve dispute systems. Dispute System Design (DSD) as it is most often called, is an inspiring example of a process that upholds the value of stakeholder knowledge and conceptualizes organizations as systems that are not rigid, but malleable to the needs and goals of all stakeholders. This process has many examples of successfully gathering stakeholder knowledge, synthesizing it into new system designs, and ultimately building better systems.

Dispute system designers have worked over the past three decades to refine a process for iteratively improving systems by gathering stakeholder knowledge and incorporating it into solutions. They conduct holistic evaluations of organizations, capturing the many sources of, and potential solutions to conflict. Organizations in conflict can be examined through the "arrangements of parts dynamically interrelated with each other and with the influences in their environment" (Amsler, Martinez, & Smith, 2015, p. s11) and stakeholders with varied vantage points on a system are essential in order to expose the interrelated elements resulting in conflict. It is through the shared project of constructing such an understanding of a system, determining the problem areas, and ultimately designing corrections that Dispute System Designers can be effective in delivering lasting and resilient solutions, legitimated through the community of stakeholders within the system.

Dispute System Design has proved its effectiveness in a range of contexts. These contexts range from international peace process negotiations to eBay's dispute system overhaul (Rogers, Bordone, Sander, & McEwen, 2013). However, it is still a somewhat niche process. There are a number of things that inhibit the Dispute System Design methods from being used more broadly, one of which being a general awareness of the methods and their broad applicability. Dispute System Design cases are often confidential so most outcomes from a Dispute System Design project are not shared widely. Another reason the Dispute System Design methods are not used more broadly is because they demand a significant investment of time and money. Dispute system designers are hired to pour over lengthy legal documents, gather research data and piece together large amounts of disparate stakeholder input (Amsler, 2017). It can also be taxing on the time and energy of different stakeholders within the organization. Geographic constraints can make it difficult to coordinate to be in the same room at the same time as is required to complete the different stages of the iterative process.

We propose that by developing a new technology to accompany the DSD process, we can increase the effectiveness of the DSD process while also lightening the load for dispute system designers and stakeholders alike. By reducing impediments and increasing effectiveness of DSD, we will make a case for broadening the usage of such a process, even beyond the realm of dispute systems.

We assert that the DSD process will be more effective if there is more stakeholder inclusion. Our reasoning is twofold: more inclusion (1) increases a designer's ability to correctly identify the problems in the dispute system, and (2) increases stakeholder buy-in for system improvement proposals later on.

Designers have greater likelihood of correctly identifying the problems in a dispute system with more stakeholder inclusion because stakeholders from different orientations in the system offer cognitive diversity. To illustrate this point, we refer to the Diversity Trumps Ability (DTA) Theorem often mentioned in defense of organizational diversity in problem-solving and the epistemological value of deliberative democracy. The DTA Theorem states that given certain conditions, a more cognitively diverse group is more likely to arrive at the optimal solution to a problem (Hong & Page, 2004). Trailblazing dispute system designers Cathy A. Constantino and Christina Sickles Merchant echo this point, going even further to suggest including stakeholders outside the dispute system, “Outside disputants often bring observations that those within the organization are not aware of or have not considered.” (Constantino & Merchant, 1996). DSD clients may find it tempting to consult purely with experts, especially if the culture of a client organization is less open to or trusting in stakeholder feedback (Lande & Benner, 2017). However, the inclusion of a greater range of stakeholders in a structured process can deliver essential credible information and uncover core issues (Constantino & Lewis, 2015).

Stakeholders have increased buy-in for DSD projects when there is more stakeholder inclusion because it gives projects legitimacy (Constantino & Merchant, 1996). When stakeholders are able to participate in the DSD process, share their perspective and learn from the perspectives of others, they find out for themselves why design decisions are justified. We find philosophical resonance with the public justification ideal in deliberative democracy (Chambers, 2018). When stakeholders are not involved in the design and decision-making process, they will be less likely to understand the rationale behind the project and find it to be justified. In Systems

Thinking, each individual has a “mental model” (Scott, 2018) that encapsulates his or her experiences and beliefs about how a system works. Without inclusion in the design process, stakeholders will miss crucial information. This will likely prevent them from aligning with the mental model developed by the dispute system designers to improve the dispute system. Later in this thesis we will discuss how this mental model alignment can take place and ways to increase the likelihood that stakeholders and designers develop a shared understanding of complex problems. Projects that do include stakeholders and justify design decisions build buy-in throughout the process including when dispute system designers ultimately propose suggestions for pilot projects. This has been evident in many DSD projects from the Chevron Nigeria Limited’s General Memoranda of Understanding (Hoben, Kovick, Plumb, & Wright, 2012), Kaiser Permanente’s Blue Ribbon Panel Report and current day advisory panel (Martinez, Smith, & Amsler, 2020), and the Maryland District Court Mediation Program (Wohl, 2001).

The two reasons listed above explain *why* more stakeholder inclusion makes DSD more effective. Now we will explain *where* technology may be able to improve stakeholder inclusion for DSD and lighten the load for designers and stakeholders. As shown in Figure 1, DSD has a series of design phases (Constantino & Merchant, 1996). While the diagnosis stage is taxing for designers and stakeholders, it also stands to deliver greater impact through improved stakeholder inclusion. In the diagnosis stage, designers gather information through interviews, focus groups, and other data sources to construct a picture of the existing dispute system. In this phase, stakeholders have the opportunity to help construct this picture of the existing dispute system and also build a shared mental model. Focus groups are key moments for stakeholders to share their perspective, hear the perspectives of others, and begin to build a

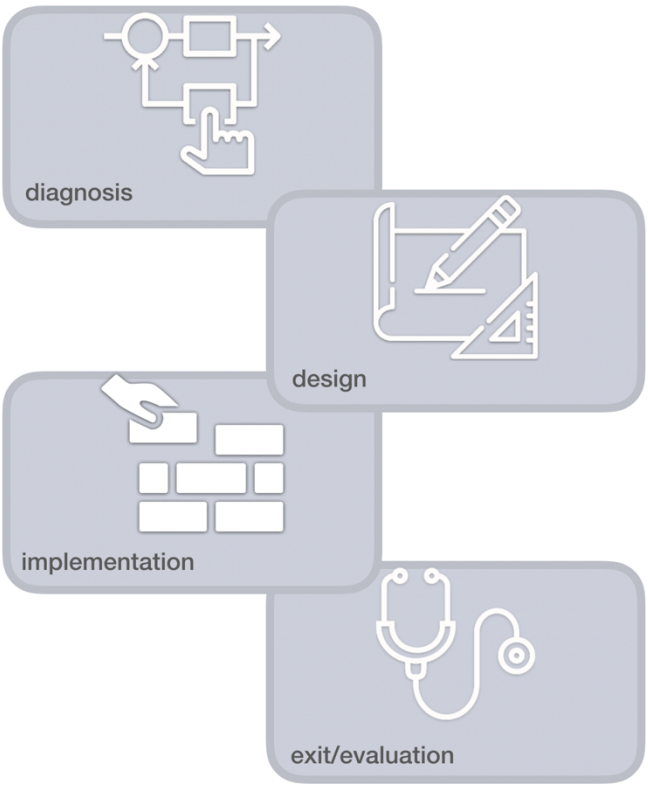

Figure 1 Dispute System Design process

perspective on the system collectively (Rogers, Bordone, Sander, & McEwen, 2013). Within a focus group, the dispute system designer guides participants through a series of questions that attempt to surface stakeholder perspectives. Focus groups suffer from a number of challenges, two of which we believe technology can be helpful in addressing. These challenges define *how* technology may be able to improve stakeholder inclusion in DSD focus groups:

1. *Comprehension constraints:* Comprehension constraints have to do with the communication and collection of information. While these focus groups are key opportunities for stakeholders to share their perspective, it is often the first time stakeholders are exposed to a bigger picture of how the system works. Dispute systems are often described in dense, legal documents, in some cases nearly a hundred pages long. If stakeholders do not have the time to invest in reading the legal language, they will lose the opportunity to contribute to a topic they have a stake in, even if they have been invited to participate (Hartley, 2008). In existing focus groups, dispute system designers take notes and photos of material generated through the session. Afterwards, designers must gather and synthesize large amounts of data. To address these comprehension constraints, we would like to make it easier for stakeholders to understand the dispute system, contribute in their own time, and contextualize their feedback so that designers can collect this information accurately and efficiently.

2. *Geographic constraints:* It can be difficult to get stakeholders and designers in the same room to participate in a focus group. This becomes even more difficult the more inclusive focus groups intend to be because stakeholders may not reside in close enough proximity to one another to meet in person (Viscomi & Budish, 2020). Restricting focus groups to in person formats also eliminates the potential for focus groups to have elements of anonymity. Anonymity can lead to substantial insights but this mode of collaboration is not possible in an in-person focus group. If dispute system designers choose to move focus groups online, their existing option is often a video conferencing, sometimes involving screen sharing to communicate information to the group. However, this experience is different than in-person focus groups where designers can provide tactile elements like Post-it notes to share thoughts and cluster

ideas in space. With video conferencing, participants are limited to chat and video features and are not able to use a collaborative workspace.

We believe that addressing geographic and comprehension constraints will bring more stakeholder inclusion to DSD focus groups. The way in which addressing these constraints enables stakeholder inclusion is (1) through enabling stakeholders to engage in focus groups they would not have access to before because of physical distance or in anonymous setups that would not be possible in person, and (2) giving stakeholders a new way to contextualize their feedback and respond at their own pace. We recognize that offering feedback is not the only way stakeholder inclusion could be improved in the DSD process. We aspire to offer many other opportunities, some of which will be described in section 8.2 on Future Work, however for the purpose of this thesis, we have narrowed the scope to address only these two constraints in DSD focus groups.

Existing technological innovation has already been applied to Dispute System Design to address aspects of these constraints. For instance, comprehension constraints have been addressed by decision support tools (Agarwal, Ramamoorti, & Jayaraman, 2011) (El-adaway, 2008) (Cravens, 2016). Geographic constraints have been addressed by making system evaluation data available online (Eisenberg, Wohl, & Guerin, 2013). However, we see a gap in the focus group space, specifically with beginner-friendly technologies. There are things we can learn from existing technology not in the DSD space for this. Existing technology for online workshops or deliberative events can serve as a source of inspiration as we design technology and apply it to the DSD process.

We recognize that in using technology to address these constraints, new constraints may occur. For instance, some stakeholders or designers may not have internet access or digital proficiency. Other stakeholders may find the new visual medium to be more confusing than helpful (Smith, John, Sturgis, & Nomura, 2009). In this way, our approach of designing technology to improve stakeholder inclusion may disproportionately reach those who resonate with our approach, likely those who are younger or more computer savvy, and may add additional work and complication for others, which is the opposite of our intention. Our hope is not to replace DSD assessment methods or focus group experiences, but to supplement them and in doing so, create greater opportunities to spread the DSD process.

When exploring the possibility of spreading DSD process with the help of our new tool into the design of other institutional systems, we recognize that there may be different design considerations that may differ. To state the obvious, the DSD process is based on design a system for conflict. While conflict is a necessary and natural part of any organization, designing systems for specifically this domain has, as previously mentioned, led to a largely confidential process. Perhaps in designing for other institutional systems, confidentiality will not be as necessary. However other aspects of the DSD process may be foreign yet helpful to design elsewhere. The importance of buy-in and legitimacy in DSD and how that manifests itself in uplifting stakeholder voices and creating venues for discussion is something that would be valuable in other contexts as well. As we begin to explore other contexts for DSD processes with the addition of our new tool, we will be attentive to the differing design challenges for DSD versus the design of other institutional systems.

OurStory Overview

For this thesis we developed a tool called OurStory based on the belief that every stakeholder voice is important in accurately telling the shared story of any institution. We use the term "story" loosely to conceptualize a shared story as the combined mental models of all stakeholders in a system. The "Our" portion of OurStory intends to encapsulate all of the stakeholders within such a system. When every stakeholder within an institution helps to fill in the blanks and create the big picture, as currently envisioned through our system annotation and visualization concept, DSD is can help write a more just and complete story for their client in the future.

We attempt to help stakeholders construct and communicate this story through our platform, OurStory. OurStory is an online tool designed to help stakeholder participants discuss complex issues by providing a visual map to assist participants in generating and curating ideas. OurStory hosts a virtual focus group where participants can use the same tactile elements that they would in the physical space. Participants put their ideas and preferences on virtual Post-it notes and move them around on a board of questions. Participants can self-curate their responses by dragging a Post-it note onto a location on the visual map of the dispute system. After the focus group session is complete, the notes that decorate the map can serve as a diagnostic to indicate pain points in the system or process and determine where it may be helpful to follow up.

Key Contribution

1. Development of a digital interface, OurStory, for remote participation in DSD focus groups with tactile elements from the in-person experience

2. Development of a visual structuring of dispute systems for easy reference. This visual reference will also have interactive capabilities giving participants the ability to provide their feedback directly onto the dispute system reference. This will offer clear documentation of problem areas.

Proposed Evaluation

As previously stated, we believe that stakeholder inclusion is important because it helps dispute system designers and stakeholders alike understand the problem with the dispute system and arrive at solutions deemed more legitimate by everyone. Given these desired outcomes from greater inclusion, we will evaluate the effectiveness of OurStory by asking two research questions:

1. Did OurStory help designers identify new information in the dispute system?

2. Did OurStory help stakeholders understand the perspectives of one another and the dispute system as a whole?

Given our larger goal of broader applications for the DSD process and technology, we will also test OurStory with the DSD focus group process on an application unrelated to DSD or disputes. We will create a user study to engage participants in a conversational activity around a contrived topic. After this user study, we will evaluate whether the process and technology were effective by asking two research questions:

1. Did OurStory help professionals identify new information on this topic?

2. Did OurStory help stakeholders understand the perspectives of one another and the topic as a whole?

We will evaluate the answers to these research questions qualitatively through user interviews and data analysis. Our hope is that OurStory will have immediate utility for Dispute System

Designers who want an easier workflow and improved stakeholder inclusion in their process and OurStory will have future utility for designers of institutional systems more generally that have similar desires.

1.2 Overview of Thesis

The following section will provide more detailed background on Dispute System Design, Systems Thinking and Deliberative Democracy. Following that, related work in DSD, deliberative platforms and collaborative design software will be covered. Section 4 will explore the design principles that support OurStory, the initial user interface design sessions, and the current assumptions and limitations. Section 5 will cover the tool itself in detail and the user roles that the tool currently accommodates. In the 6th section, the focus will be on the DSD test and the user study that was conducted. This will include the set-up, methods and expectations of the study, as well as study findings from the post-survey and conversations with an expert in the field. Section 7 will address future work that could move this project forward as well as research to test the underlying premises of this thesis.

2. Background

Our background will provide further explanation of DSD, reasoning for how systems thinking works within DSD, and reasoning for why stakeholder inclusion in DSD is more effective.

2.1 Dispute System Design

DSD came onto the scene just over thirty years ago as a way to conceptualize how organizations, employees, and other stakeholders could improve approaches to addressing conflict (Amsler, Martinez, & Smith, 2015). As discussed in section 1.1, a "Dispute System" refers to the processes and stakeholders involved in resolving a dispute in a public or private organizational context. "Dispute system" is the descriptor used because such things are complex and involve a number of interdependent variables. Designers within DSD may be internal or external to the organization they are analyzing and they may be acting as individuals or as a team. Although dynamics vary depending on these factors, in general designers are interveners who arrive at a moment of change within an organization with a toolkit of conflict resolution techniques that can be tailored to the community they are acting with (Rogers, Bordone, Sander, & McEwen, 2013). The design process benefits from designers' expertise in facilitation, conflict theory, and relevant laws and regulation.

In 1996 Cathy Constantino and Christina Merchant wrote Designing Conflict Management Systems: A guide to Creating Productive and Healthy Organizations. In addition to the other conceptual contributions, this book was influential in structuring the DSD process. Constantino and Merchant structured the stages of dispute system design as follows: *diagnosis*, *design*, *implementation*, and *exit/evaluation*.

Diagnosis: When designers diagnose a potential DSD project, the first question is: is the system "ripe" for intervention? Ripeness can be contingent upon things such as interest and support from different stakeholders and decision-makers within the system, as well as resources that are available to undertake such a design process. After taking stock of these factors, designers decide whether or not they will take on the project. Should they decide to proceed, they will begin conducting assessments of the system. They will gather data and

conduct interviews in efforts to get a feel for the culture and context of the system as well as the various stakeholder interests at play.

Focus groups are key moments for members of the community to begin to build a perspective on the system together. This may be for the first time stakeholders have analyzed their community from this vantage point, and it may be the first time they have had the opportunity to think about what a better system could look like. Constantino and Merchant write,

> "Practitioners have discovered that the very act of designing, through the processes of participation, openness, and feedback, often builds and improves organizational relationships among stakeholders as collateral effect to the technical aspects of changing the existing dispute resolution system" (Constantino & Merchant, 1996, p. viii)

During focus groups, designers gather a small group of stakeholders together for a discussion. Sometimes the stakeholders are from different vantage points on the system, or sometimes stakeholders are all gathered from similar positions. Designers often ask stakeholders a series of questions to envision a future system or understand more about the system currently in existence. These questions can be answered through visual brainstorming activities such as adding Post-it notes to a shared white board. These notes are clustered by theme or sorted by color to create themes as a group. Afterwards, designers take photos of the Post-it notes and synthesize the content of the discussion.

Design: After gathering sufficient information from stakeholders and other data sources, the designers work on system design proposals. They distill the feedback into a vision for what changes could be made to the system. Proposals might be written briefs or flow charts; whatever method effectively communicates some possible areas for development. These proposals will be shared with decision-makers and assessed for whether a pilot test is viable.

Implementation: In the implementation stage, pilot tests of system improvements are run. Certain sets of stakeholders are often the first trial users of a pilot. To be effective, it is best if stakeholders understand the purposes of the changes to the system and have something to gain from the changes. Decision-makers are willing to expend the resources and stakeholders are amenable to the pilot, things move forward.

Exit/Evaluation: After the pilot and throughout its course, it is best to run evaluations to get a detailed picture of what is working and what is not. This can be through different methods of sensing and gathering feedback. Often this includes interviews and data collection. After evaluation, the designers may exit and hand off the project to stewards within or outside of the organization.

Many DSD designers and clients find it necessary to emphasize stakeholder inclusion in order to be effective with their project. For instance, the Chevron Nigeria Limited's General Memoranda of Understanding in 2011 was in response to earlier unsuccessful attempts at community development projects. Chevron had been invested in infrastructure and business in the Niger Delta for over a decade (Constantino & Lewis, 2015). While they had built schools and hospitals in local communities under the assumption that it would foster goodwill, Chevron Nigeria Ltd.'s first attempts at community development projects were perceived by community members as oppressive and misleading. After a period of regional instability in 2003, Chevron Nigeria Ltd. and the local communities began a DSD process to reset the relationship. After multiple attempts at drafting the General Memoranda of Understanding, they undertook a "Participatory Stakeholder Evaluation" process to understand the root of the problem in the relationship. Through multiple facilitated design workshops, the community gathered all of the core data for the evaluation. "The process succeeded in providing credible, public information that described how community residents and other stakeholders were experiencing the GMOUs. It named the core issues that needed to be addressed in the re-negotiation, and, in the process, improved strained relationships, setting the stage for a productive interaction during the re-negotiation and beyond." (Hoben, Kovick, Plumb, & Wright, 2012, p. 8) In this instance, stakeholder inclusion was essential to gather the right information about the problem and gain legitimacy and buy-in.

Another example is the community redesign of the Maryland Court of Appeals. Rachel Wohl, a litigator, and Chief Judge Robert Bell formed a stakeholder commission and spoke with over 700 stakeholders to implement a statewide consensus-based action plan called Join the Resolution (Commission, 1999) which aimed to design a new conflict resolution system for the court. After a two-year collaborative planning process, Join the Resolution received a decision by the Maryland legislature to fund the initiative. (Rogers, Bordone, Sander, & McEwen, 2013) Today, the stakeholder commission has been transformed into the Mediation and Conflict

Resolution Office (MACRO) and now operates with a software that provides ongoing free assessment of MACRO programs. In this instance, a crisis did not spur the redesign. Instead, influential leadership recognized that the dispute system could be improved with stakeholder involvement and proactively began the DSD process. Another noticeable feature of this example is the use of technology to further stakeholder inclusion. In this instance, technology is impacting the Exit/Evaluation DSD stage. In the related work section, we will cover more examples of technology designed for DSD.

2.2. Systems Thinking

A system, as defined by environmental scientist and author on systems thinking, Donella Meadows, is “a set of things -- people, cells, molecules or whatever -- interconnected in such a way that they produce their own pattern or behavior over time.” (Meadows, 2008, p. 2) In this way, systems can encapsulate a vast array of things. To extend this conceptualization, Systems Thinking is the practice of observing the relationship between this structure of interconnected “things” and the behavior it exhibits over time.

Within DSD, the problems in a dispute system were not isolated events, but the downstream effects of some chain of events in a larger system. (Constantino & Merchant, 1996) Systems Thinking helps to reframe a problem in terms of interrelated events, relationships and goals. (Amsler, Martinez, & Smith, 2015) This way of framing problems lends itself to more stakeholder inclusion because stakeholders may have essential pieces of information needed to understand the problems in the larger system. (Senge, 1990)

All stakeholders within a system have their own “mental models.” These mental models encapsulate the implicit causal map, the description of how the system operates, and the related network of beliefs about the system that all individuals carry in their minds. (Sterman, 1994, p. 4) Mental maps are never perfect. Mental models may have an incorrect perception of the reality of the system and these misaligned perceptions of reality lead to disagreements and difficulty in adopting a shared vision for system change. (Belt, 2004) Ideally, designers and stakeholders work together to learn about a system and form an aligned mental model, which will later legitimate decisions. (Vennix, 1996) However, as John Sterman, MIT professor and director of the MIT System Dynamics Group, describes in his research (Sterman, 1994, p. 4), there are a number of challenges they may encounter:

Limited Information: People receive feedback about the real world from samples, averages and estimates. It is most often impossible, if not very cost-inhibitive to capture all of the feedback data from an event, and thus we draw conclusions from small fractions. (Page, 2018) Professor Chris Argyris relates the available information to how we understand the systems we are in through the Ladder of Inference (Argyris, 1985). In the Ladder of Inference, we base our understandings on our available data which is then selected, interpreted, and evaluated for our future actions, which then serve as the new material in our future available data set. We are hoping to expand the available information for designers through OurStory.

Misconceptions and Flawed Causal Relations: When we receive information about a system, we tend to make overly-simplified explanations for the information. Our mental models often assume simple causal relations that do not consider many influencing factors. Also, we often blame others who exhibit displeasing behavior in a system instead of considering how the system creates or enables that behavior. (Repenning & Sterman, 2001) Sterman would say this is likely the result of human limitations in memory, attention, recall and information processing. OurStory attempts to address this by developing a virtual diagram of the system where information can be gathered and appended.

Interpersonal Impediments to Learning: It can be the case that even if we correctly understand information about the system and a way to improve it, humans can be defensive and deny the information if it is unpleasant. Defensive behavior can discourage learning and the ability for mental models to be openly discussed. We hope to translate DSD focus group norms to the online environment through facilitation practices that may diminish defensive behavior.

In response to these challenges, Sterman suggests we can learn about complex systems through “virtual worlds.” Virtual worlds are, as Sterman describes: “formal models, or microworlds in which the decision makers can refresh decision making skills, conduct experiments, and play.” (Sterman, 1994, p. 27) These virtual worlds are valuable for revealing qualities and relationships that would not be possible to imagine otherwise (Schön, 1983). We draw inspiration from this idea of virtual worlds with our visual system map reference. While there is not currently the capacity to entirely simulate different scenarios, the OurStory map is interactive in that participants can identify where on the map they would be interested in exploring design solutions.

One could imagine that in an effort to be rigorous, system maps would become more and more complex and this is the case. Because of the interconnected nature of our world, there are no clean boundaries on where a system starts and ends. (Sterman, 2002) Constantino and Merchant even advocated for open systems without clear boundaries because of the many factors that could influence disputes. Systems analysts often end up with massive system diagrams with minute detail and even still these models cannot perfectly map all of the influencing factors. Systems modelers refer to the "requisite decision model," (Phillips, 1982) a term that refers to the tradeoff between model validity and utility. An extremely valid model may actually have less utility because it is too complicated to understand. For OurStory, we will work to find the appropriate balance between the validity of our model and the utility for the focus group context. Learning from the techniques in systems thinking for combatting comprehension constraints and learning from the mental models of others can inform our designs for stakeholder inclusion.

2.3 Epistemic and Legitimacy Ideals from Deliberative Democracy

For this thesis we are recounting the design, build, and evaluation of a technology that aims to improve stakeholder inclusion in DSD. Earlier we summarized *why* stakeholder inclusion is important to DSD, *where* technology can be applied to improve stakeholder inclusion in DSD, and *how* technology can be applied to improve stakeholder inclusion in DSD. This section will give background to *why* stakeholder inclusion is important to DSD. Earlier we established two reasons why stakeholder inclusion is important. Those reasons were (1) more stakeholder inclusivity increases the likelihood that dispute system designers will be able to identify the most important problems in a dispute system, and (2) more stakeholder inclusivity increases the legitimacy of the DSD process and outcomes. We will draw from research and theory in Deliberative Democracy to ground these two reasons.

Deliberation is an old concept. In the time of Aristotle, he defined deliberation as: "A considered judgment of what seems right or wrong to do (not true or false), an exchange of arguments about the reasons for a practical choice, a rational process of acquisition of information, and the clarification of one's preferences." (Floridia, 2018, p. 42) In the 20th century between 1980 and 1993, democratic theory experienced a "deliberative turn." This

deliberative turn gave birth to the field of Deliberative Democracy which is now known as a practice of democracy that makes deliberation, based on mutual respect and equal status, a central focus. (Bächtiger, Dryzek, Mansbridge, & Warren, 2018, p. 2) The field of Deliberative Democracy has been shaped by a number of philosophical and political ideals, two of which are relevant to our concept of stakeholder inclusion benefits in the DSD context.

Epistemic Ideal

The epistemic ideal suggests that deliberation in democracy should aim to arrive at the best possible answer to collective problems. This deliberative ideal traces back to Aristotle, the philosopher who suggested that the "multitude" might be capable of reaching a degree of wisdom and virtue even greater than the wisdom one exceptional individual could possess. (Chambers, 2018) In modern times, this idea has been theoretically proven under specific conditions. The Diversity Trumps Ability (DTA) Theorem states:

> "if (a) the problem is hard (no individual always gets it right), (b) the problem solvers converge on a finite set of solutions, (c) the problem solvers are epistemically diverse (they don't all converge on the same local optimum), and (d) there are many problem solvers who work together in moderate sized groups, then a randomly selected collection of problem solvers outperforms a collection of the best problem solvers" (Anderson, 2006, p. 12)

According to the DTA theorem, experts still arrive at better answers for straightforward problems but particularly for difficult problems such as problems in complex systems, randomly selected problem solvers outperform. The conditions of this theorem align well with the focus of our technology design for DSD. In a more inclusive DSD process, stakeholders (a) are encountering a difficult, systemic problem, (b) must arrive at finite improvements to the dispute system, (c) are epistemically diverse in that they have knowledge from different roles in the system, and (d) are in focus groups which often operate at a moderate in size of around 6-10 participants. Hélène Landemore, professor of political science at Yale uses the metaphor of a group lost in a maze to describe how decision-making with a diverse group can improve deliberative outcomes. In the metaphor, the group is given riddles that can only be solved by people with very diverse knowledge that other group members are unlikely to possess. If the group in the maze were homogenous, even if they were very skilled, they would not have the

information necessary to escape. “including everyone is the best group strategy when faced with complex, ever changing problems… all things equal otherwise inclusiveness was a good proxy for the cognitive diversity necessary to the emergence of collective intelligence in both problem-solving and predictive contexts” (Landemore, 2014)

Legitimacy Ideal

The legitimacy ideal suggests that democratic legitimacy is gained when those affected by decisions are included in the processes of decision-making. Political philosopher John Rawls conceptualized this legitimacy as public justification, (Rawls, 2005) or the act of providing reasons for arguments to the public in ways that are “acceptable to all citizens” (Chambers, 2018, p. 63). Since in democracy citizens are free and equal individuals, government coercion must be justified to those affected through deliberation. Those affected by decisions must have equal opportunities to participate, and equal (or fair) influence over the outcomes of discourse. (Bouvais & Bächtiger, 2016) Deliberation is the process by which the public legitimizes such arguments. Thus, it is essential for citizens to understand and acknowledge the validity of an argument. This is an important extension of the epistemic ideal because it implies that arriving at the supposedly optimal solution does not give anyone moral authority to impose the solution on those who do not agree.

DSD projects are not usually democratic in nature however projects still require public buy-in to be effective. The legitimacy ideal gives an indication for how validating an argument for stakeholders can be an important step to gain legitimacy and buy-in. Political researcher Dr. Edana Bouvais connects ideas of facilitation to gaining legitimacy. She writes:

> “Another important institutional design choice for promoting equality and inclusion in micro-institutional settings is facilitation. This is one of the most important techniques for ensuring participants’ internal inclusion since facilitators can ensure that everyone can use the formal opportunities to speak and, by ensuring that different sides of the debate are heard, can promote equity” (Bouvais, 2018, p. 150)

Facilitated focus groups is *where* we plan to use technology to improve stakeholder inclusion in DSD. We hope to see that improved stakeholder inclusion will increase the legitimacy of DSD projects. This is supported by our research into the legitimacy ideal.

3. Related Work

Within this section we will begin by covering the related work in DSD in greater detail, then briefly explore the related work in deliberative platforms and collaborative design platforms. Covering these domains will make a case not only for the opportunity within DSD for a tool that prioritizes stakeholder inclusion, but also within other domains for future work.

3.1 Dispute System Design Technology

The purpose for our technological intervention in DSD is to increase stakeholder inclusion. We determined that for our project, technological intervention stands to make the greatest benefit on DSD in the diagnosis phase of the DSD process, specifically in focus groups. Technological interventions in DSD have so far not been very plentiful in this area. There may be two reasons for this. First, this may be because there are other tools that can be useful for DSD focus groups that are not specific to DSD. Second, this may be because DSD practitioners do not often use technological tools in DSD focus groups since they often take place in person. The answer is probably a little bit of both. Later we will share related technology outside of the domain of DSD that services focus groups. In this section, we will recount a handful of examples of technology interventions in DSD process and DSD solutions. Technological interventions in the DSD *process* pertain to the different steps of the design process: diagnosis, design, implementation, and exit/evaluation. Technological interventions in DSD *solutions* pertain to Online Dispute Resolution (ODR) systems.

Process: Technological interventions in the DSD process have mainly been centered on the beginning and end of the process: diagnosis and exit/evaluation. An example of a technological intervention in the diagnosis phase is MarineMap, a decision support tool to test potential solutions for the care of marine protected areas against visualizations of the geographic attributes of the areas under discussion (Cravens A. E., 2016). This tool was designed to be an aid for collaborative conversation with non-technical stakeholders. MarineMap and OurStory share the same aim of stakeholder inclusion by reducing comprehension barriers. One main difference is MarineMap visualizes physical space, whereas OurStory visualizes systems and processes. An example of a technological intervention in the

evaluation phase is the Alternative Dispute Resolution Evaluation Support System (ADRESS) in the Mediation and Conflict Resolution Office (MACRO) of the Maryland Court System (Maryland Mediation and Conflict Resolution Office, 2010). This online tool is used by alternative dispute resolution program managers to assess various features of performance in alternative dispute resolution (ADR) processes from litigant satisfaction to case timelines. This information is submitted by practitioners, attorneys, and clients to create ongoing performance improvements to the dispute system. This system addresses comprehension barriers by providing new information and making that information more broadly accessible.

Solutions: Technological interventions in DSD solutions include ODR for online and offline industries. eBay is an example of an online company with an in-house ODR system (Rule, 2017). When eBay's dispute system was being redesigned, they were dealing with resolving 60 million disputes per year. Instead of hiring thousands of online mediators, they created a filtering system which enabled disputants to begin resolving the disputes themselves through eBay's Dispute Console with a decision tree of options to fit their situation. An example of an ODR technology made available to offline organizations is Modria. Judge Randall Slagle of Travis County, Texas partnered with the Austin Dispute Resolution Center and Modria to make an ODR system for small claims courts (Schmitz, 2019). When a case is added to the county's court management system, the dispute is automatically logged in Modria. Disputants are given the opportunity to draft an agreement together without involving a mediator. If they cannot agree, then a mediator works with them virtually to reach an agreement. If an agreement still cannot be met, the dispute is brought to court.

The examples that we have shared demonstrate ways in which technology is already working to address geographic and comprehension constraints. This is done through different forms of data collection and communication as well as online access to resolution for disputants that would find it severely impractical to resolve a dispute in person. This related work indicates the remaining need to address the constraints in the diagnosis phase of the DSD process, specifically within focus groups. Our thesis will explain the design, implementation and evaluation of a technological intervention in a unique position within DSD focus groups.

3.2 Deliberative Platforms

Deliberative platforms are related to the field of deliberative democracy discussed earlier. Given that our thesis draws from deliberative ideals to support our rationale for stakeholder inclusion, it is not surprising that deliberative platforms are often designed for stakeholder inclusion as well. In this way it is helpful to see *how* technology has been applied for greater stakeholder inclusion in the deliberative process. Our technology design will focus on addressing comprehension and geographic constraints in the context of DSD focus groups. In this section we will demonstrate that a number of deliberative platforms have sought to address the same constraints to reach the same goal of stakeholder inclusion. We will also discuss where our approaches diverge and the promising potential of applying our approach to these platforms in future work.

Geographic Constraints:

Studies on the design of deliberative platforms (Friess & Eilders, 2015) have explored many different ways to address geographic constraints and offer remote deliberation. They have tested different communication modes for the deliberative experience such as audio, video, text, or combinations thereof. Some studies use only text-based communication for deliberation such as the Electronic Dialogue Project (Price & Cappella, 2002). Others use only audio for deliberation such as Online Deliberative Polls (Luskin, Fishkin, & Iyengar, 2006) and the Virtual Agora Project (Muhlberger, 2005). In the realm of hybrid communication modes, the Finnish Virtual Polity Experiment (Grönlund & Strandberg, 2012) and online deliberative town halls in the United States (Neblo, Esterling, & Lazer, 2018) both took a multi-modal approach which incorporated video, text, and audio. Researchers have found that the communication mode used in a deliberative platform influences the kind of deliberation the platform produces (Grönlund, Bächtiger, & Setälä, 2014). For example, the mode of interaction can impact a participant's ability to engage anonymously. If a forum is purely text based, especially if real names are not required, participants may engage anonymously. This is particularly relevant because our technology will employ text-based communication and allow participants to engage anonymously. Deliberative platform research has found pros and cons to this approach (Towne & Hersleb, 2012) (Witschge, 2004). They have found positive effects to be the absence of social pressures and the ability for participants to express their real opinions without fear of

negative repercussions. On the other hand, the loss of accountability that this comes with this approach can unfortunately devolve into disrespectful behavior (Leshed, 2009). In our approach we use text to communicate, but we also enable participants to express themselves by indicating on a visual map where their comments are relevant. It is possible that the ability to be more specific in feedback could reduce frustration and keep the discussion on topic. Later we will share our reflections on how our anonymous experience worked and why.

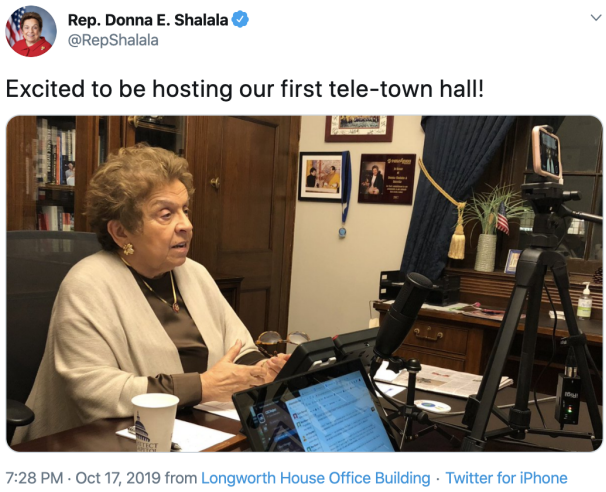

Figure 2: tweet posted by Rep. Shalala about the virtual town hall

Comprehension constraints:

Similar to DSD systems, political topics discussed in deliberative studies are often highly complex. There are lessons to be learned in how online deliberative platforms equip participants with contextual background information. Some scholars conducting deliberative experiments choose to provide participants with background information on the topic of deliberation before the session begins (Min, 2007). This can be in the form of video, for instance when Virtual Polity provided participants with a video of experts debating the topic of deliberation. In online deliberative town halls, a balanced, text-based descriptions of the topic are provided to participants before beginning the session. Gudowsky and Bechthold stress that providing high quality information is essential to participatory processes that deal with complex issues (Gudowsky & Bechtold, 2013). As Town and Hersleb (2012) concluded, common information helps to build a shared mental model and improves communication. For OurStory, we will offer background information in a tutorial when participants first visit the site.

This background information will largely be communicated visually in the form of a process map. This is different from how deliberative platforms have communicated their background information. Our background information will continue to be available to participants as they engage in the DSD focus group. The visual map is also interactive and can be annotated with participant feedback. We think this could be an interesting concept for application to deliberative platforms.

Facilitation has been a major topic in the design of online deliberative platforms (Wright & Street, 2007). The role of facilitators in a deliberative session is to ensure that the deliberative guidelines are followed and to assist whatever questions or problems a participant may have (Grönlund, Strandberg, & Himmelroos, 2009) (Luskin, Fishkin, & Iyengar, 2006). Some examples of facilitation in deliberative exercises are Online Deliberative Polls, Virtual Polity, Daum Deliberative Project, and Electronic Dialogue. Janssen and Kies (Janssen & Kies, 2005) have observed that facilitators can work positively and negatively. Facilitation may be received negatively if the moderator censors or removes opinions that do not fit the majority or are personally opposed to the moderators' own beliefs (Wright, 2009). However, it can be received positively if the moderator promotes deliberation by helping participants to synthesize the discussion, lifting up minority opinions or less vocal participants, and providing background information to information-dense topics. Towne and Hersleb (2012) suggest that content should appear immediately if possible so that the perceptions of censorship aren't discouraging to participants. Our approach to facilitation through OurStory for DSD focus groups is consistent with the facilitation practices in the offline DSD focus group environment. Later we will describe some affordances and shortcomings we have found to translating DSD focus groups online. However, as we compare our approach to facilitation through OurStory for DSD focus groups to that of deliberative platforms, we find our approach to be lightweight with no censoring of participant content.

3.3 Collaborative Design Platforms

When looking for *how* to use technology to improve stakeholder inclusion in DSD focus groups, we considered other technologies that have addressed comprehension and geographic constraints during the design process. Collaborative design platforms address similar constraints and have many similarities in terms of approach. All of the collaborative

design platforms we reference below are designed to accommodate a wide array of tasks including focus group workshops. Focus group workshops are not central to the platforms, but they are a featured use case in each platform. These tools have considered design solutions to both comprehension and geographic constraints to improve focus groups. Since this is the focus of our design intervention, there is much to learn from their approach. Some highlights that will be mentioned are the visual elements that are translated from in-person focus groups such as whiteboard space and Post-it notes, facilitator roles to manage an online group, and collaboration features to accommodate real-time online workshops such as widgets to show active users and contribution tracking to show who did what work. For our own work we will draw inspiration from these platforms while we design our own platform to address comprehension and geographic constraints in DSD focus groups.

The remaining need that is not expressed in these collaborative design tools, yet is a part of our contribution to DSD focus groups is the process of reference map annotation. In our concept, mental model alignment occurs through the process of (1) facilitated dialogue through virtual notes, combined with (2) the activity of using those notes to annotate a shared reference map of the system under discussion. Reference map annotation is a key part of our process where stakeholders can contextualize their feedback from the virtual notes on the portions of the map and collaboratively create a visual diagnostic of pain points in the system. We annotate the reference map through Tabs (a feature that will be discussed later) which are an abstraction of Notes (also discussed later) to build complexity into a reference map without creating clutter and confusion. Later we will explore in detail the unique features of OurStory. Below we will describe collaborative design platforms that inspired our design.

The following descriptions of collaborative design platforms will evaluate existing tools and highlight the aspects of these tools we will draw from when designing OurStory.

Figma: Figma is an online collaborative user interface design tool. In Figma, UI and UX design, prototyping, and wireframing are main use cases, however the tool can also accommodate brainstorming purposes that involve more diverse stakeholders (Figma, 2020). There are a number of different templates for predefined purposes, or users can start with a blank canvas. Figma has a left side panel which keeps a list of all of the visual elements that have been added to the canvas. On the top panel, users can add new visual elements or modify existing elements.

The two main design learnings we gather from Figma are related to contextual feedback and collaboration. Collaborating designers use “contextual feedback” to respond to particular areas of design (Figma, 2020). They can drop a pin and leave a comment anywhere on a visual element. This could be a helpful way to design to address comprehension constraints when discussing a complex system such as DSD. We will consider this approach when designing our interactive visual map. Figma has also been designed to allow fellow designers using the platform to see who is active online and who made changes to what part of the design project. This could be a helpful way to address geographic constraints when designing technology to improve stakeholder inclusion in remote focus groups. In our design we will consider mechanisms to recognize the presence of stakeholders in remote settings.

Figure 3: screenshot of Figma interaction

Miro: Miro is a collaborative design tool for creative teams (Miro, 2020), used for a range of purposes including facilitated workshops (Miro, 2020). Miro provides an “infinite canvas” within their variety of built-in templates or user-built templates. Users can choose from a selection of widgets including virtual Post-it notes, shapes, arrows, and drawing tools. The site also has embedded video and audio for real-time work sessions (Meredith, 2020).

The main design learnings from Miro are related to facilitator roles, visual elements, and collaboration mechanisms. In Miro, facilitators can host focus group workshops. As a facilitator you can invite participants through a link to have access to the workshop on Miro. On Miro’s upgraded service, facilitators can time sessions and add in voting mechanisms. Miro’s approach to facilitating workshops is an inspiration for how we may address the geographic constraint to stakeholder inclusion in DSD focus groups. Miro’s visual elements such as Post-it notes, templates and shapes are also useful elements to consider when designing to address geographic and comprehension constraints. Participants in a remote focus group can have the

same access to visual elements that they would in an in-person focus group. These visual elements can help focus group participants connect ideas and improve comprehension of complex systems. Lastly, Miro is designed for collaboration as is evident in the compatibility with video conferencing software, the active online bar in the upper righthand corner, and mouse tracking to show where a participant is contributing on the shared screen. These collaboration features are useful in addressing geographic constraints in DSD focus groups because participants may feel more connected to one another and thus be able to learn more from the contributions of others.

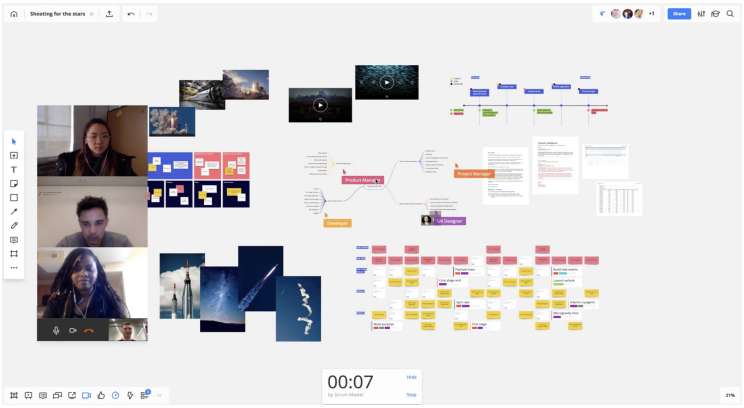

Figure 4: screenshot of Miro interface

Mural: Mural is a collaborative design tool for remote creative teams. It is also used for a number of different purposes including facilitated workshops (Mural, 2020). Mural offers templates for an array of use cases including but not limited to project planning, brainstorming, and evaluation. These templates are often different ways of arranging and orienting the whiteboard workspace such as plotting elements on a matrix or a Kanban layout. Similar thematic elements carry over throughout the many templates.

The main design learnings from Mural are related to facilitator roles, visual elements, and collaboration mechanisms (Tippin, Kalbach, & Chin, 2018). Much of the Mural technology overlaps with Miro. However, Mural does offer more facilitator privileges in focus group workshops. For instance, in Mural facilitators can lock content so certain content on the screen is adjustable while other content is not, they can summon participants to follow the facilitator as they move to other parts of the canvas, and they can track the contribution of different team members. These features are helpful for geographic constraints in particular because

facilitators in person are able to control their environment. An unstructured virtual environment may dissuade facilitators from moving their focus group online. However, if these features enable facilitators to have more control over the virtual environment and design intentional experiences for their stakeholder participants, they may be more likely to move their focus group online. This would mean more geographically dispersed stakeholders who would not be able to attend the in-person focus group can be included. Similar to Miro, Mural's visual elements such as Post-it notes, templates and shapes are useful elements to consider when designing to address geographic and comprehension constraints. Also similar to Miro, Mural is designed for collaboration as is evident in the active online bar in the upper righthand corner and mouse tracking to show where a participant is contributing on the shared screen.

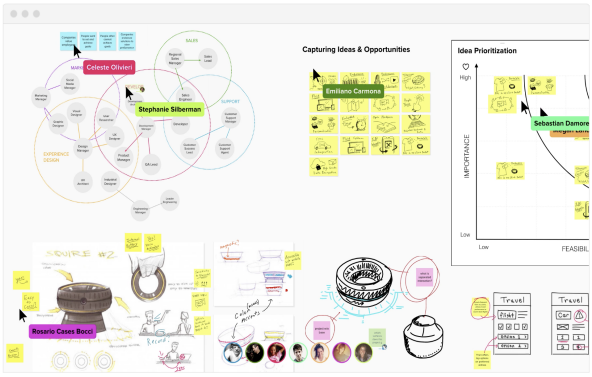

Figure 5: screenshot of Mural interface

Research into these three commercial collaborative design platforms help us understand *how* technology can be used to improve stakeholder inclusion in DSD focus groups. These tools address geographic constraints through remote collaboration design elements and visual elements drawn from in-person experiences. These tools can also address comprehension due to the visual annotation that they enable. We believe this visual annotation will be easier identifying problems in complex systems within DSD. We will use these concepts as inspiration while we design our own platform, OurStory, and apply it to the distinctive DSD process.

4. Design Rationale

For this thesis, the reason *why* we want to improve stakeholder inclusion is because it will improve DSD project outcomes. We have seen this to be the case in prior DSD projects such as the Chevron Nigeria Limited's General Memorandum of Understanding and the Maryland Court System's MACRO program. We have also found our reasoning to be enforced by epistemic and legitimacy ideals in deliberative democracy and concepts of mental maps and shared system learning in systems thinking.

The place *where* we want to improve stakeholder inclusion is in the earliest stage of DSD, the diagnosis stage. Technology in the diagnosis stage could reduce the effort expended by designers and stakeholders alike while increasing effectiveness. Our work will make efforts to improve stakeholder inclusion in DSD focus groups during the diagnosis stage of design.

The mechanisms that define *how* we will design technology to improve stakeholder inclusion in DSD will relate to identified constraints of geography and comprehension. These are two constraints that currently impact stakeholder inclusion in DSD focus groups. Stakeholders and designers struggle to gather for in-person focus groups but do not have the ability to bring the DSD focus group process online. Designers would benefit from simpler ways to collect and synthesize information and stakeholders would benefit from simpler ways to communicate all of the valuable information they have to offer. We looked to related work to see *how* technology has been used to address these constraints. We find technology in the same domain of DSD, however we have not seen technology specifically designed for DSD focus groups that address our same constraints. For deliberative platforms and collaborative design platforms we see two different approaches to technologies that are designed to address the same constraints of comprehension and geography. Because of our original hypothesis that visual communication of complex information will improve comprehension, we drew design features from the collaborative design platforms such as virtual Post-it notes and collaboration design elements. We drew process design elements from deliberative platforms such as usage of background information and facilitation practices. From this body of related work, we learned tangible ways to design the technology as we try to fit it to our use cases: one within DSD and one outside of it.

4.1. Design Principles

The following design principles are shaped by the *why, where* and *how* of OurStory. Our purpose for designing OurStory is contextualized by its setting in DSD focus groups and informed by the constraints it seeks to address. The design principles are listed as follows:

Everyone can Contribute:

Building upon the approach to stakeholder inclusion in prior DSD projects, the approach to building a shared mental model in systems thinking, and the ideals that are present in deliberative democracy, OurStory is motivated by the belief that every stakeholder has a perspective that is valuable in forming a clearer picture of the system at hand. Therefore, it is important that OurStory be designed in such a way that it encourages everyone to contribute. OurStory attempts to remove barriers to participation by allowing for remote participation and anonymous participation. In addition to removing barriers, it is important that OurStory emphasize the importance of each individual contribution. In the initial design, all contributions on the platform will have equal weight and will not be ranked by status or popularity.

Simplify Without Losing Complexity:

As was explained in the system design section, systems can quickly become very detailed and complex. There is a tradeoff between utility and validity of a system model because the more complex and thus the more valid a system model is, it may provide less utility because it becomes impossible for most people to understand. This tool aims to find design tricks that can make complexity more approachable by using visual elements, digital features like abstraction, and annotation methods to help improve the comprehension of complex system features.

Make it Easier to Synthesize:

Synthesis is an important stage in design iteration. After brainstorming and gathering many ideas, these ideas must be distilled into high level themes and action items in order to move forward. This design will draw from existing methods of grouping, sorting, and annotating to encourage a synthesize-while-we-work approach. This synthesis will hopefully reduce workload for designers and stakeholders.

Make Design Features Intuitive:

The prototype design of OurStory draws heavily from existing collaborative design platforms to make the platform as intuitive as possible. An intuitive design makes it easier for participants to not get distracted by the technology and focus on the group exercise before them. When users first join the platform, OurStory will provide a brief tutorial to get participants up to speed. In this way, we will optimize to decrease the learning curve.

4.2 Implementation

4.2.1 User interface design

In order to ultimately test the effectiveness of our tool against our research questions, we needed to find a DSD collaborator. We were put in touch with Professor Rachel Viscomi director of the Harvard Negotiation and Mediation Clinical Program (HNMCP). HNMCP happened to have a clinic specifically for DSD where Harvard Law School students learn about DSD and collaborate with real world clients. That was the beginning of our collaboration which took place over the course of multiple conversations and eventually resulted in a test run of OurStory with a student and client partnership. We will break the stages of our collaboration out into sections below.

Why: From the beginning of our conversations with the DSD clinic we were aligned on the importance of stakeholder inclusion. We were all excited at the potential of technology to improve inclusion and as a result the effectiveness of DSD projects. In our initial conversation with Prof Viscomi, we discussed our mutual interest in technology for stakeholder inclusion in DSD and we determined the next step was to figure out where technology would be best suited in the DSD process. We planned for a follow-up conversation after the clinic provided more information that would support our first design iteration.

Where: After we received materials from the DSD clinic that shed light on their approach and after additional supplemental research, we determined that the systems aspect of DSD might be quite complicated for stakeholders to understand. Often designers are the vessel of knowledge, the ones that understand the big picture of the dispute system. This places a lot of responsibility and effort on the designer. They need to find ways to incorporate many disparate

pieces of feedback from stakeholders who have only partial information about the system. Often this big picture of the system is shared with decision-makers who occupy a specific stakeholder group, but the big picture is not always communicated to the rest of the stakeholders. Not only was this approach creating extra work for the designers, but stakeholders were left out of the loop. We saw this as a comprehension constraint that could prevent stakeholders from fully buying into the DSD process. DSD is also limited in its ability to design with stakeholders remotely. We saw this as a geographic constraint that could prevent stakeholder involvement

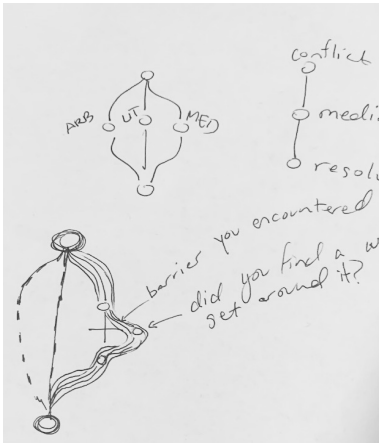

Figure 6: early paper sketch of visual map of dispute system

As we began to conceptualize the role for technology in the DSD process, we also started designing maps of the dispute systems themselves in an attempt to communicate their structure and function in a simpler manner. Early mockups experimented with different perspectives and possible visualizations of the dispute systems. The next two rounds of mockups were designed on the UI design tools Sketch and Figma.

With geographic and comprehension constraints in mind, we conceptualized three different technology features that would support different stages of design. Two of the design features were focused on the diagnosis stage. The first feature was made to support virtual focus groups. The second feature was more of an interview/survey data collection mechanism that mapped the data collected onto an interactive system map. The third feature was for the pilot project stage. This feature was made to support DSD pilot project proposals also mapped onto the virtual system map.

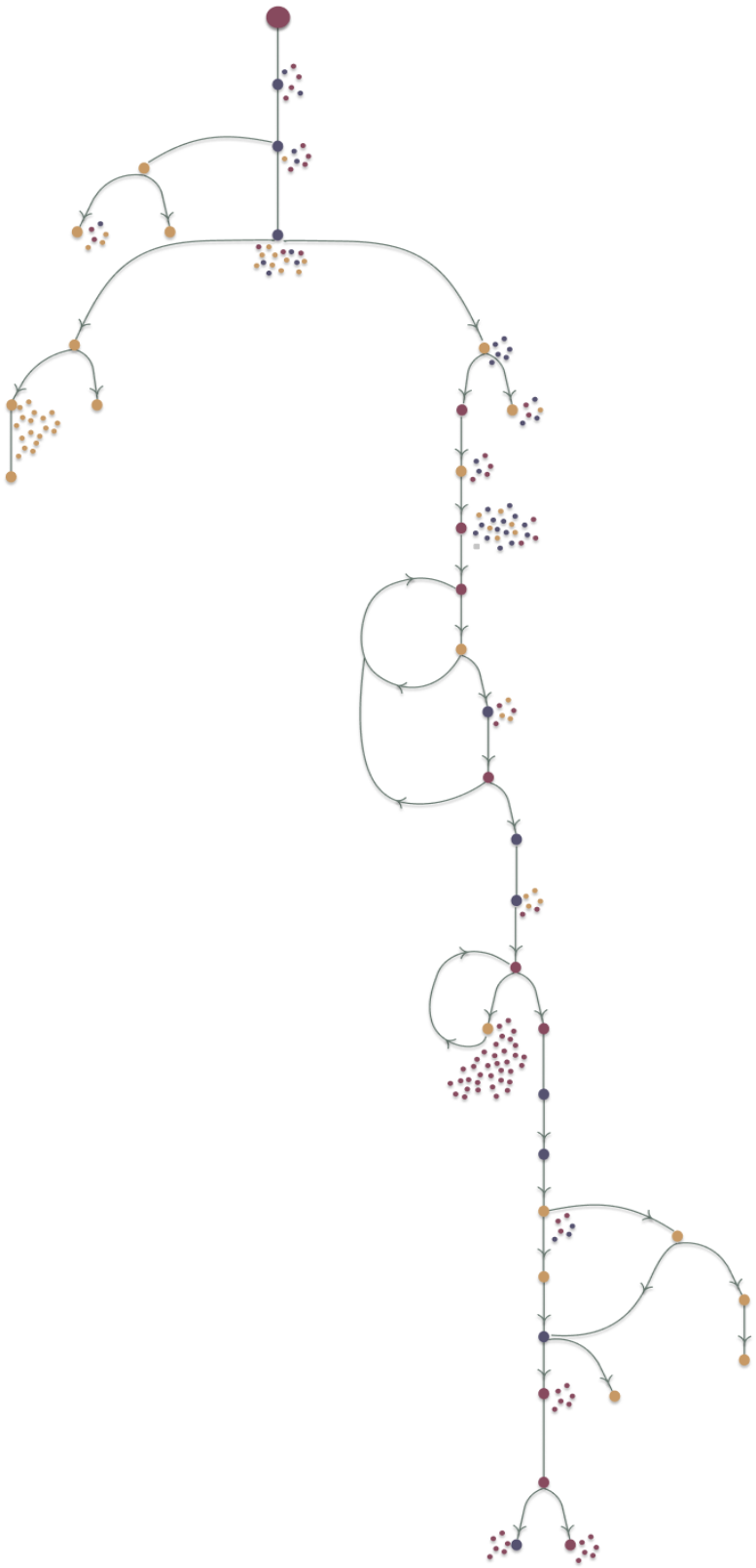

Figure 7: Early mockup of a dispute system in Figma. Dots here represent stakeholder feedback

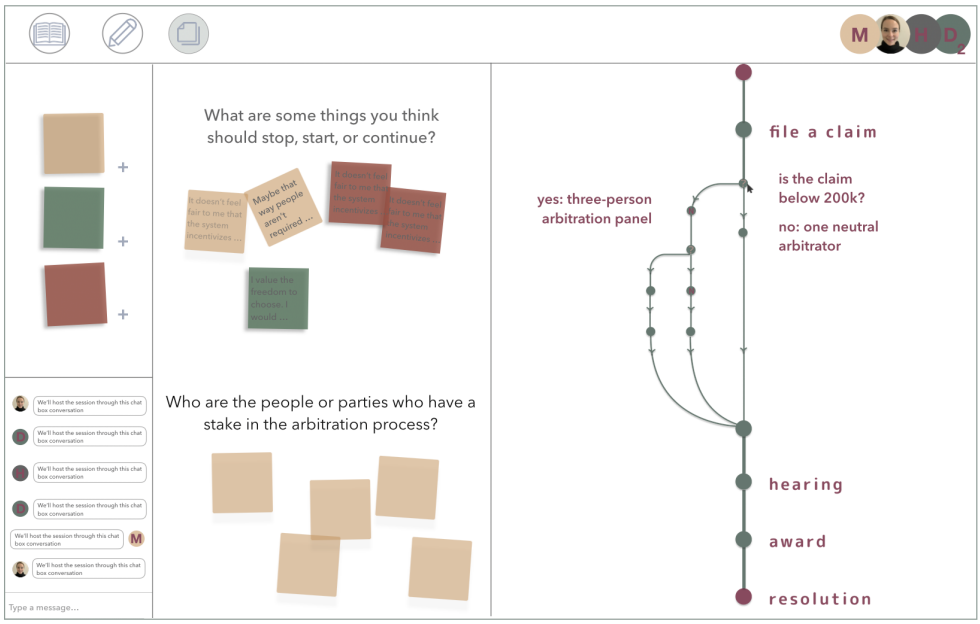

Figure 8: Early mockup of OurStory in keynote

At this point, mockups were animated and presented on Keynote. In the second meeting we presented these initial mockups to assistant director of HNMCP, Sara del Nido Budish. Some minor changes were made after this meeting, then in a third meeting, we regrouped with Prof. Viscomi and Mrs. Budish to select the feature to pursue. Prof. Viscomi and Mrs. Budish could see the most immediate use case for the tool in the focus group stage of their process, so the scope of the tool was narrowed to translating focus groups online. The next step would be building the tool and presenting it to the DSD clinic class. At that point, the students would decide whether the tool would be of use in their focus group work with a client at the clinic.

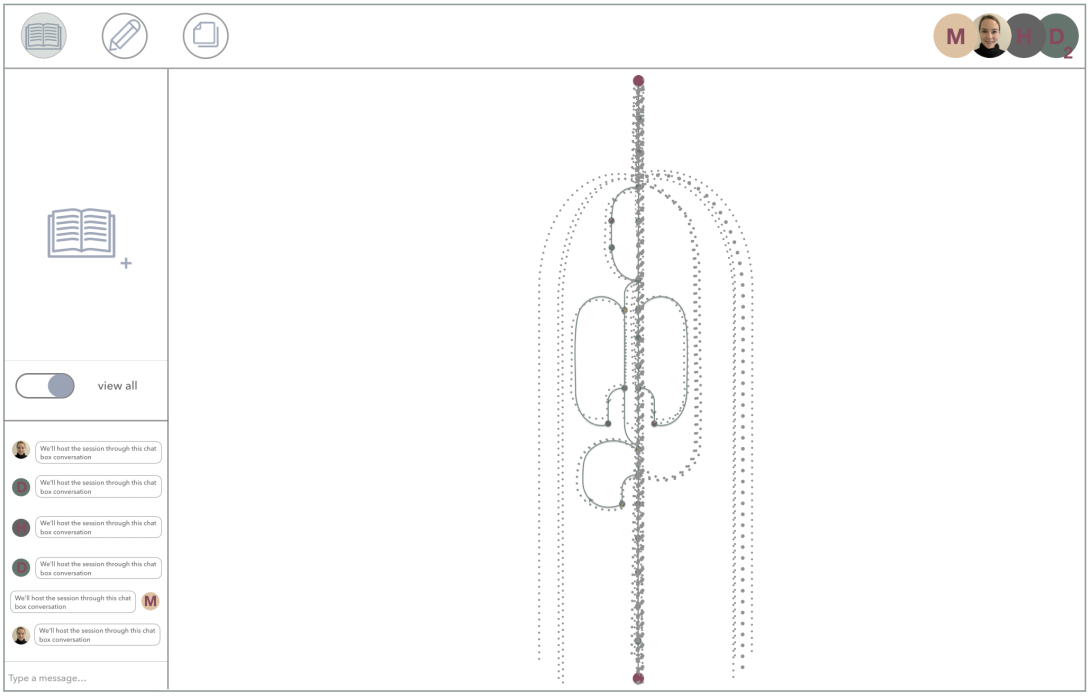

Figure 9: Stories concept to map individual paths through a dispute system

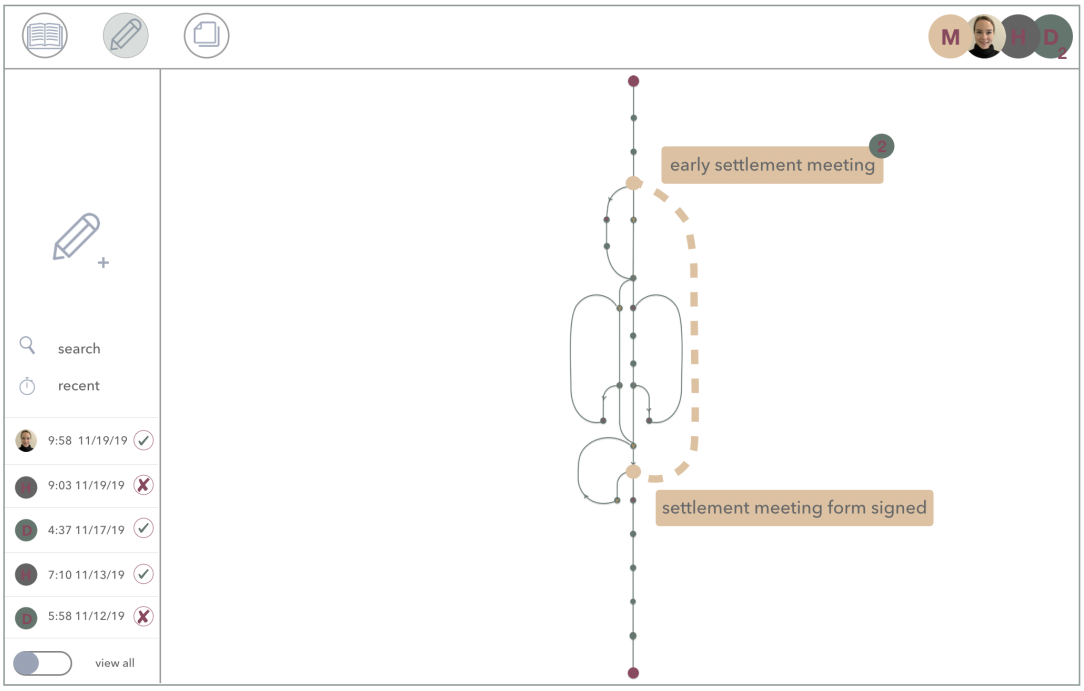

Figure 10: Proposal concept for DSD design phase

How: Once we answered *where* in the DSD process we would focus on for the development of our tool, we needed to address *how* technology would improve stakeholder inclusion. With our rough mock-ups, our design principles, and our background research, we prioritized a selection of features to build. The main focus of our tool was on using visual elements to make participation in the virtual focus group interactive and comprehensible. The elements from the in-person focus group that we prioritized were Post-it note-taking and chat discussion. To augment the experience, we added a visual reference map of the system being discussed. Including the reference map was an attempt to test our hypothesis that visual aids can help collaborators discuss complex topics. The details of the features we designed will be described in section 5. User Experience and User Interface.

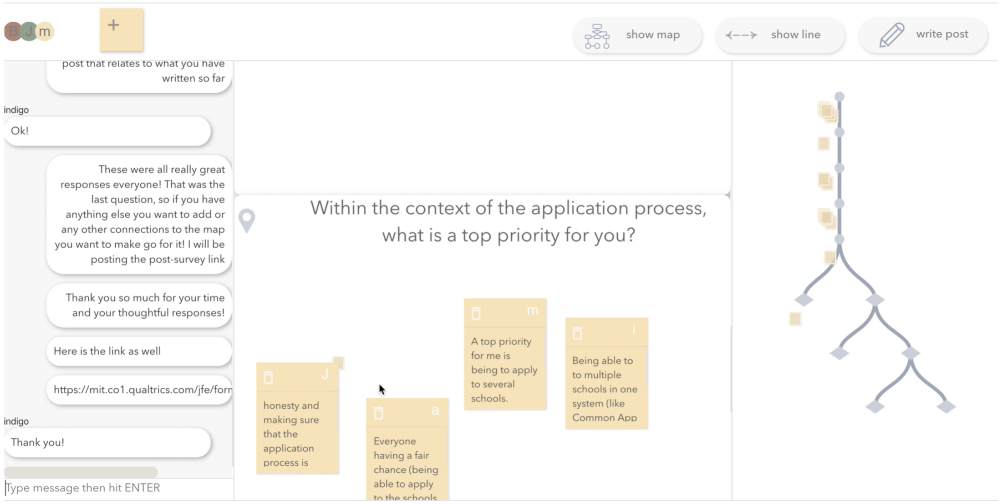

Figure 11: screenshot during user study of participants participating in the DSD focus group

As we refined these elements, there were two design critique sessions from fellow classmates. The first design critique took place while the tool was still a mock-up on Keynote. Various classmates gave their input on different features. In the second session, the tool had been built to a basic level of functionality. Classmates tested the tool and then responded to a post-survey. In this session, a number of practical design changes were made such as enlarging the side chat panel, moving the buttons from the left side to the right side, and limiting the use of color on the platform. After this round of feedback, the tool was ready to be fully implemented which will be discussed in the following section.

It should be noted that our design process was purely catering to DSD focus groups, not other potential applications. For this thesis, the decision to test OurStory in other applications did not come up until after the design was completed. However, we do not see this as a negative. Our hypothesis was that DSD processes could benefit other institutional systems and our mechanism for testing this hypothesis was the usage of OurStory technology and the DSD focus group method on a topic unrelated to disputes. Therefore, we were not testing two different technology designs, but the same technology design for two different purposes.

4.2.2 Technical Build

This web app was designed for laptops and desktop computers because the design of the site makes full use of the available screen space and usability might be more difficult on smaller screens. That being said, in future versions it may be possible to make this tool accessible on tablets as well. And with some modifications, it could likely be usable as an iPhone app as well.

The infrastructure of OurStory includes the Javascript library, React Web App, a virtual machine server backend, the Pusher Chatkit server backend, the Pusher Chatkit API, and external packages such as Pusher Chatkit, D3, ReactJoyRide, and ReactDOM. Pusher Chatkit provides a set of SDKs and APIs that add chat functionality to web apps. For our purposes, all real-time features used Pusher Chatkit. The collaborative features including chat messaging, Note activity, and Tab movement on the map panel are all supported by the Pusher's Chatkit web server. This is enabled through the Pusher Chatkit cross-platform SDK which provides a chat manager. OurStory uses an initialized instance and token provider on the chat manager to set up unique chat rooms for each focus group session. As the client, we query the Pusher Chatkit API token provider to authenticate message requests and return new messages to the web app. Chat data can be sent and received through the Pusher Chatkit API. Usernames are also stored remotely on the Pusher Chatkit web server. The OurStory app has a backend hosted by an MIT virtual machine using nginx.

4.2.3 Assumptions and Limitations

Assumptions:

There were a number of assumptions at this stage of the project. We assumed that users with some sort of connection to the topic being discussed would be able to communicate their perspective and experience in short-form or semi short-form response. We assumed that if participants were asked the proper questions, their responses would be applicable to the visual reference map that was provided. We assumed that the responses gathered in the course of a session would adhere to community guidelines and would not be destructive or distracting to the process. We understood that this was a privilege that came with performing small-scale controlled user studies and that if this technology were to scale, it would be necessary to put in place content moderation or some other more robust method for upholding community guidelines.

Limitations:

There were three technical limitations that are mentioned as follows. First, our ChatKit API had a limited number of requests that could be retrieved at one time which led to chronological misalignments when reloading the page in the middle of a session. The server in use did not receive messages in the correct timestamp order so we were limited to asking the participants to log in at the start of the session and refrain from refreshing the page so that all messages arrive in the correct order. Another limitation was the local server being used to host the site. The server was hosted from the researcher's personal laptop computer which meant that it regularly timed out and the connection dropped. During the hour-long sessions this connection was sufficient but it was not possible at this time to test out longer asynchronous sessions. The third limitation, as previously discussed, was that the platform could not be used on smartphones or tablets.

Two other limitations arose due to the nature of the testing setup. First, the selection of participants for the study was a limitation. For the test, we relied on respondents from the MIT Behavioral Research Lab's testing pool. This pool of participants was not as diverse of a group of stakeholders as would be ideal for future usage of OurStory. We relied mostly on participants from similar stakeholder groups which slanted the feedback towards a certain

perspective. This feedback will be elaborated on later in this thesis. Another limitation was that in the sign-up process used by the MIT Behavioral Research Lab participant pool, participants were asked to sign up for one hour at a time. This was because it was not possible to pay users for one hour spent over the course of a longer time slot. Participants were paid hourly and for the full hour. In future experiments it may be possible to schedule testing that allows for asynchronous participation.

5. User Experience and User Interface

Our design aims to address comprehensive and geographic constraints for DSD focus groups. The user experience and user interface were based upon our research into DSD and other related work in deliberative platforms and collaborative design platforms. Below we offer our rationale behind the roles and tool features of OurStory and a brief explanation of how they operate in practice.

5.1 Overview of User Roles

Given that we built a tool for DSD focus groups, OurStory offered distinct roles for the facilitator and participant in an online focus group session. There were dynamics of focus groups that we expected would not translate from the offline environment to online, for instance, reading body language. There were also new affordances to online focus groups that expanded the capabilities for both facilitator and participant roles. We will briefly describe these two roles and what the online environment could offer to improve stakeholder inclusion.

Facilitator: The purpose of the facilitator is to guide participants through a series of questions that can elicit ideas. The facilitator often does not respond to the discussion questions herself but will post a question to the group and encourage different forms of behavior from the participants by communicating with the group on the chat panel. Facilitators are encouraged to be attentive and helpful to any questions or concerns that a participant may have. Facilitators do not impose their perspective, but instead guide the attention of the group, keep the conversation active and maintain a cordial tone. A facilitator may choose to take advantage of anonymous capabilities online and host an anonymous focus group. This changes the relationship with participants because it can be more difficult for a facilitator to keep track of the emotional states of individual participants, but it can also increase the candor of conversation.

Participant: Participants are invited to join a conversation and share their perspective. There is no particular kind of person who fits or does not fit the criteria of a participant. A facilitator may select participants in advance because they have knowledge or experience with the subject area to be discussed, or participants may volunteer themselves. Participants are encouraged

to act autonomously and collaboratively with the other participants. As will be discussed later, participants are encouraged to draw inspiration from the input that other participants are offering. The activity of participants fuels the discussion so all works best when a participant actively contributes to the questions posed by the facilitator. Participants have a different relationship with one another and with the facilitator online. There may be less pressure to respond quickly online, especially in a text-based medium such as OurStory. Participants can take their time to respond and reflect upon the comments of others.

5.2 Overview of Tool Features

The features in OurStory were built with our original goal in mind: improved stakeholder inclusion in DSD focus groups. We came up with four design principles that encapsulate how we hope to address comprehension and geographic constraints in DSD focus groups. These design principles in addition to our research with the DSD clinic and research into other related work such as deliberative platforms and collaborative design platforms informed this build iteration. The features listed below were included in the build iteration that was tested in our focus group session with the DSD client and our user study of the college admissions process. In this section, we have not listed all of the features, only a handful that exemplify our thought process for the build of OurStory. For a detailed account of all of the tool features, please refer to Appendix A.

Tutorial: Before users begin the focus group, they are offered the opportunity to walk through a tutorial of the OurStory features. We added the tutorial to align this project with two of our design principles: *Make design features intuitive* and *everyone can contribute*. Some users may be familiar with how to use our features without a tutorial, but other users may not have much experience with online platforms, particularly platforms used for design, discussion, and collaboration. The tutorial intends to bring users to a more level playing field before beginning the focus group so that everyone has the greatest opportunity to contribute. The tutorial is optional and can be skipped if users feel confident with their understanding of the tool and the subject of the session.

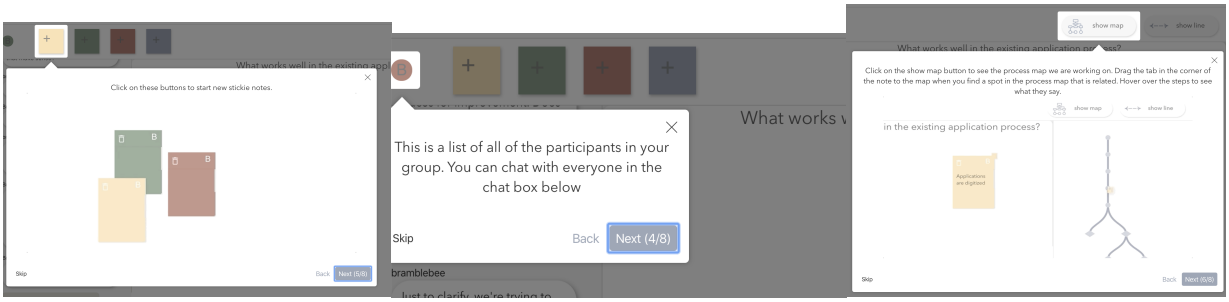

Figure 12: (left) tutorial slide to add notes, Figure 13: (center) tutorial slide for user icons, Figure 14: (right) tutorial slide to drag Note Tabs

There are two key interactive visual elements that participants will use during an OurStory section: Notes and Tabs. Their descriptions are as follows:

Notes: We decided to make Notes the medium through which participants respond to focus group questions because we wanted to translate the visual features of the offline focus group to the online focus group. We hoped to see that the continuity of this element would address our design principles of: *make it easier to synthesize* and *make design features intuitive*. Designers are familiar with the idea of instructing stakeholders to write on tangible Post-it notes, thus writing on virtual Notes will hopefully put participants in the same frame of mind and enable them to arrange their feedback and the feedback of others in a way that makes sense for them visually on the screen. Additionally, the affordances of the digital space allow for some enhancements to the Post-it note concept. In Appendix A, we will discuss the two enhancements that this tool has currently added to Post-it note design in the virtual space.

Figure 15: Note

Tabs: Note Tabs are an original visual element in OurStory. Each Note has one Tab which can detach from the note and be dropped onto a particular step on the process map. This Tab feature enables participants to self-sort their comments and enhance the map with their own perspective. Tabs were created to address the design principles of: *make it easier to synthesize* and *simplify without losing complexity*. We hope to address the *make it easier to synthesize* design principle by using Tabs to enable participants to contextualize their Note commentary with where it may be relevant on the process map. We hope to address the *simplify without losing complexity* design principle by using layers of abstraction. Tabs are a layer of abstraction from the Note. Instead of placing the Note itself on the map with all of the written detail, the Tab is a placeholder that references the Note it is affiliated with. This abstraction simplifies the details visible on the map while retaining the full complexity of the Note in the question panel. As Tabs populate the map, they become a useful diagnostic for where to draw attention when looking for problems or solutions in the system. (see Appendix D for examples of Tab usage in user study sessions)

Figure 16: Note Tab

The Panels: The OurStory interface has three panels for interaction. Below we will list the characteristics of each panel in the interface and their component parts. The panels will be listed from left to right.

The Chat Panel: The Chat Panel is where all users can talk to one another. Facilitators will often use this panel to provide instruction on how to respond to different question prompts or check in with participants to make sure that everything is running smoothly. Participants can ask clarifying questions in the chat panel or discuss details of the experience with one another.

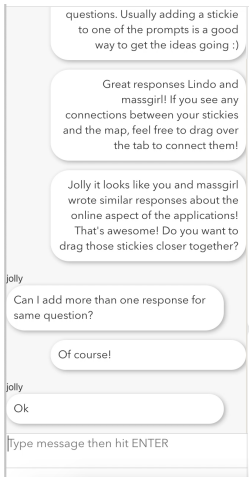

Figure 17: Chat Panel

The Question Panel: The Question Panel is where the bulk of the activity in the session takes place. Facilitators post new questions and participants respond on notes. This panel can be used to brainstorm topics and surface sentiments that participants may not be aware another participant carried.

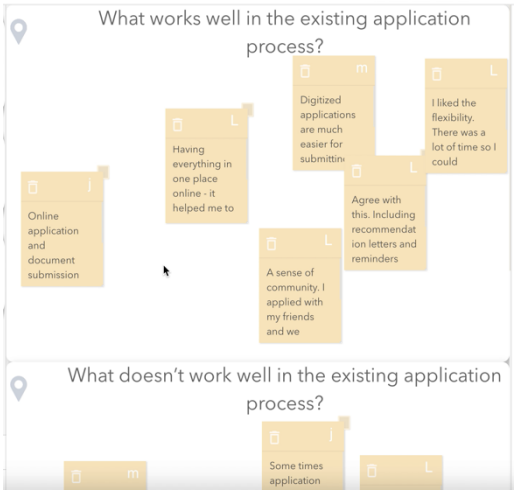

Figure 18: The Question Panel

The Map Panel: The Map Panel is a visual reference for the system being discussed. Participants can refer to the map if they need to be reminded of how the process works, especially as processes become more and more complex. For the sake of our user test, this map reference is quite simple, but the hope is that the maps loaded into this panel would have more complexity for users to explore as they work. When a user hovers over a process step, a label for the process step appears. This map is not just a static visual reference, but it can also be annotated by adding Note Tabs at whichever process step a participant deems relevant to their Note.

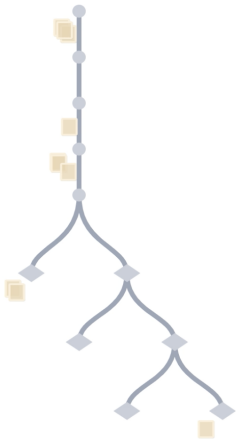

Figure 19: the Map Panel

6. Evaluation

Once we built OurStory to a sufficient level of completion, it was time to evaluate its performance. We evaluated OurStory in two ways:

1. Through a test run of OurStory with the DSD clinic. A student of the DSD clinic tested out OurStory technology during a focus group conversation with a real-world client. Interviews with the student and professors at the DSD clinic were conducted after the conversation.

2. Through a controlled user study in which we contrived a topic of discussion and analyzed the resulting conversation in regards to our research questions. This user study also involved a post-survey where participants in the study responded to questions about the interface.

The effectiveness of the OurStory platform and methods are evaluated by existing research questions. These research questions are:

1. Did OurStory help a designer/expert identify new information on the focus group topic?

2. Did OurStory help stakeholders understand the perspectives of one another and the topic as a whole?

6.1 Dispute System Design Test

As we have said previously, we believe that stakeholder inclusion is important for DSD because (1) it increases the ability to identify problems in the dispute system, and (2) it legitimizes the DSD process. In section 2.2 on system thinking we saw that aligning mental models is important for groups to learn together and improve system performance. Aligning mental models comes from uncovering and understanding the mental models of others. In section 2.3 on deliberative democracy, we saw that deliberation amongst diverse stakeholders under certain conditions leads to better epistemic outcomes and legitimacy is the result of recognizing the perspectives of others and justifying proposals before them. Based upon this

reasoning, we will determine the effectiveness of OurStory by its ability to address these two desired benefits of stakeholder inclusion. They will be framed in terms of two research questions:

1. Did OurStory help the designer identify new information in the dispute system?
2. Did OurStory help stakeholders understand the perspectives of one another and the dispute system as a whole?

We will describe who used OurStory, how the focus group session was set up, and then evaluate the session against these two research questions through interviews with various individuals who were involved.

Who used OurStory: The DSD clinic we partnered with had a spring class of less than 20 students who were each paired up and assigned real-world clients in need of DSD. These clients could have been from many different sectors of society from state judicial branches, to university ombuds offices. Through the term of the class, the students go through the various DSD stages and by the end of the semester produce a DSD recommendation for the client. As stated in section 4.2.1, OurStory was built in time for a presentation before this class in the hopes that a student would be interested in trying out the tool with their client.

Mrs. Budish, clinical instructor at HNMCP's DSD clinic, described her logic in terms of when students would be introduced to OurStory: "we tried to be thoughtful about when we shared [OurStory] with the students this semester because we wanted it to be a time when they had wrapped their head around the project. That way it wasn't brand new and they could envision ways that it could be used... I think hitting that spot is ideal in terms of getting people to think about [the tool] in a concrete and creative way with their projects."

After presenting for the DSD Clinic class, a student (kept anonymous upon request) from the clinic was interested in using the tool with her client and she reached out to work out the details.

How the session was set up: We had a preliminary phone call with this student to align her needs with what OurStory could offer. She did a test run of her focus group and afterwards she requested some minor changes to the tool: adding a couple more colors to the Note options,

removing the Map Panel, and enlarging the Question Card. After these changes were made, the session was ready to begin.

Evaluation of the session: While working with the DSD Clinic, for confidentiality reasons we were not permitted to observe the session or document any of the communication between the DSD practitioner and the client. For that reason, our evaluation of OurStory's performance with the clinic will be based on interviews with the DSD student practitioner and DSD professors.

Did OurStory Help Designers Identify Any New Information in the Dispute System?

There are two main ways in which OurStory helped designers to identify new information in the Dispute System. The first is the new data collection method through OurStory. OurStory was able to address the geographic constraint and help identify new information in the dispute system during remote focus groups. As Professor Viscomi said: "One of the real benefits [of OurStory] is the ability to collect assessment data from a swathe of folks that we can't necessarily get to in person." Prof. Viscomi recounted how on a particular project in the past, there were many "very far flung offices" and they were not able to get assessment data from everyone due to the distance. "While it was possible that we might be able to get to one or two of the locations over the course of a semester there was just no way we were going to be able to travel to the four corners of the world." Prof. Viscomi compared the experience with OurStory to survey data collection. "You can't expect the people are going to go back and fill out a second survey when it turns out you everyone misinterpreted that question and we didn't quite get the data we wanted. In this context you can continue to learn and change as you're moving forward and adapt if you need to and that's really helpful." OurStory reduced the workload for designers by enabling them to collect new information without travelling and in an iterative manner, unavailable through existing survey methods. This addresses our design principle of *Everyone can Contribute* because remote participation enables a broader net of participants. Often a barrier to learning when working to align mental models occurs when information is limited or misunderstood. By gathering more information and reducing opportunities for the information to be misunderstood, it becomes easier to align mental models of stakeholders in a dispute system. Mental models with greater alignment across stakeholders in a system will result in better epistemic outcomes with more legitimacy.

The second way OurStory helped designers to identify new information in the dispute system came from the new relationship between participants. When the DSD student hosted the focus group, she chose to have everyone invited participate anonymously. In the session with the client, participants all logged in under the same username. In this way, whenever a participant added a note or wrote a comment, it was impossible to distinguish who said what. Dispute System Design can naturally be a contentious topic so anonymity can be a protection for stakeholders, enabling them to engage more honestly. The DSD student who ran the session affirmed that participants shared new information because of the anonymity: “I did notice them sharing the more strong opinions in the anonymous [OurStory session] ... my hypothesis would be that people are willing to be more candid or more willing to speak.” The online experience created a new dynamic between participants that was not possible to manufacture in person. Prof. Viscomi explained the difference between in-person versus online anonymity: “In person we go to the extent of having everyone use the same kind of pen. You could still sometimes read someone's writing or you can tell that somebody was sitting next to someone else. I think one of the things that's cool about this tool in the virtual world is you really don't have that.” In this way, OurStory reduced the workload of designers because they did not need to construct workarounds for anonymity as they would offline. In this way, our design principle of *Simplify without Losing Complexity* was addressed because the design of the platform simplified an interaction that in the real world requires more workarounds. As a result, the valuable information that results from anonymous interaction is retained.

OurStory is currently a purely text-based platform. This turned out to be a positive for the DSD student who ran the session. Due to the potentially sensitive or thought-provoking nature of the questions raised by a DSD facilitator, there was a benefit to giving participants the time to think through their response without talking over one another. The DSD student believed anonymity and text-based communication led to more candid responses that would not have been possible to gather in person. “In a focus group, sometimes you have one person talking first and then everyone has to wait, and here people could theoretically type at the same time. So, it could create more space for people to engage and to either take time or have to wait for others” OurStory was helpful in identifying new information because in-person focus groups do not offer the same anonymous protection and text-based communication mediums that a virtual focus group can. This wound up making a difference in the quality of information revealed. When participants are able to answer honestly and take their time to come up with

responses, the responses will likely be more thoughtful and thus provide greater epistemic value to the picture of the entire system.

Did OurStory help stakeholders understand the perspectives of one another and the dispute system as a whole?

To answer this question, it would have been ideal to speak directly with a stakeholder who participated in the discussion. However, for confidentiality reasons, our conclusions were drawn through interviews with the designer/student and clinic instructors.

There are two main ways in which OurStory helped stakeholders understand the perspectives of one another and the dispute system as a whole in the Dispute System due to stakeholder involvement. The first way OurStory helped stakeholders is due to anonymity yet again. Participants in the focus group were more candid in the anonymous online session. This anonymity revealed new information that helped stakeholders to understand the perspectives of one another. As the DSD student explained, "Part of our purpose in using the tool wasn't just to brainstorm. It was also for them to see how one another were feeling. And I think it did allow them the freedom. You can't have an anonymous focus group in person." When participants are able to understand the perspectives of others, this helps to align mental models and gain buy-in. Stakeholders are more likely to understand the rationale behind the proposals of dispute system designers if they have been exposed to the perspectives that informed the designers' proposals. The second way OurStory helped is due to democratized information. Participants generally know what they have shared individually, but they could see more clearly what others thought through this virtual focus group. Given that more people can participate and share honestly, it connects pieces of information in such a way that people get a larger picture of what is going on. Prof. Viscomi described the phenomenon as follows:

> "Expanding our ability to do focus groups is very helpful because it democratizes the information. It gives people a little more insight into what we're learning… It's always helpful for data gathering and, in this case, it was really helpful for building buy-in and shared understanding in the group which was really helpful from a client management perspective"

Prof. Viscomi explained this further by describing how OurStory helped to provide insight into the big picture being gathered from many disparate sources.

> "People have a good sense of what they've individually shared, but they don't necessarily know what other people have shared and so they don't necessarily have insight into what the universe of data looks like… in this case by having everyone see what everyone else was sharing in the same moment was super helpful because it meant that they had access to and guidance around what other folks in the room were saying that up until that point in some for bits and pieces of it we were hearing independently."

This big picture granted to stakeholders through democratized information gives the DSD project more legitimacy because stakeholders are not left wondering how the information shared from their own mental model wound up being incorporated into the mental model of the dispute system designers. When they see the big picture themselves, there is no mystery and a shared mental model can be formed more easily.

Challenges: Going into the session with the DSD clinic, we anticipated a couple of bugs in the technology. Some of those bugs did pop up while the DSD facilitator and client were using the tool. The two main bugs they experienced were the "sticky Note" problem and the "no text" problem. The sticky Note problem is when a Note sticks to the Question Card panel and not to the Question Card itself. This means that the Note does not move when the screen scrolls and cannot be deleted or dragged away. This creates clutter on the Question Cards. The no text problem is when a participant writes their response on a Note and it appears on their screen but not on anyone else's. After a couple of rounds of debugging, this problem occurs very infrequently now, but it can still sometimes occur.

We were also technically limited in how long the sessions could stay active. Due to the configuration of the server, participants could only visit the session during a time window that was approximately two hours long. The DSD student remarked on how an asynchronous experience would be interesting to explore and could perhaps offer participants even more flexibility to make themselves available to participate, offer thoughtful responses, and keep up with the responses of others. In the future, we would like to configure the tool to be available for a longer time window.

Aside from known bugs, some challenges occurred with usability of the tool. One of our design principles was around making the tool as intuitive as possible. We discovered that there was some demographic bias in what might have been considered intuitive. The student said,

> “it's funny because to me it's so straightforward and easy to use, and I think we did the test with people in various age ranges who didn't grow up using technology, and ended up with a lot of confusion at the beginning about how to even put a [Note] and make it work.”

The tool was given to the student a day before the session to try out the features and let us know about any challenges. She didn’t report any confusion, yet once the session was underway, a number of the clients who were older or less familiar with technology did not find the same things intuitive. Our aim with designing OurStory was to offer an interface for DSD focus groups that would reduce comprehension constraints and enhance the ability of stakeholders to contribute their perspective. To put this in systems thinking terminology, our aim is to align the mental models of dispute system designers and an inclusive selection of stakeholders to create more effective outcomes from DSD processes. Mental models will struggle to be revealed and ultimately aligned if different sets of stakeholders are not able to use the technology proficiently and instead find technology to be a hindrance to their participation. This will amplify at least two barriers to learning as addressed in system thinking. Information will continue to be limited and misunderstanding of the available information will increase. Thus, this is an important design challenge to address to meet our goals and will be a challenge for future design. One of our design principles is *Make Design Features Intuitive* so we must find ways to be user-centric in the explanation and illustration of not only the online focus group method, but also the new visual description of dispute systems so that diverse stakeholders can understand how to contribute. One suggestion made by the student was to expand upon the tutorial and consider adding an explanatory video at the beginning of the session. This may be a way to improve the on-ramping process for those who are less familiar with the technology, although more options remain to be explored.

6.2 User Study

The purpose of our design is to increase stakeholder inclusion in DSD focus groups. However, dispute systems are not the only kind of systems that could benefit from the DSD method. We

would like to test our technology on its ability to conduct focus groups for a process unrelated to a dispute system. We believe that with assistance from a technology to reduce constraints to adoption, the DSD method could benefit more processes than it currently reaches. To test our technology in this way, we conducted a user study.

The user study was designed to engage participants in a conversational activity around a contrived topic for roughly an hour. During the course of the hour, participants used the features of the OurStory platform to add Notes to Question Cards and drag the Note Tabs to the Map Panel. After the activity was complete, the participants completed a brief post survey. Below we will describe these components of the user study in greater detail.

6.2.1 Overview of User Study Topic: College Admissions Process

The college admissions process was the topic of discussion for our study. We intentionally chose to discuss a process unrelated to disputes. To gain the epistemic benefits of stakeholder inclusion, our study must engage cognitively diverse participants. This means participants with different life experiences be it through age, gender, race, employment, etc. Given our resources available to select participants for our study, we chose a topic that would hopefully deliver the most cognitively diverse participants possible. We thought that the college application process would be generally familiar to our participant pool (e.g., as a former university applicant themselves, or are a parent of an applicant, or are a staff member at a university) and thus allow for more cognitive diversity.

We have reason to believe that our approach of DSD focus groups through the OurStory platform will provide new information for an expert in the college application process. Prior research on the college application process focuses on either a specific point in the application process, such as the interview stage (Corelli, et al., 2015), a specific quality that applicants should possess, such as real world experience (Waheed, Mengal, Shah, & Sheikh, 2011), or a particular subset of the population that the application process touches, for example students, application professionals (Sorey & Duggan, 2008), or parents (Cabrera & La Nasa, 2002). Some studies examine the preferences of American families from different racial demographics for practices that should continue, be added, or be removed (NORC, 2019). Other work asks admissions professionals to rank the criteria they believe to be the most important in assessing potential university choices (myKlovr, 2017).

The design challenge in this setting, is not necessarily introducing a new feedback mechanism. Focus groups already exist for college admissions process research. What sets the DSD method apart is the “open system” approach to evaluating a problem. Within the DSD method, it is important to set a broad net for what factors may be the source of a problem and this requires including diverse stakeholders and taking a birds-eye view on the system. Specifically in DSD focus groups, diverse stakeholders have the opportunity to contribute to the assessment of such a system. We were interested to see how participants in the study would respond to the opportunity to explore and discuss the college admissions process in such a way.

The OurStory technology aims to improve stakeholder inclusion in DSD focus groups by addressing comprehension and geographic constraints. We hope to see that applying DSD focus groups through OurStory technology to the college admissions process can address comprehension constraints by enabling stakeholders to visualize the college admissions process and connect feedback directly through an interactive map. We hope to see that applying DSD focus groups through OurStory technology to the college admissions process can address geographic constraints by bringing together stakeholders who would not be able to talk about this topic together in such a way otherwise.

The boundaries of what we define to be the college admissions process were determined by information that is public-facing. We chose this definition intentionally in an effort to equalize stakeholders’ ability to contribute. Our definition of the admissions process was a generalization based off of an amalgamation of undergraduate admissions resources available through various university websites (MIT, 2020) (Harvard, 2020) (Boston University, 2020) and college prep documentation (Common Application, 2020) (Best Colleges, 2020). Our process diagram was a high-level and intentionally did not go into much detail. We kept this diagram high-level as a first test of comprehension through a new interactive visual mapping of information. We designed it to serve as basic scaffolding for testing the potential of the software to enable participants to connect ideas to such a map. In this manner, the map serves to test how participants respond to the idea of annotating the map themselves. Future maps will incrementally work up to more detailed, system-level information.

In our diagram, the admissions process starts when an applicant decides to apply and ends when an applicant is either admitted or denied admission. There are a number of decision

points in this diagram. These decision points are notated with a diamond instead of a circle on the process map. In this particular process diagram, each decision point denoted a point at which an applicant is removed from consideration and denied acceptance, thus these decision points do not create new process paths.

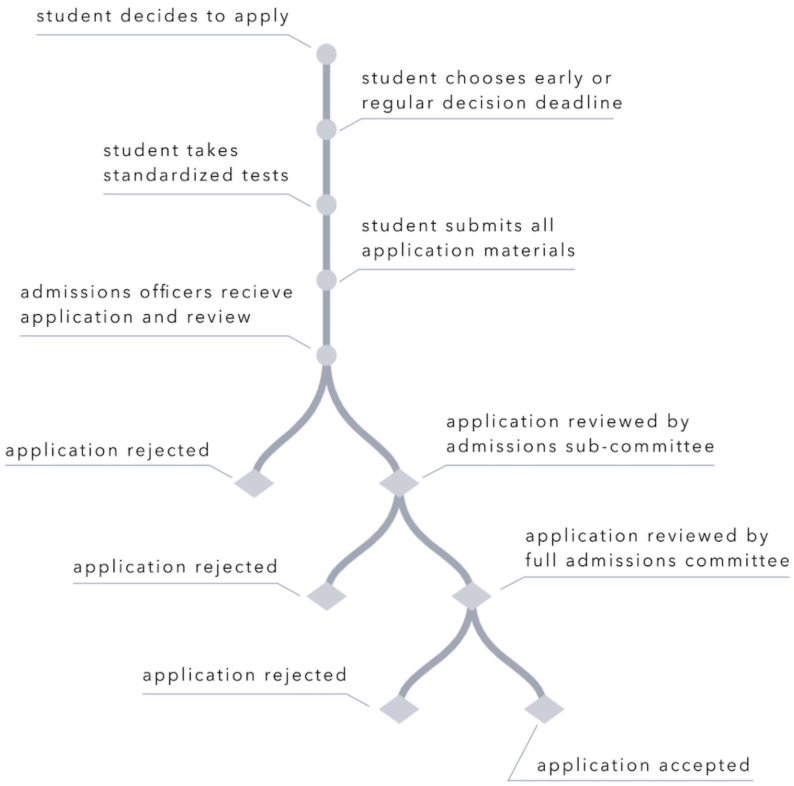

Figure 20 process map of college admissions for user study

6.2.2 Overview of Study Setup and Methods

Study Recruitment

To begin, we gained COUHES exempt approval which permitted us to conduct a study with human subjects. Then we set up a study on the MIT Behavioral Research Lab Sona website. In order to participate in the study, users needed to have access to a computer and WIFI. Compensation for the study was a $15 amazon gift card and participants were expected to participate for one hour only. It was also required that the first page of the web app have COUHES approval information. In this case, before a user entered the site, they needed to approve of the COUHES consent form, generate a username, and enter the session password.

Once the study description was approved, we scheduled 24 time slots in which participants could sign up. Next, the MIT Behavioral Research Lab released an email blast to the participant pool. Participants signed up for a certain time slot through the Sona site. Ultimately not all of these sessions were filled and the testing took place in a total of 16 sessions. When participants signed up, they filled out a pre-survey that included demographic information. The demographic information is listed below.

Participant Demographics

The study involved participants both currently enrolled and not currently enrolled in a university. We had 75 participants organized into 16 small groups. The majority of participants lived in the Massachusetts area. Most participants were students either in an undergraduate, graduate, or post-doc capacity. Of the students who attended a university in the Boston area, MIT was most heavily represented. (Listed in Appendix B)

Study Sessions

Before each session began, we launched a new chat room so that it would be empty and prepared for the next set of users. A user would receive a reminder email 15 minutes before the session was scheduled to begin in order to give her time to reach her computer and find WIFI connection. A second email containing the password for the session would be received by a user five minutes before the start, and she would be free to log in.

When a user first logged on she would see a welcome message from the facilitator in the chat panel as written below:

> "Hi everyone! This is Bridgit, I will be facilitating the workshop. Please message me if you have any questions. Usually adding a sticky note to one of the prompts is a good way to get the ideas going :)"

Bridgit, the researcher for this project, was the facilitator for all of the sessions. A user would see new question prompts appear gradually throughout the session and receive chat messages from the facilitator and potentially other users.

The first three questions were written as follows:

1. What works well in the existing university application process?
2. What doesn't work well in the existing university application process?
3. What questions if answered would help you know how to improve the university application process?

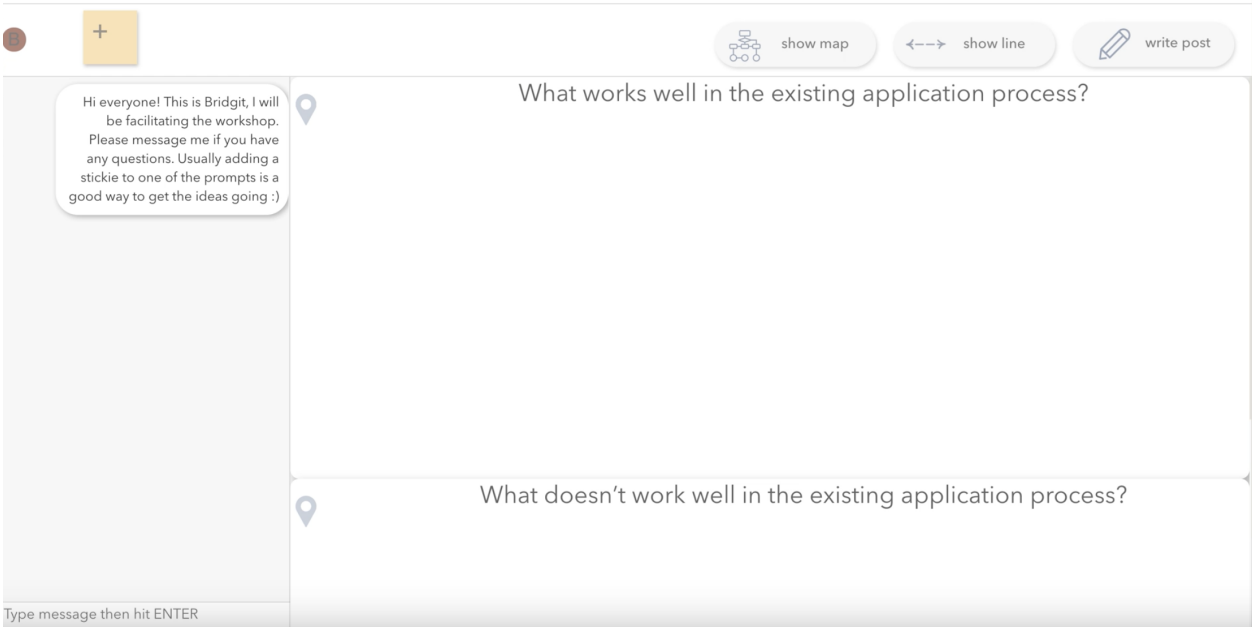

Figure 21: OurStory at the beginning of a session

A user would begin adding her responses to the questions on Notes. Sometimes she would refer to the process map and find a connection between a step on the map and one of her comments. If this happened, she would drag and drop the Tab associated with the Note to the step on the map. As the session continued, Bridgit posted five additional question prompts and encouraged users to add notes or draw connections between their notes and the process map.

The remaining questions were:

4. Within the context of the application process, what is a top priority for you?
5. If we improve the application process, what do we hope will happen?
6. If we do not do anything to improve the application process, what do we fear might happen?

7. What are some themes or takeaways from our workshop?
8. Are there any process steps you think definitely need work?

A user would reply to these questions as well and towards the end of the session, a user would see a link appear to a post survey. A user would take the link to the post survey and complete it to describe her experience.

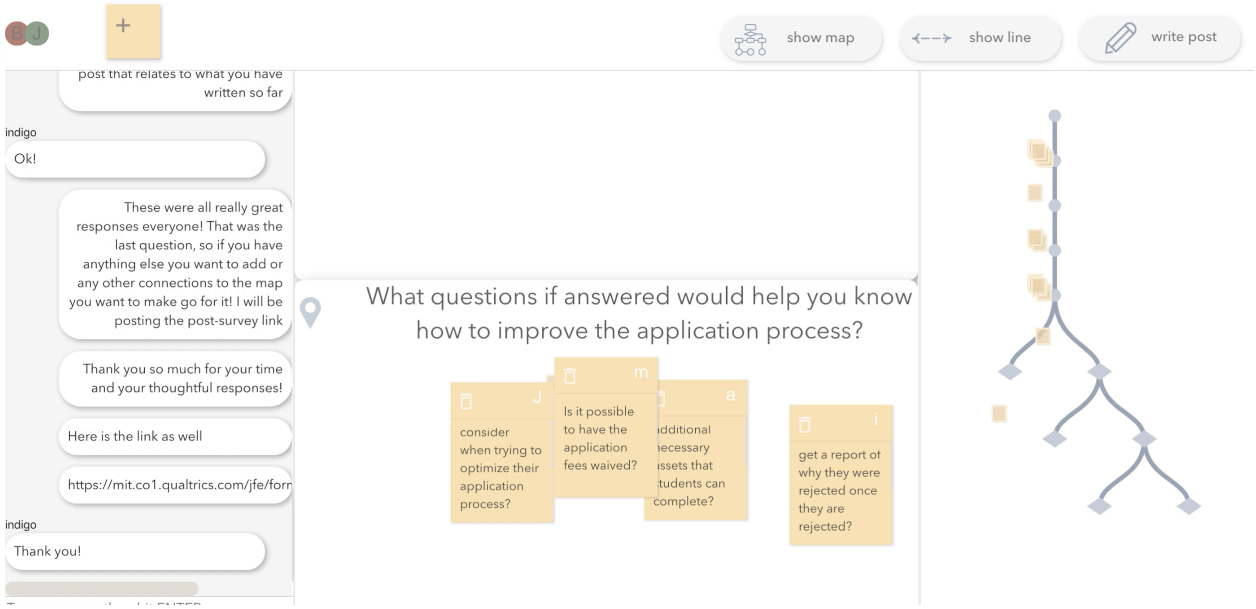

Figure 22: OurStory mid-session

6.2.3 Findings From Study

The findings from this study will be discussed in terms of the two research questions posed at the beginning of this section. We will address the first question first:

Did OurStory help an expert identify new information in the college admissions process?

To address this research question, we discuss findings from the virtual focus group and explore the degree to which these findings are novel by examining a conversation with an admissions professional who will serve as our expert. In this section we will recount the information provided across all of the focus group sessions. Whether or not the information is new will be determined by the admissions professional in section 6.7 on Feedback from Admissions Professional.

The information we are evaluating comes from the notes that participants connected to the map of the college admissions process. Figure 26 shows all of the Tabs collected across all 16 small group sessions. Tabs have been scaled to a smaller size for easier visualization. Also, Tabs have been color-coded corresponding to sentiment. Red Tabs represent negative, green represent positive, and yellow represent neutral sentiment. Participants drew connections between their responses to question prompts and various points on a map of the college admissions process. Below, their responses have been distilled and divided into two phases of the application process: before and after submission of the application. In each phase, we have selected a number of themes that arose through the sessions. After we discuss each phase, we will determine the high and low points in the process based on participant feedback.

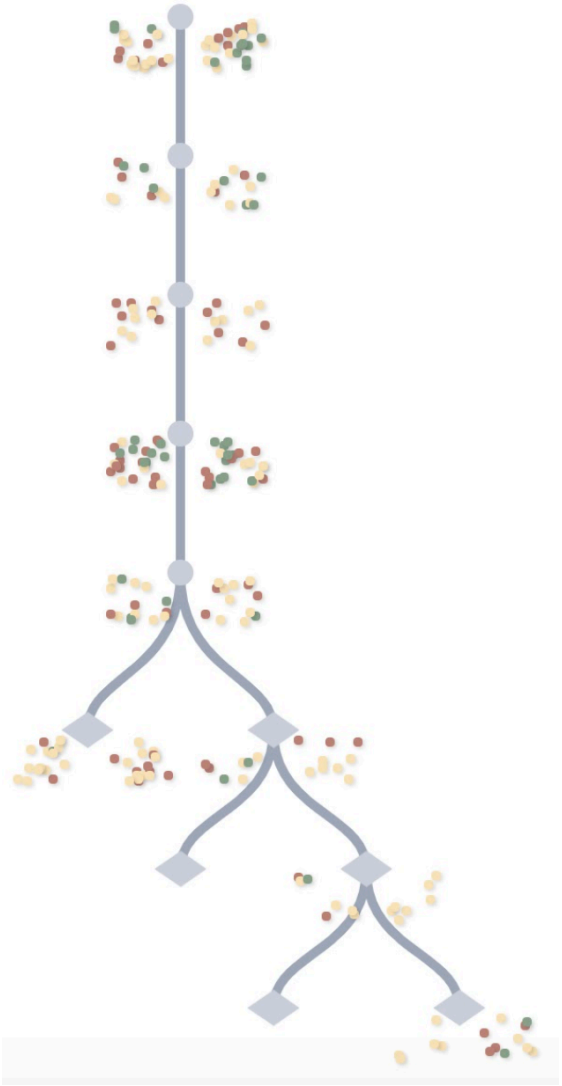

Figure 23: process map with Tabs from all 16 sessions

Before Application Submission

Access: Participants were concerned that students without a natural network of university graduates or close proximity to a university would be less inclined to apply. The participants were particularly concerned for minorities and applicants from low-income families that might not be exposed to what their options are. For example, participants stated:

"I fear the participation gap for college education between the wealthy and those in poverty/of a lower socioeconomic class"

"Minorities are lost due to lack of knowledge of application process"

Cost: The financial burden of the entire application process was concerning. From submitting application materials and taking standardized tests, to touring schools, many aspects of the application process seemed to be discouraging for individuals without financial resources. Participants listed these concerns as:

"Paying additional money to submit supplements"

"Applicants need to pay to submit every application"

"having to submit scores and pay money from different sources outside of application"

Standardized Tests: Standardized tests were particularly frustrating for participants because of the discrepancies between those who have the resources for coaching and preparation materials, and those who did not have resources and were alone in the process. Participants also seemed to have little to no faith that standardized tests were a good representation of an applicant's abilities when they stated:

"Standardized tests are not a good measure of a student's full capabilities"

"Standardized tests miss out on students that have potential in ways they don't capture"

Complexity: The complexity of assembling multiple applications with multiple requirements and deadlines was often a point of discussion. Participants questioned whether assembling a well-rounded picture of oneself for an application was worth all of the stress. Participants were mixed on whether they felt that schools did a good job of capturing an applicant's true capabilities through their many submission requirements. Many felt frustrated by the limited facets of themselves they could convey through the existing means. For example, participants expressed:

> "Not being able to express yourself completely - being a piece of paper among all the others"

> "A lot of problems stem from how students are required to present their abilities"

Mental Health: The complexity of completing multiple applications was a concern for participants from the mental health standpoint. In addition to the overwhelming experience of assembling applications for multiple schools, participants were also concerned by the many ways in which applications could be a source of hostility and competition between peers. Two examples of this can be seen in the following statements:

> "It creates a hostile overly-competitive environment among seniors"

> "Students will go to extreme measures to be accepted into a 'good' college such as cheating or sabotaging others"

Existing Affordances: Participants did recognize several positive aspects of the existing application process. For instance, submitting early decision applications was seen as a positive option to potentially lessen the workload for applicants and admission officers alike. Another positive aspect was the digital nature of applications. Participants loved the ease and flexibility that came with submitting an application online. The Common App stood out as a strong positive for applicants when submitting to many schools and trying to keep track of the various application requirements. One participant highlighted this by stating:

> "Schools have a fair amount of information about themselves for students to learn about what school fits their preferences"

After Application Submission

Transparency: Little was known by participants about what happens once applications are handed over to universities' admissions departments. This is where many participants voiced concern about transparency and unpredictability. One participant explained:

> "It's in the best interests of both the schools and the students to be effectively 'matched'. A more transparent and efficient application process might help students and schools to identify which would be the best fit as opposed to now when students might not be making the most informed decision about which schools to apply to"

A dominant question for participants who were discussing the last few process steps was "Why didn't this person get admitted?" Participants asked repeatedly if the process could be improved to offer more insight for applicants on the reasons behind a rejection and things to work on for the future. Participants stated their frustration with this, saying that:

> "There is a lack of transparency in the process. Applicants can't get feedback on what they should have done better"

Timing: Once the application is submitted, it is out of the control and visibility of the applicant. Participants wanted to know if it was possible to share information about how far along an application was. Particularly when dealing with applications sent to many schools and juggling the prospects of financial aid, participants emphasized that students would want to know how close or far they were from a decision, stating:

> "Applicants are left in limbo"

> "If deadlines [to receive an admission decision] are too far students might not wait until application decision and accept the admission from a different university"

Evaluators: Participants felt that the lack of insight that they had into the admissions process after applications were submitted caused suspicion about the integrity of the committee's decisions, namely it raised concerns about bias. Participants wanted to know what was being evaluated by the committee members and they wanted to be assured that this evaluation criteria seemed fair to them. The opacity of the process fostered a mistrust which participants expressed in the form of discrediting admission committee decisions. For example:

> "Decisions can be too subjective or arbitrary"

> "What steps if any are taken to address unconscious bias within admission committees?"

Process high points and low points:

The high and low points of the application process were determined through reviewing all of the pieces of feedback at each process step and manually labelling them as positive, negative and neutral. Often the positive comments were in response to the question “What works well in the existing application process” and the negative questions were in response to “What doesn’t work well in the existing application process” Once all of the pieces of feedback were labeled, we reviewed the ratio of positive to negative feedback. If a process step had one of the highest ratios of positive feedback to negative feedback, it was labelled at a “high point.” Conversely, if a process step had one of the lowest ratios of positive feedback to negative feedback, it was labelled as a “low point.” The diagram below displays the high points and low points on the process map.

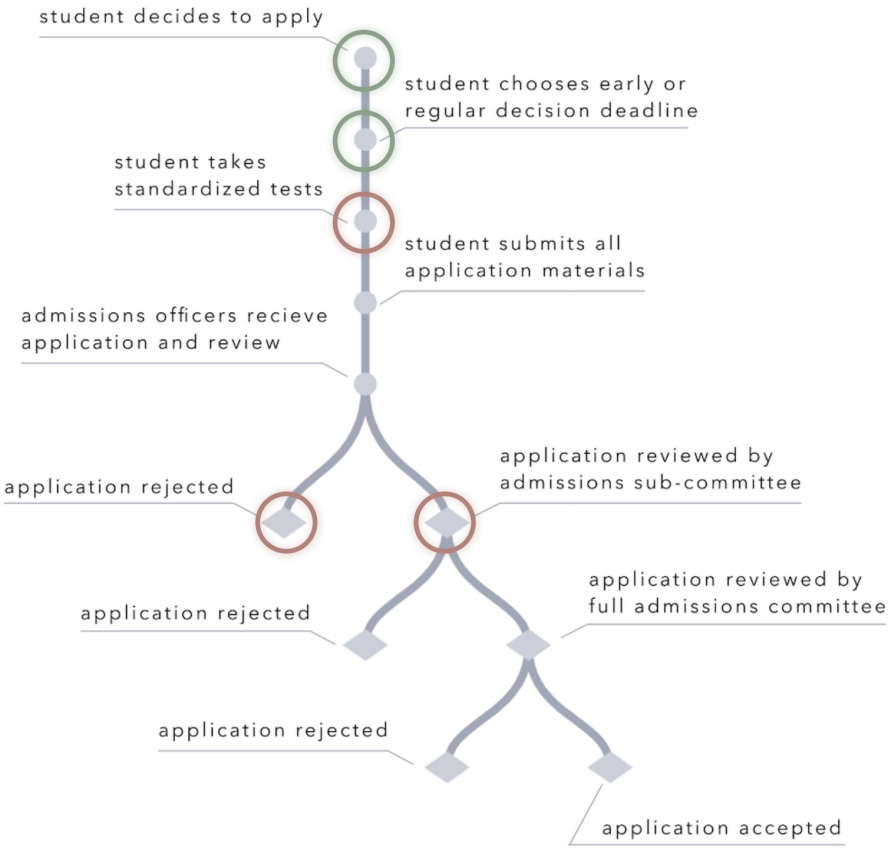

Figure 24: process diagram with high points in green and low points in red

High points:

- *Student Decides to Apply:* When the student is deciding to apply, there are many online resources to learn about the universities that might be a good fit for them. This can save time and cost and expose potential applicants to options they might not have realized were available.

- *Student Decides to Submit Early or Regular Decision:* Participants appreciated the flexibility of this option and how it could potentially save both applicants and universities a lot of time.

Low points:

- *Student Takes Standardized Tests:* Participants expressed dramatically negative feedback about standardized testing. It was seen as an unfair method for assessing the abilities of applicants.

- *Application Rejected:* Participants felt that a rejection response could be handled with more constructive feedback and given in a timelier manner.

- *Application Reviewed by Admissions Sub-Committee:* Participants questioned the composition and decision-making preferences of the committee. They hoped for more transparency in this stage of the process as well.

Did OurStory help stakeholders understand the perspectives of one another and the college admissions process as a whole?

To address this research question, we discuss findings from two post-survey responses. Where it is useful we combine this post-survey data with examples from focus group sessions. We evaluate how stakeholders understand the perspectives of one another by how stakeholders were influenced by the ideas of others. We evaluate how stakeholders understand the college admissions process as a whole by how stakeholders respond to the post-survey question: To what extent did this exercise give you a clearer idea of what you would like to see in the redesign of the application process?

Understand the perspectives of one another: One of the aims of this method was to engage participants with each other so that they would generate new ideas and offer new information. In the post-survey, participants reported that they were regularly influenced by the ideas of others. The chart below documents this aspect of the post-survey.

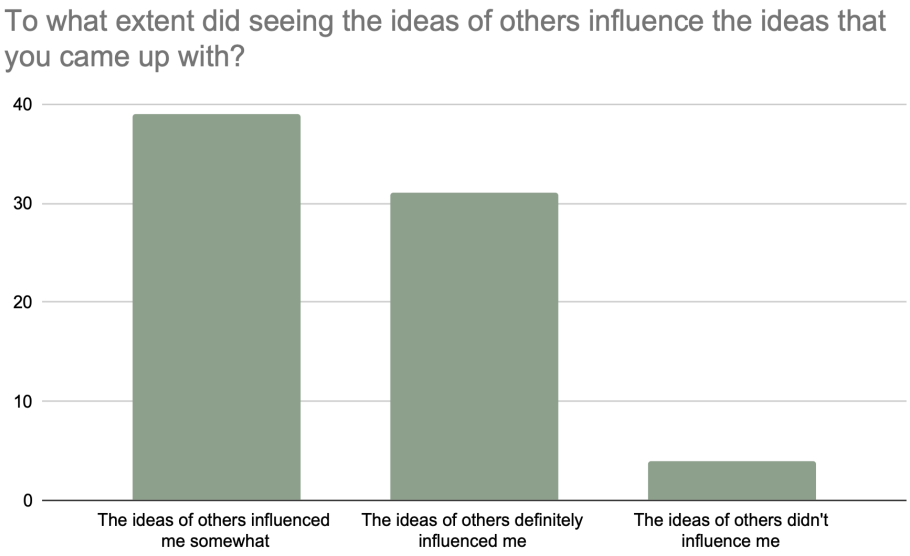

Figure 25: Graph of responses to question on participant influence

To illustrate the influence from others that participants reported experiencing, below is an example of how participants were influenced by each other to discuss two different topics: bias and mental health

In the discussion around bias, participants began responding to the prompt: “what doesn’t work well in the existing admissions process?”

3:59:03 PM user bramblebee writes, “being biased towards legacies (i.e. students whose family members have attended).”

4:02:58 PM user mthompson wrote, “favors the wealthy stacked against low income students.”

4:03:39 bramblebee writes: “I agree with that [mthompson]! It's important to have a diverse group of people reading applications.”

Later on in the session when a new question was asked: “What are some themes so far from the responses in our workshop?” one user who had not brought up the topic of income themselves chose to address it as a theme:

4:31:10 PM user eluzzi writes “income”

In this instance, group work was helpful for understanding the perspectives of others and the influence of others was seen as a positive. We also understand that sometimes the group work can bias the perspectives shared and thus, reduce the ability of stakeholders to contribute to their fullest. Given that our goal is to reveal mental models and then align them, it is important to truthfully reveal mental models before these mental models are aligned so that we can benefit fully from their unique perspective. As discussed earlier, cognitive diversity offers great epistemic benefits.

Understand the College Admissions Process as a Whole: In the post-survey, participants reported positive-leaning feedback on their clarity after the focus group exercise. The most dominant feedback was indicating a slight improvement on their preferences. The second most dominant feedback was indicating definite clarity of their preferences. Neutral feedback was not as common and negative clarity feedback was quite uncommon. It was an affirming indication to see that responses leaned positive in terms of participants’ understanding of the admissions process. We believe that by understanding the existing admissions process better, participants may be able to (1) offer more informed and contextualized feedback and improve epistemic outcomes, and (2) find suggestions for design improvements to be more legitimate later on. The positive results from this post-survey response compliment well our design principle, *Make it Easier to Synthesize* because these results indicate that many participants were able to synthesize the information they were receiving through the activity into a more general understanding of the college admissions process.

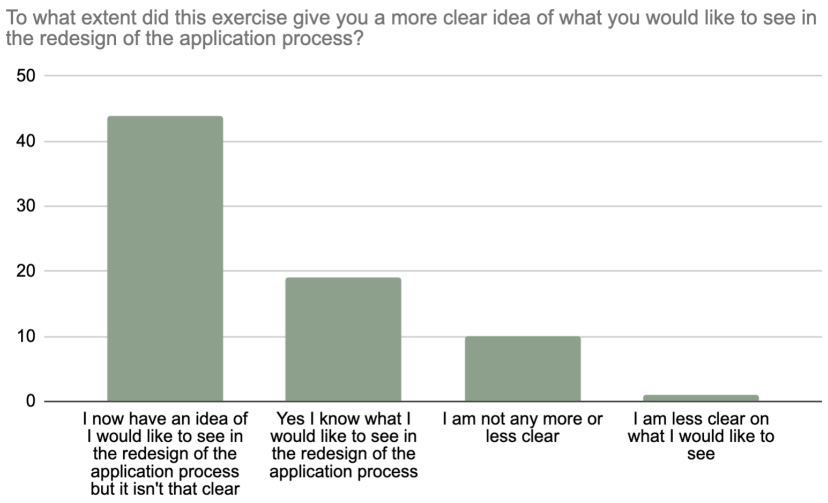

Figure 26: Graph of responses to question on process clarity

Participation intensity: Participants were invited to an hour-long session however they were not required to stay online for the entire hour. They were informed that they could come and go as they please and respond at their own pace. It appears that the platform was quite active throughout the entire hour. Each individual participant contributed some form of activity to the platform on average every 1 minute and 10 seconds. This is a rough indication that our design principle, *Make Design Features Intuitive* was performing well.

The platform itself was primarily seeing new activity every fifteen seconds or less.

Figure 27: Graph of time between messages

6.2.4 Findings From the Post-Survey

The post survey consisted of nine questions that evaluated the OurStory tool design, facilitation, and collaboration experience. (A detailed account of the post-survey results is in Appendix C) In summation, participants felt strongly that it was possible to do all of the exercises in the hour-long timeframe allotted to them. Participants for the most part felt like the exercise increased their level of interest and made gains in clarifying their preferences for improvement of the university application process. Participants also reported strongly that the facilitator was helpful.

In terms of utility of OurStory as a tool, it seems like the greatest advantage for participants compared to interfaces they are already familiar with is the ability to answer honestly and participate at their own pace. In this user study, we did not specific which other tools a user should compare OurStory to. Because we did not specify the other tools a respondent should compare OurStory to when formulating their response, we cannot pinpoint the features that made OurStory preferable in this respect. However, given our research into existing online discussion options, we assume that the ability to answer honestly was enhanced by anonymous participation and potentially by the medium of response (e.g. Notes and Tabs). Answering honestly is important for deriving the epistemic and legitimacy benefits from the exercise. We understand that in some instances different technological modifications may need to be made to protect the ability for participants to answer honestly; perhaps participants may engage in solo-work instead of group work. Perhaps honesty may be increased by using real names instead of anonymous participation. We have learned that honest participation is an important result of using OurStory and we would like to design in the future to continue to protect this capacity.

Another helpful piece of feedback from the post survey addressed the map and tab features. Participants consider the map to be helpful as a visual reference, however, participants report mixed feedback on connecting the tab to the map. It seems like improvements could be made in this area. The virtual notes fared somewhat better than the note tabs in terms of flexibility of use, but it seems as if participants still experience some constraints while using the notes. As we consider our design principles *Make Design Features Intuitive* and *Simplify without Losing*

Complexity this would be worth following up on. This may mean that the notes need to be adjusted or that the use case for adding notes needs to become clearer.

6.2.5 Feedback From Admissions Professional

As discussed previously, dispute system designers can be hired to design a system or take initiative to take on a dispute system themselves. Often designers are hired by decision-makers within the organization with the dispute system in question (Rule, 2017). Sometimes the dispute system designers are hired by external organizations (Niezen, 2017). Sometimes designers volunteer themselves to individuals in contact with decision-makers (Bishop, 2012). To get traction with the dispute system design process, there must be buy-in from some set of stakeholders that can ultimately present a persuasive case to decision-makers.

In the user study we conducted to make the case for DSD processes in other domains, we consider an admissions professional to be akin to an individual in contact with a decision-maker in the DSD setting. In this user study, our role as researchers is similar to DSD designers volunteering their findings to a knowledgeable professional in contact with decision-makers. This admissions professional will be able to give us an idea of the buy-in our DSD focus group technology and method would hypothetically receive from decision-makers in the college admissions process. These professionals are also well-informed about the admissions process and various stakeholder perspectives. In order to proceed with other aspects of the DSD process and/or propose changes based upon our initial findings we would ultimately need buy-in from some decision-makers. The admissions professional can provide insight on whether the information we offer is novel enough and whether the process is insightful enough to be of interest to decision-makers.

This admissions professional works at a university that we will not disclose due to confidentiality. It should be noted that the feedback we provided the admissions professional was general and not specific to her university. Our conversation with the admissions professional served the purpose of addressing our first research question: Did OurStory help an expert identify new information in the college admissions process? We divided this research question into three sub questions regarding the content of the information as we described it in section 6.4 Finding from Study, the presentation of the information in the context of a process map, and the utility of replicating this approach.

1. *Was any of this information content novel?*

The admissions officer had seen much of this feedback through different channels before. Via existing communication channels, the admissions officer gets feedback by phone, survey, and over email from various stakeholders. If the admissions officer was interested in gaining additional insight into an applicants' perspectives on the application process, they could also check the message threads on the university blog postings. Through these streams of data, many of the complaints of stakeholders are similar to the results of the OurStory study: the costs of applications are a barrier, applicants want more answers in why they aren't accepted, and the application process is taxing on mental health are a few of the findings from the report that were not new to the officer. However, there was feedback on some process steps that possessed unexpected results.

The degree of dislike for standardized testing, even amongst students who have been admitted to elite universities was surprising. While the admissions officer acknowledged that there was not much to be done about this step, the results were more drastic than expected.

Due to the presentation of the feedback in the form of process steps, the admissions officer could visually observe the places in the process that performed the best and those that performed the worst. The admissions officer came to the following realization through looking at the map: "it makes sense that those are the positives where students are making decisions but hadn't really thought about it." It was clear through looking at the process map that part of the relationship between happiness or dissatisfaction with the application process had to do with where a certain group had decision-making power or agency.

2. *Was the presentation of this information as a process map helpful?*

Given that a focus in OurStory is grouping feedback onto a system map and hypothesizing that it will be a helpful diagnostic for determining problem areas, it is important to ask someone with deep knowledge of the process if this form of presenting feedback is helpful. The response was yes, and this manifested itself in two ways. First, in the example mentioned above, the admissions officer was able to look at certain features of the high and low points and create a hypothesis on why some are high and others are low. When the admissions officer saw a negative remark on the "applicant is admitted" step, she asked about why that may be. That negative remark was due to a comment made by a participant about the cost of

touring a university in the process of deciding whether or not to choose the school. Once this comment was explained, it made sense to her. Visually observing feedback in this way is sometimes intuitive at first glance, and at other times requires a closer look.

The other way in which it was helpful to view feedback in a process map was through providing a launching off point for follow-up investigation. We received the most enthusiastic suggestions from the admissions officer in this area. The initial hope for this design was that the visual diagnostic map could point out areas to follow up on and dig into deeper. The admissions officer suggested that it would be helpful to know why a student chooses a school and what may make that experience positive. On the other hand, the admissions officer wanted to know more about the ways in which the admissions experience could still be positive even if the applicant is not admitted. While she conceded that there is not much to do about the black box effect and the lack of transparency, she was eager to know how else the experience could be constructive.

3. *Do you think there is utility in replicating this approach in the future?*

The admissions officer affirmed the value in continuing to pursue this approach. She was particularly interested in following up on this project by having the same kind of conversations with other admissions officers. She was interested in the results of such a study particularly if admissions officers were able to participate anonymously.

6.3 Dispute System Design Case Study

In our DSD test, the Map Panel of our tool was not used. In the user study, we used the Map Panel, but it was on a topic outside of the DSD context. Given that visual mapping is a key contribution of our thesis, we will share a case study to provide an example for how visual mapping could be useful in the DSD context. We see this case study as a way to combine the two pieces of our existing evaluation into a hypothetical whole. Below we will share a case study of the Kaiser Permanente DSD process as an example of what a DSD case could have looked like if it used OurStory to improve the dispute system.

In 1998, a team of three individuals collectively known as the Blue Ribbon Panel (BRP) produced The Kaiser Permanente Arbitration System: A Review and Recommendations for

Improvement. The creation of this report and the Blue Ribbon Panel came about due to a decision at the Supreme Court of California which determined that Kaiser Permanente's arbitration system was misleading to disputants and required revision. This court decision was the result of a tragic story. In 1991 Wilfredo Engalla, a member of Kaiser Permanente, realized that for years he had been misdiagnosed. What had previously been diagnosed as a common cold, turned out to be terminal lung cancer. Mr. Engalla pursued legal action against Kaiser yet due to a failing dispute system, Mr. Engalla's case was dragged out for so long, he passed away before he saw it resolved. To add salt to the wound, Kaiser had not only misdiagnosed Mr. Engalla, but the dispute resolution process was faulty and unable to provide him justice before his death. Mr. Engalla's family filed a lawsuit alleging medical malpractice and breach of the arbitration agreement in Mr. Engalla's contract with Kaiser. For Kaiser Permanente, this was a shameful, public failure. After the court ruling, not only were they obligated by the court to improve their dispute system, they needed to correct their mistake and win back public favor.

The BRP was instituted to undertake the DSD process: evaluate the existing system, identify the problem areas, and make recommendations on potential improvements. The BRP consisted of outside experts in fields relevant to the case. The outside experts were Sandra Hernandez, the executive director of the San Francisco Foundation and practicing physician, Philip L. Isenberg, an attorney and also former member of California State Assembly, and Eugene Lynch, a retired federal judge with a background as an arbitrator and mediator for JAMS (Judicial Arbitration and Mediation Services). Stephanie Smith served as the rapporteur for the project. In the process of compiling the report, the panel met weekly over the course of three months and invited representatives of stakeholder groups and experts across many domains such as health care, ADR (Alternative Dispute Resolution) and arbitration to discuss different system design elements. In total they spoke with over 75 stakeholders. They gathered all of the information they could through stakeholder presentations, interviews, and data collection. Ultimately, they drafted 36 recommendations for improvements to the Kaiser arbitration system in the Blue Ribbon Panel Report.

Their report begins by providing background on Kaiser Permanente: figures on 8.8 million members, 90 thousand employees, and 10 thousand health care providers. Following that, the report provides background on Kaiser Permanente's arbitration in particular: reference to the 5,313 cases for arbitration filed in the past five years, reference to the questionable data

available regarding the number of arbitration cases filed or dropped, and reference to the lack of comparison available between the performance of Kaiser arbitration relative to other health care providers. To quote, “there is no body of information available which allows us to meaningfully compare the Kaiser Permanente system of arbitration to systems run by other health plans or to the civil court system” (11) Often through the course of their research, the BRP found essential information on the performance of the dispute system to be either absent or lacking. It was very difficult to get a clear picture. Due to the lack of easily accessible performance data, the panel had to exert extra effort to dig up material that may serve as clues to the performance of Kaiser arbitration.

Following the background information section, the report describes the existing arbitration system at Kaiser in detail. This description is nine pages long and covers how a disputant goes from raising a complaint to the issuance of an arbitration award. Following this description is a fourteen-page list of recommendations for improvements to the arbitration system. Their suggestions cover a broad range from alternatives to arbitration such as mediation and ombuds to additional documentation and independent oversight of the arbitration process. Since the publication of the report in 1997, nearly all of the recommendations have been implemented and now Kaiser has an Arbitration Oversight Board comprising thirteen stakeholder members from the public, employers (who provide access to Kaiser Health Care for their employees), physicians, hospital staff, labor, plaintiff bar, defense bar, and Kaiser Health Plan members. This board publishes an annual report with the latest evaluation of Kaiser’s arbitration system performance and improvements. Additionally, Kaiser now offers a hybrid process of mediation and health care ombuds as alternatives to arbitration.

The fact that many of the Blue Ribbon Panel’s suggestions have lasted until today even with substantial upgrades in transparency and documentation indicates that they improved the dispute system. However, we would like to bring attention to a few details of the Blue Ribbon Panel’s report to suggest that greater stakeholder inclusion would have been helpful. First, the panel consisted of three experts and one rapporteur, and these individuals consulted with a total of over seventy-five stakeholders. These stakeholders were responsible for representing the viewpoints of 8.8 million members, 90 thousand employees, and 10 thousand health care providers, all stakeholders involved with Kaiser Permanente and potentially impacted by the decisions of the panel. While the inclusion of seventy-five stakeholders is an effort in the right direction towards stakeholder involvement, still only 0.0009% of all stakeholders were

impacted by the redesign of the dispute system. The next point to draw attention to is the amount of information that was important for the panel's assessment at the time of their report investigation and yet was impossible to find. The BRP was only as effective as the information they were given. The BRP likely would have identified different problems or possible solutions with more information from stakeholders. Additionally, the first few years after the BRP report, Kaiser took no action on several of the panel's recommendations. (Martinez, 2020) With greater legitimacy and stakeholder buy-in, the time frame for implementing the changes might have been shorter.

Now we will describe what it might have looked like if the BRP used OurStory. As we demonstrated with previous examples, the Note and Question Card interface is intended to imitate in-person focus group methods. Likely, this process would have run similar to the DSD clinic study we ran. There would have likely been small groups of participants using colored Notes to respond to questions. We have not yet tested OurStory with larger groups, but this might have been a possibility for the Kaiser DSD process with some design modifications. It is unknown whether focus group sessions would have experienced less friction if they were composed of similar or heterogeneous combinations of stakeholders. This would have been a tradeoff for facilitators to make between potentially contentious behavior and the benefit of exposure to different mental models. It is likely that the anonymous feature would have been helpful in this setting as well so that stakeholders could feel more able to speak freely but it would have needed to be weighed against the possibility of unfriendly behavior.

We could imagine that in this scenario, a dispute system designer might have been interested in using the map feature to communicate the structure of the existing arbitration system to the group. The image above shows what that dispute system would have looked like on the right. Participants would have been able to connect their feedback to different points in the map. They may have identified discomforts with a step that the panel would not have thought to address. Perhaps the group met again later in the DSD process and the panel had the chance to put together a revised version of the arbitration system map to share with the group and get feedback. The image above shows what the revised version of the dispute system would have looked like on the right. The changes are marked in yellow. In this scenario, the design could be opened up to more feedback or questions about why the designers chose to revise the system in certain ways. This conversation might have revealed more unthought-of problems in the system and brought the stakeholders and designers into greater alignment.

We expect that this current version of the tool, if used during the Kaiser DSD process, would have experienced the same challenges of technological fluency. We expect that participants in a Kaiser DSD online process would have needed an expanded tutorial like those in the clinic DSD process and/or other explanatory aids for the technology. It is still possible that systems thinking barriers to learning such as Misconceptions and Flawed Causal Relations and Interpersonal Impediments to Learning would have emerged. Perhaps the visual reference would have confusingly simplified causal relations and extra care would be needed to create a system map that would not be misleading. Perhaps new interpersonal impediments would have emerged and been more difficult to detect in the virtual space. In this way, it would be important to set firm norms and make space for check-ins with stakeholders to evaluate their experience through OurStory. With design challenges and unknowns, there would still be much potential upside. Kaiser stakeholders would have much greater visibility into the process and many more opportunities to contribute their knowledge towards more informed and legitimate DSD solutions.

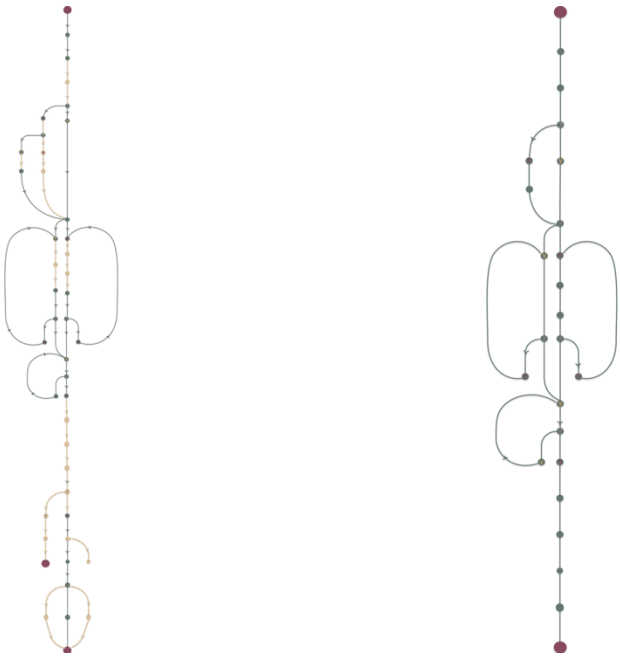

Figure 28 Kaiser arbitration system in 1997(right)
and Kaiser arbitration system present day (left)

Today, Kaiser has an Independent Advisory Board for their dispute system. When we imagine what it would look like to use such a tool today, we imagine OurStory could continue to be helpful with bringing in more stakeholders and continuing to find opportunities for revision in the Kaiser dispute system so that it could meet the goals of stakeholders better and avoid another public mistake like what happened had before.

7. Conclusion

7.1 Discussion

Through this thesis, we established our reasoning for *why* stakeholder inclusion is important in DSD. That reasoning was built upon claims of epistemic and legitimacy improvements. When more stakeholders are included, dispute system designers are more likely to have the information they need to correctly identify the problem and stakeholders are more likely to buy into the process and consider the suggested improvements to the dispute system legitimate. This reasoning is backed up by examples of previous DSD work such Chevron Nigeria Limited's General Memoranda of Understanding and Maryland Court's MACRO. This reasoning was also backed up by ideals from deliberative democracy and systems thinking approaches to creating shared mental models.

We also learned *where* technology might be helpful for improving stakeholder inclusion in DSD. We described the different design stages of DSD and the existing technology that has been built to improve the DSD process and solutions. As a starting point, focus groups in the diagnosis stage of DSD appeared to be an area that could benefit from exploration and intervention. We also determined that the DSD focus group feedback could be helpful in processes other than DSD. For this reason, we created a user study to engage participants in a conversational activity around a contrived topic. For this study, we chose the topic of the college admissions process. We learned *how* technology might be helpful for improving stakeholder inclusion in DSD focus groups. We spoke with DSD practitioners to understand the constraints that they encounter in their work. We also did research on deliberative platforms and collaborative design platforms. These resources inspired our own platform design and helped us to craft design principles centered around accessibility and an intuitive, beginner-friendly approach. We evaluated the success of OurStory based on two research questions:

1. Did OurStory help designers/experts identify new information in the dispute system/college admissions process?

2. Did OurStory help stakeholders understand the perspectives of one another and the dispute system/college admissions process as a whole?

Through a test run of OurStory with a client of the DSD clinic and through an anonymous user study we documented the performance of OurStory. We determined that OurStory was successful in positively answering our research questions, however we recognize that neither study achieved the full picture of what our tool was trying to achieve. The visual map of dispute systems has yet to be fully tested. With the anonymous user study, participants offered feedback about the usability of the map which will be addressed in future work. Participants of both studies learned more about the system they were discussing and the viewpoints of other participants through their OurStory sessions. Surprisingly, the anonymous text-based nature was seen as a positive for certain kinds of conversations. In this way, our design principles of *Everyone Can Contribute, Make it Easier to Synthesize,* and *Simplify Without Losing Complexity* seemed to perform well. However, in our test run with the DSD clinic, some participants who were less familiar with technology struggled with understanding the tool at first. In this way, there is still work to do with our design principle of *Make Design Features Intuitive* so that all participants have the resources they need to find the tool as intuitive as possible. We will learn from these observations as we address future work.

7.2 Future Work

Future work for OurStory relates to the premises it is built upon and the potential for expansion of features.

OurStory premises: OurStory is our novel technology built to improve stakeholder inclusion in DSD focus groups by addressing comprehension and geographic constraints. We address comprehension constraints by using visual aids such as the visual dispute map and virtual Post-it notes to annotate the map and collect data. This new organization of information is intended to improve stakeholder's comprehension of the system and thus be better able to contribute to focus groups. We address geographic constraints by bringing DSD focus groups online so that stakeholders who previously were too distant to join in focus groups are now included. We address these constraints upon the premise that stakeholder inclusion will improve the quality of DSD outcomes. Our hope is that by addressing these constraints and improving outcomes, DSD processes will be applicable to other use cases outside of disputes. While focus groups are only one part of the DSD process, their performance can make an impact on the rest of the process that follows. As it stands, there are a number of assumptions

in our approach that would be useful to validate or challenge through further testing. To do so, we may explore the following questions in future work:

- How might visual aids make for better comprehension of a system, in DSD or otherwise, than other methods? (i.e. written form)
- What is lost in translating this DSD focus group experience online and using visual aids? Who may be excluded?
- In what instances does stakeholder inclusion not deliver better epistemic and/or legitimacy to a DSD or non-DSD project?
- How might techniques used in small group formats translate across different processes and at different scales?
- What other ways can stakeholders participate aside from simply offering feedback

Expanding OurStory Features: There are many directions in which it would be possible to build upon the interface design of OurStory. In the discussion with the Dispute System Design Clinic, a number of features were brought up that could be particularly useful to Dispute System Designers, including:

- Glossary of topics accessible to participants as they are adding comments –for participants to easily connect their feedback on Notes to existing themes
- Notifications outside of the portal when new action has occurred –for participants to stay updated with the progress of the discussion if they are engaging asynchronously
- Toggle options for different facilitation constraints –for facilitators to be able to fine-tune and customize the focus group to the settings that work best given their unique circumstances
- Add a question mark onto the Note –for facilitators or participants to be able to ask for further clarification of the meaning of the feedback written on a Note
- Ability to reply within a Note –to have conversation in the context of a specific comment

- Referencing a particular Note in the chat –for example to ask clarifying questions or ask others to engage with the Note
- Upvote and downvote buttons –to gauge the consensus in the group around an idea
- A more detailed method for tracking changes –to identify if someone edited someone else's note or if an important wording change occurred

A more detailed explanation of some of these features is available in Appendix A.

It was necessary to constrain the scope of OurStory for the build and testing phases of this project. However, in the earlier phases of this project, a number of other features were designed. In its ideal form, OurStory could capture the full spectrum of the Dispute System Design (DSD) process from diagnosis to evaluation. Within the tool, these stages are encapsulated in three panels: stories, focus groups, and proposals. The focus group panel was built for testing, but stories and proposals were not. Below, we review several other features of this tool that did not make it to the build or testing phases but may inform future work.

Stories: A valuable part of the Dispute System Designer's role in the diagnosis stage is in collecting first-hand accounts of stakeholder experiences within the system. To simplify the task of gathering stories and anecdotes, the tool might have the ability to mark up the system map with individual paths that represent the story of an individual experience within the system. When people map their stories onto the same point of reference, they might start to notice patterns in the paths people took, where they got stuck or dropped off, or where they paved a new way to a solution.

To share their first-hand account, stakeholders might complete a survey which they recount the path they took through the process map. Similar to preexisting surveys, stakeholders could answer a series of questions that walk them through the process map and gain insights about their personal experience. For instance, if the stakeholder in question was a former claimant within the Kaiser arbitration system, the beginning of a series of questions may align with the steps in the process as follows:

1. Did the you submit a demand for arbitration to the health plan? Yes/No

2. Did you receive a list of 12 possible arbitrators with their application forms and redacted awards? Yes/No
3. Was your claim above or below $200,000? Above/Below

Etc…

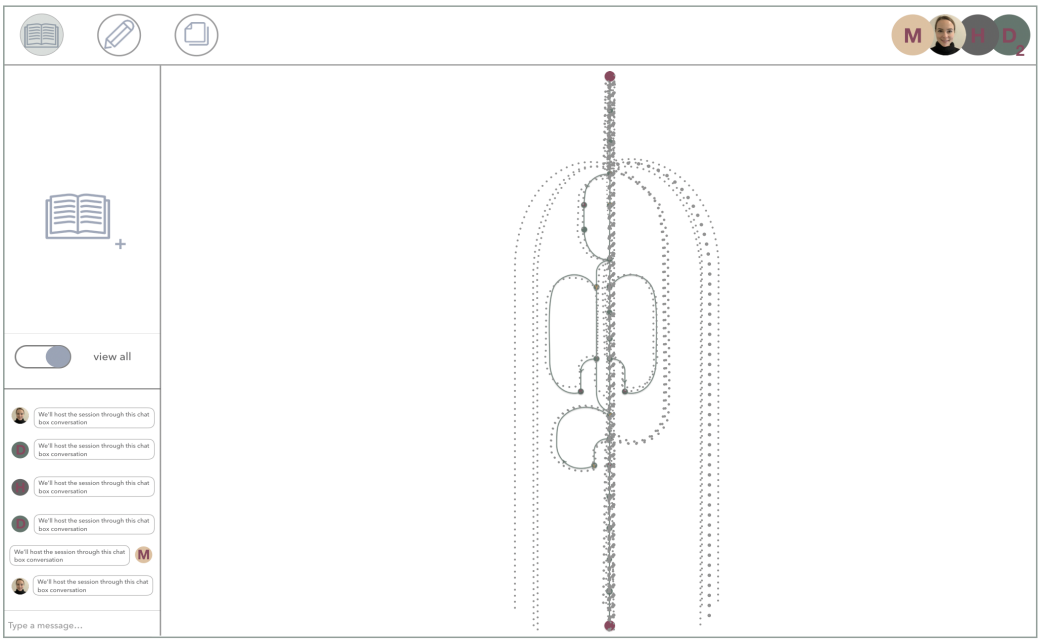

Figure 29: Figure of Stories feature for future work

In the visual diagram above, suppose many people answered “No” to “Did you receive a list of 12 possible arbitrators with their application forms and redacted awards?” Since the process map does not offer a Yes/No branch at this process step, the visual path of the stakeholder diverges from the existing map. In the Blue Ribbon Panel Report which covered the recommendations for the Kaiser arbitration system, they noted that in 1997, significantly more arbitration cases were dropped. Where in the arbitration process were these cases dropped and why? With such a visual diagnostic, it would be easy to detect strange behavior. Perhaps in this scenario where many former claimants answered “No” to “Did you receive a list of 12 possible arbitrators with their application forms and redacted awards?” the dispute system designers would have discovered an issue with the delivery of the list of arbitrators. Maybe a revised system would benefit from being able to guarantee that claimants receive such a list. Additionally, stakeholders could see for themselves their own story path overlaid onto the

formal system and the story paths of others. This may validate concerns and provide strength in numbers when stakeholders feel at the mercy of a broken system.

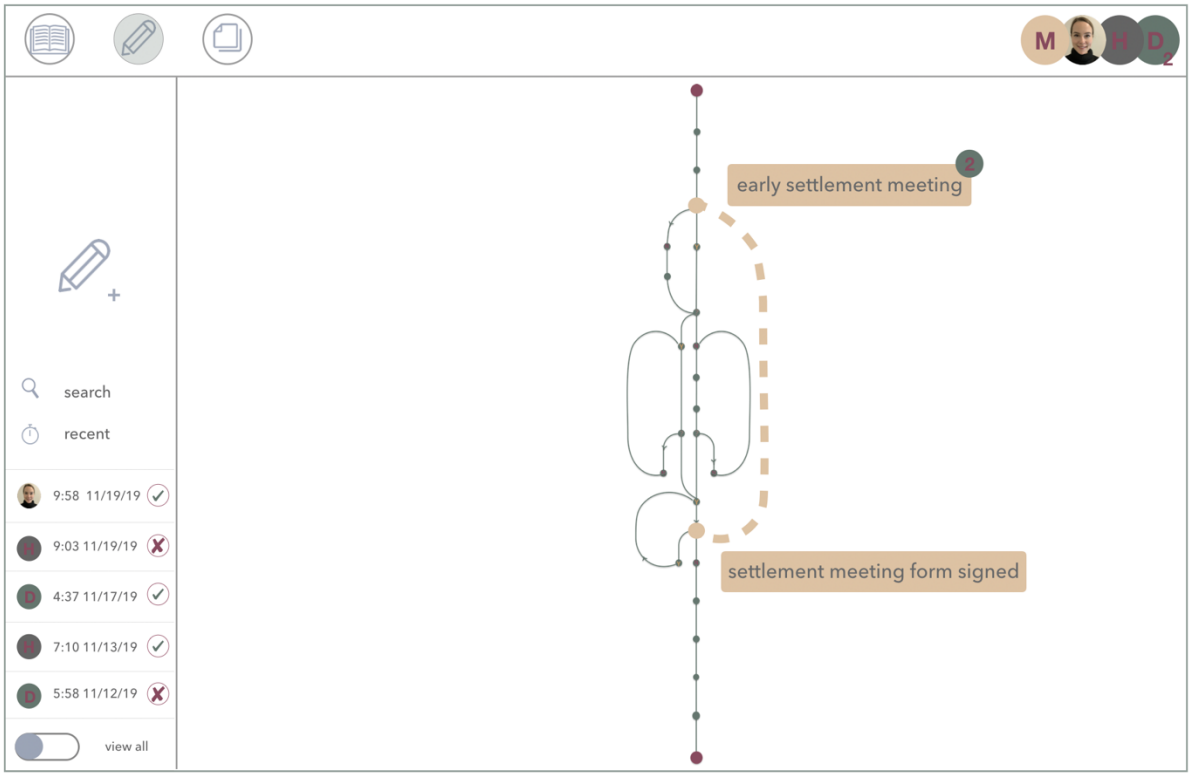

Figure 30: Proposal feature for future work

Proposals: In the design phase, designers could use the information from the feedback on the existing system map to inform new design proposals. They could draw proposed modifications directly onto the map and get feedback. Drawing on the map may be a clear indication of the proposed relevance and scope of the changes. In expanding the participation of stakeholders beyond simply offering feedback, stakeholders themselves could also make design proposals. The hope is that proposal drawings supported by rich system context and first-hand accounts could be a persuasive part of a formal proposal sent to decision-makers at an organization.

Should the decision-makers apply the recommendations and continue to apply recommendations over time, organizations could have snapshots of their system over time. If we continue to have more snapshots of our formal systems over time, they could offer a shared record of the influence of stakeholder inclusion.

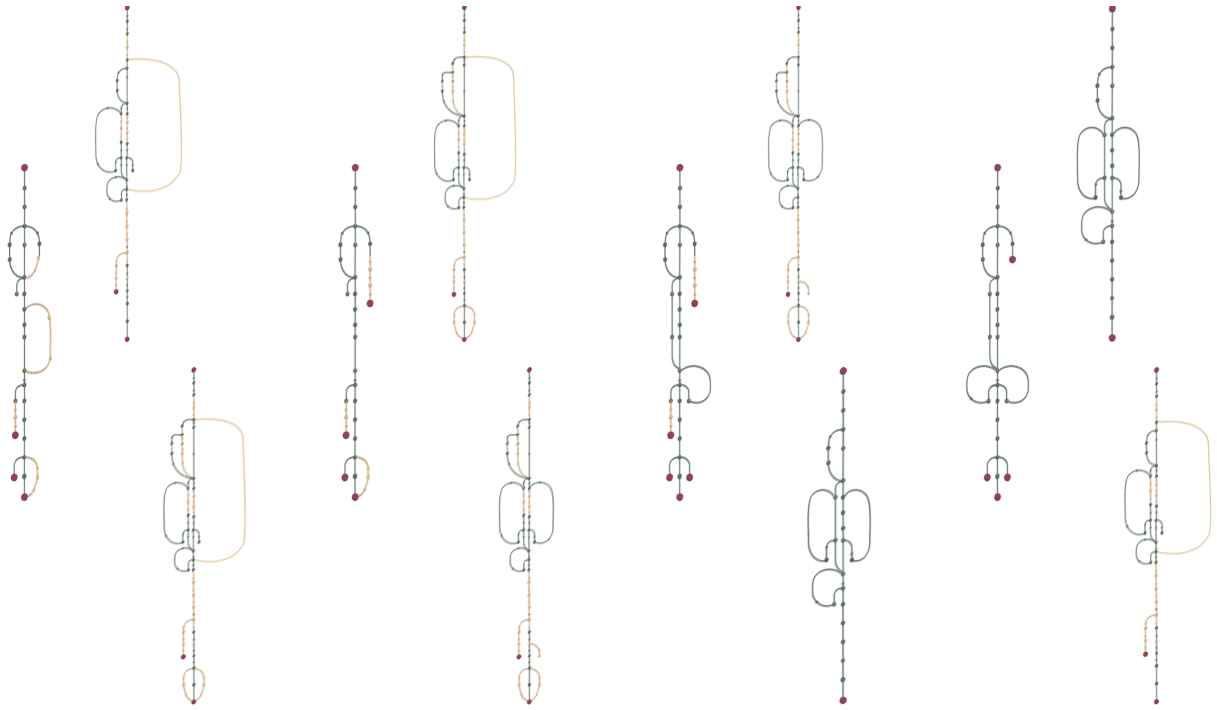

Figure 31: imagined future system diagrams

7.3 Concluding Remarks

As we have shared the design, build, evaluation, and future work of this thesis, we understand that there are many pieces still missing to validate this idea and there are many reasons why such a technology does not work for all processes. There will surely be pushback on future work in different applications. Not all institutional systems would welcome such stakeholder inclusion. Not all institutional systems would welcome a design process that would require a change in the established way of doing things. However, we believe that the benefits of stakeholder inclusion in DSD ultimately lead to more agile systems that learn quickly and have teams aligned on purpose.

This is one small step, hopefully with many more applications. The test setting for this tool was small group discussion and future work will reveal if this approach translates in different settings, potentially at a larger scale. One can imagine a future realization of this technology

that gathers feedback from the public across a complex system, presents proposals of improvements to the system, and receives a greater degree of public understanding and buy-in than was possible before. If we continue to have more snapshots of our formal systems over time, they could offer a shared record of our shared story.

Recent advances in technology have led to an explosion of data, but many of the insights from these data have not yet been inferred or applied to equitably redesign the systems we live in. Processes can still be opaque and rigid, legal language can still feel foreign, and the voices in the public sphere still do not translate effectively to representatives.

But technology has the capacity to empower us to expand our information processing capabilities, to act collaboratively, and to thrive in a world of dynamic complexity. As we collectively learn from the perspectives of others, we collectively envision our present and future.

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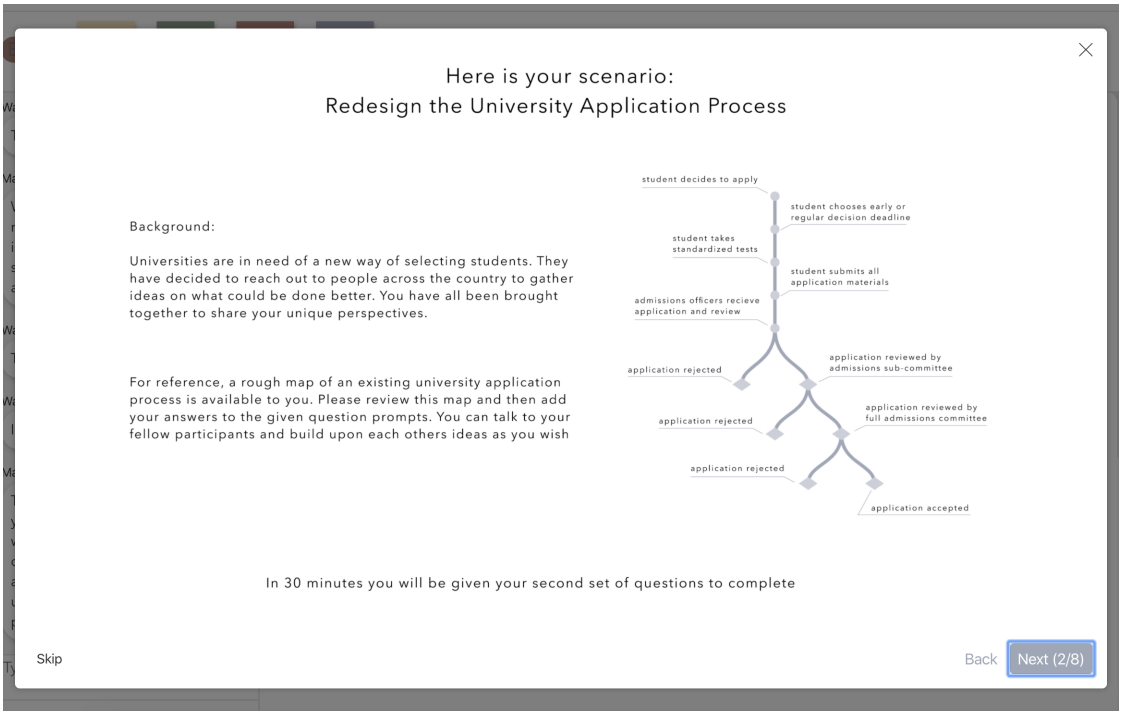
8. Appendix

A. Tool Features

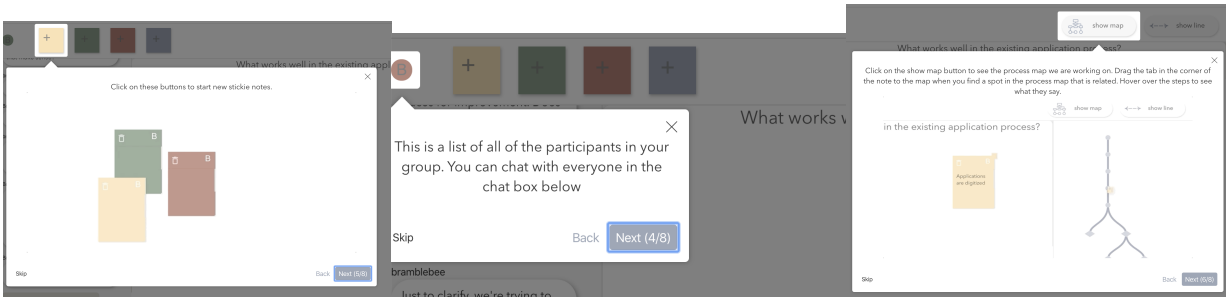
Tutorial: The tutorial is optional and can be skipped if users feel confident with their understanding of the tool and the subject of the session. The tutorial offers a series of slides that informs users of two things: the topic of the session and the features of the dashboard.

Topic: When users click to begin the tutorial, they are welcomed to the session and told what the topic of their session will be. The topic slide offers a description of the participant's role in the session and a description of the topic in visual form. The participant is treated as a "co-designer" in the session with valuable personal experience on the topic at hand. A process map with a series of steps and linkages is laid out in such a way that encapsulates the topic visually. The process map will continue to be available to participants when they open the map panel.



Dashboard features: The remaining slides of the tutorial introduce the users to the different features in the dashboard of the tool. The slides highlight dashboard features one by one and

in some cases, offer a brief video description to demonstrate how the feature can be used. Once the users have clicked through all of the tutorial slides about the dashboard, they have finished the tutorial and they are ready to begin the session.

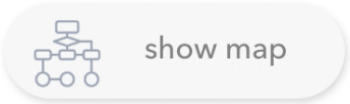


The layout of the tool is divided into an upper dashboard, and three panels below. The following section will describe each aspect in greater detail.

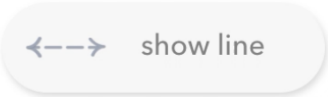
Dashboard: The dashboard of the tool runs along the top of the screen. We will describe the features of the dashboard from left to right.

User icons: The user icons signify which users are currently online. Each unique username is distinguished by a circle with the first initial of the username inside of it. Users can hover over these icons to see the full username. When users leave the site, the circles representing their presences go away.

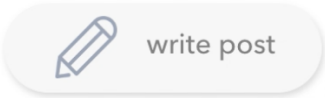
Note button: For participants to add a note, they must press the note button. The note button has a plus sign to signify its purpose. In some versions of this tool, there are note buttons of different colors that add notes of their respective colors. When the Note button is pressed, a Note appears on whichever Question Panel is currently in frame on the screen.



Show Map button: The Show Map button toggles the map panel to be visible or hidden. When the Show Map button is pressed, the map panel slides into frame and whichever note tabs are attached to the map become visible. When the Show Map button is pressed again, the map panel slides out of frame and the note tabs become invisible.

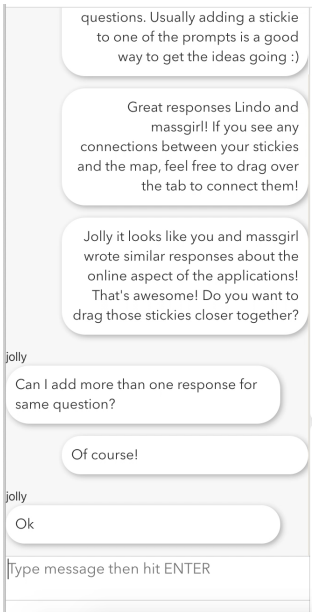


Show Lines button: The Show Lines button toggles visibility of the connection between note tabs and their respective notes. When a note tab has been attached to the map, a user can press the Show Lines button to show the connection between the note tab and the note. When multiple note tabs have been added to the map, the Show Lines button will display all of the connections between Note tabs and Notes at once. Even if a Note is currently out of frame, the connecting line between the tab and the Note will still appear.



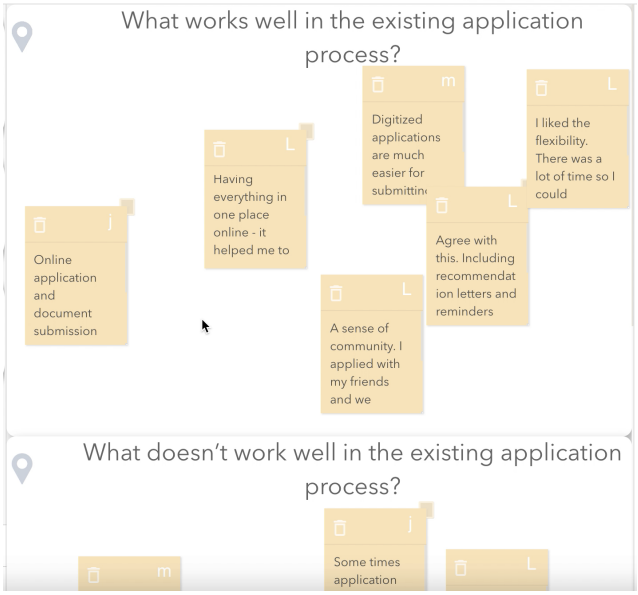
Write Post button: The Write Post button is only visible to the facilitator of the session. When this button is pressed, a text entry box pops up. Facilitators can write their desired questions in the text entry box and when they press enter, the questions will appear on new question cards for the entire group to see. If a facilitator writes a question that has already been added to the question card list, it will not appear again.

The Panels: Below we will list the characteristics of each panel in the interface and their component parts. The panels will be listed from left to right.

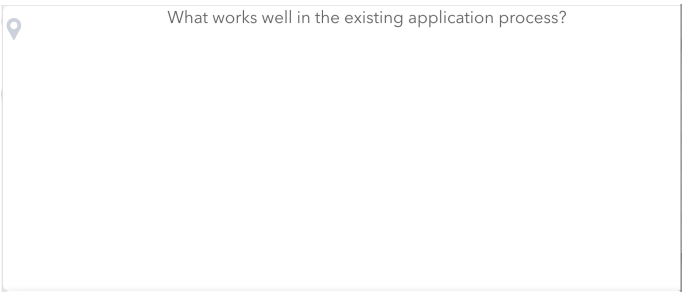


The Chat Panel: The Chat Panel is where all users can talk to one another. Facilitators will often use this panel to provide instruction on how to respond to different question prompts or check in with participants to make sure that everything is running smoothly. Participants can ask clarifying questions in the chat panel or discuss details of the experience with one another. For whichever user is currently logged in, the chat messages he or she sends will be oriented to the right on the chat screen and messages from other users will be oriented to the left.

The Question Panel: The Question Panel is where the bulk of the activity in the session takes place. The Question Panel works through the interaction of two different parts: Question Cards and Notes.

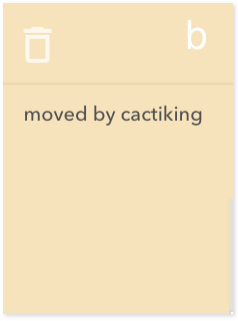


Question Cards: A new Question Card appears every time the facilitator enters a new question. The newest questions will be added to the top of the panel and users can scroll to see older questions below. The Question Card will have the question text written at the top and a large empty space below for participants to place their notes. Each question card is designed to be like a virtual white board where users can arrange and group their Notes as they see fit.



Notes: The Note is where participants write their response to question prompts. Notes are modeled after real-world post-it notes. However, the affordances of the digital space allow for some enhancements to the post-it note concept. Here I will discuss the two enhancements that this tool has currently added to the post-it note design.

Length: In the physical space, post-it notes allow for short form responses. Virtual notes have an overflow scroll feature which allows for participants to write longer form responses if they feel that they would like to use the space to add more detail or context.



History: In the physical space, individuals can see when a post-it note is moved from one place to another or when someone changes the content of this post-it note. However, if an

individual is not in the room when the changes are made, that individual does not see them. And even if the individual is currently in the room as the changes are made, it is easy to forget what has happened and who did what. Virtual Notes keep track of these changes so that everyone has access to them. A user can scroll to the bottom of a note to see the history of who has most recently either edited or moved a note. A Note is edited when the written content of the Note is changed. A Note is moved when a user drags the Note to a different location on the screen. The Note history says whatever the most recent action is on the Note as well as who performed the most recent action.

Tabs: Note Tabs are a key element in OurStory. Each Note has one Tab which can detach from the note and be dropped onto a particular step on the process map. This Tab feature enables participants to self-sort their comments and enhance the map with their own perspective.

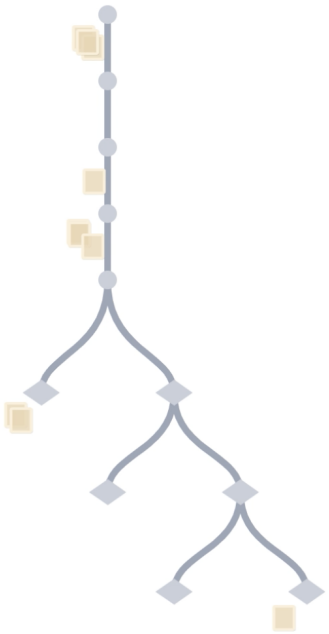
Now we will describe some features that could be added to the note for future work:

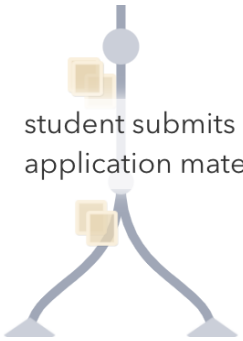
Voting: Voting is a useful feature for seeing where the agreement is amongst participants on different concepts raised during the session. In future work, it could be helpful to add a voting feature in the form of a like button or upvote and downvote buttons on the Note.

More History: While a certain level of visibility is offered to users now in terms of the history of individual notes, it could be helpful to keep track of all actions that have been performed on a note. This could be like google docs where you can keep track of who made changes and what those changes are. This could be helpful to not lose ideas but also to maintain the integrity of the session and make it more difficult for users to compromise the responses of others.

Multiple Tabs: Sometimes users can imagine multiple locations on a process map where their note could be relevant. In this way, it could be useful to allow users to add extra tabs to their notes if they want to connect to additional process steps.

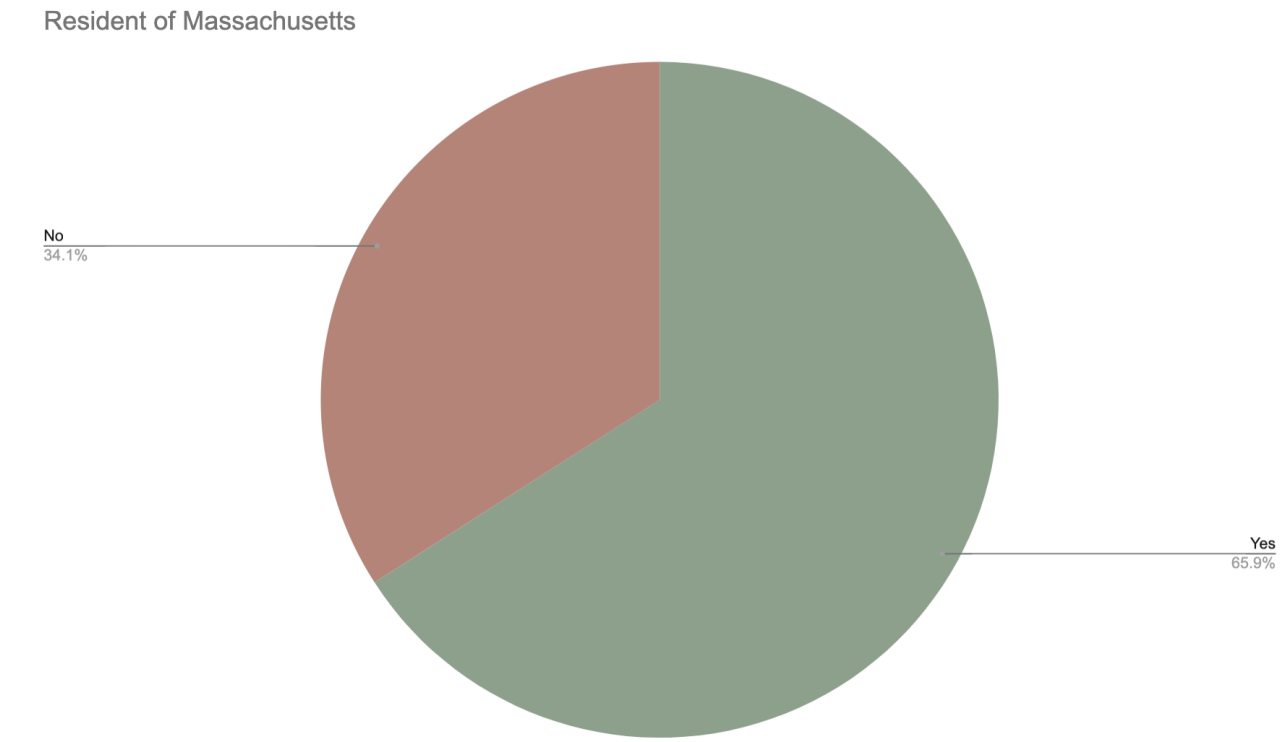
The Map Panel: The Map Panel is a visual reference for the system being discussed. Participants can refer to the map if they need to be reminded of how the process works, especially as processes become more and more complex. For the sake of our user test, this map reference is quite simple, but the hope is that the maps loaded into this panel would have more complexity for users to explore as they work. When a user hovers over a process step, a label for the process step appears.

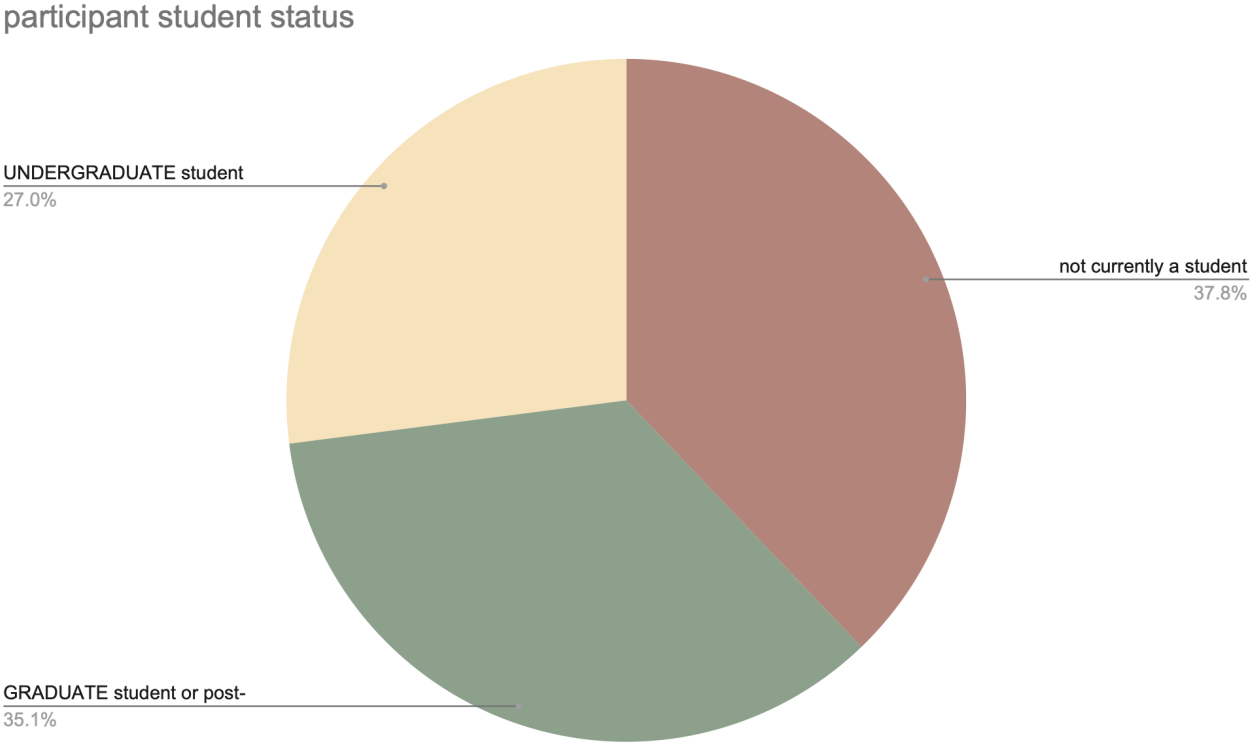


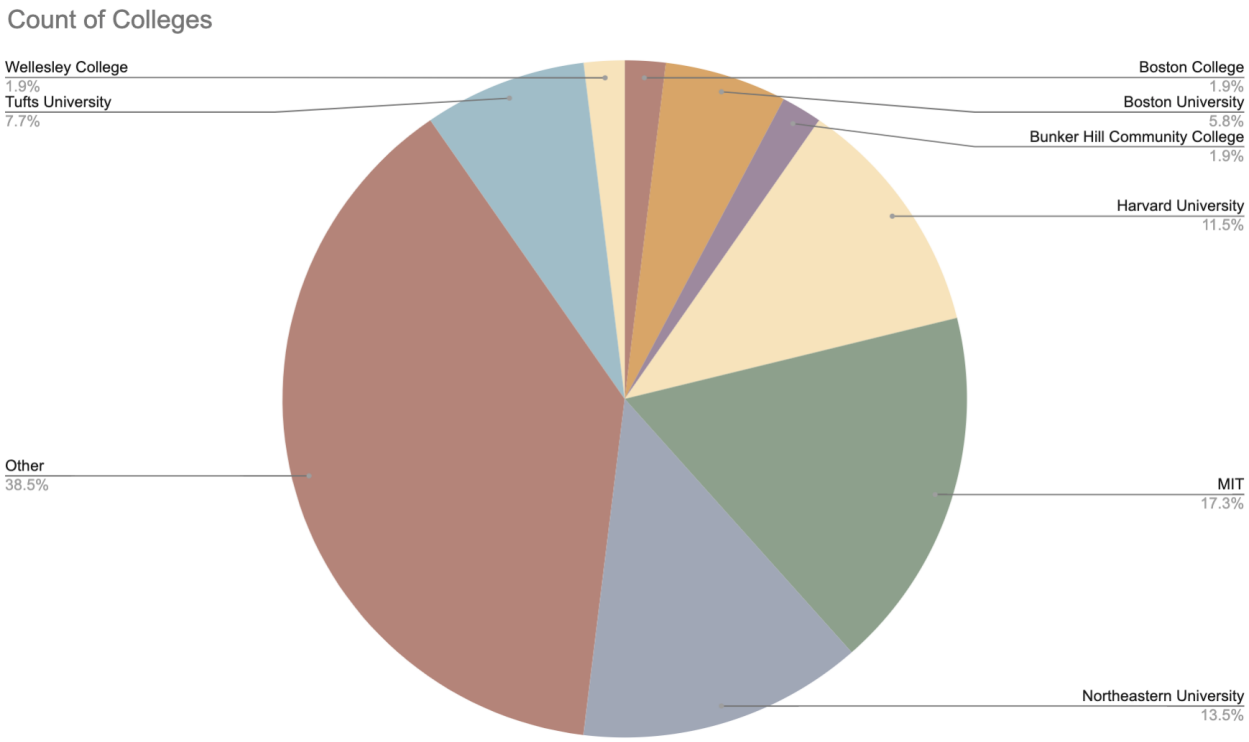


This map is not just a static visual reference, but it can also be annotated by adding Note Tabs at whichever process step a participant deems relevant to their Note.

B. User Study Participant Demographics

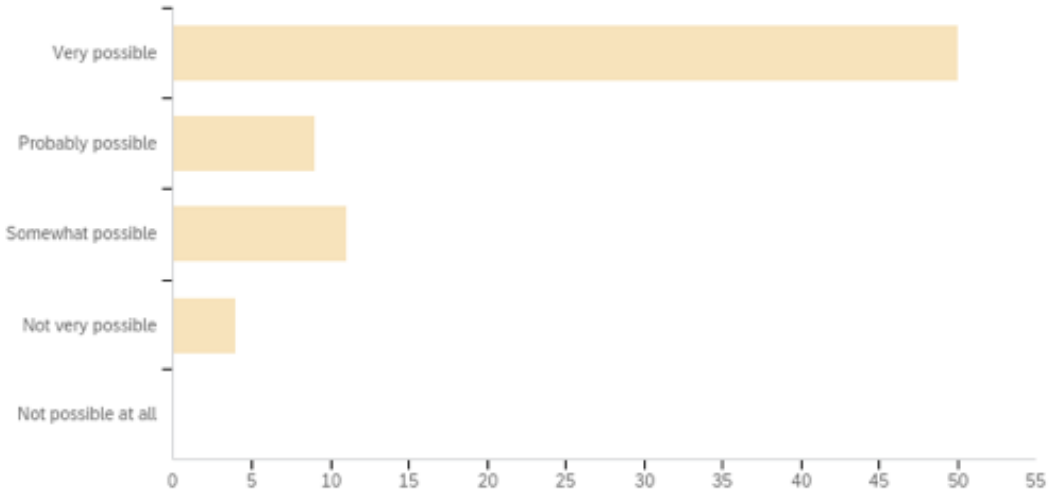






C. Post-Survey Responses

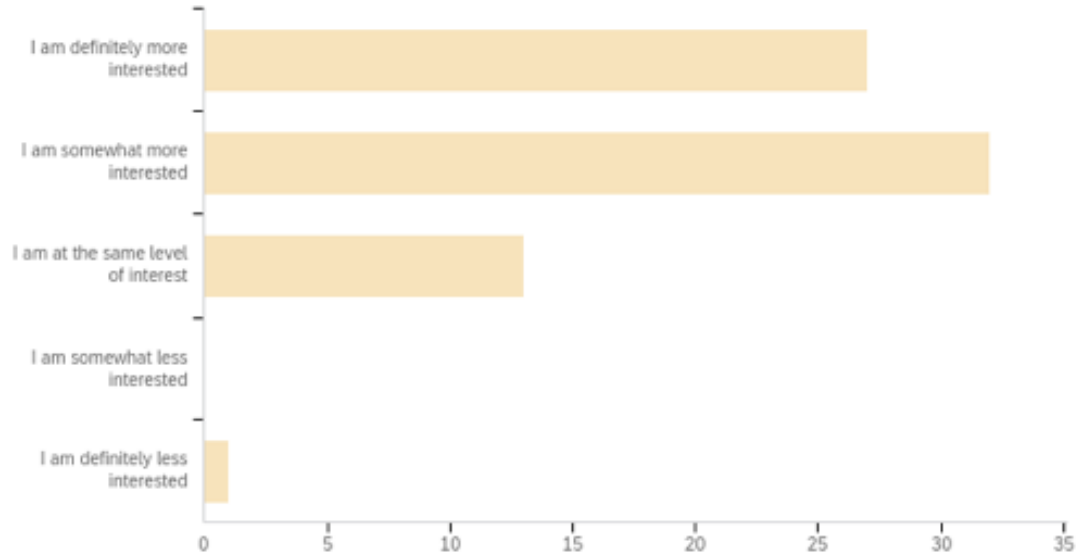
Q1 - How possible was it to complete the tasks in the allotted time?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How possible was it to complete the tasks in the allotted time?	1.00	4.00	1.58	0.93	0.87	74

#	Answer	%	Count
1	Very possible	67.57%	50
2	Probably possible	12.16%	9
3	Somewhat possible	14.86%	11
4	Not very possible	5.41%	4
5	Not possible at all	0.00%	0
	Total	100%	74

Q2 - To what extent did this exercise make you more interested in improving the application process?

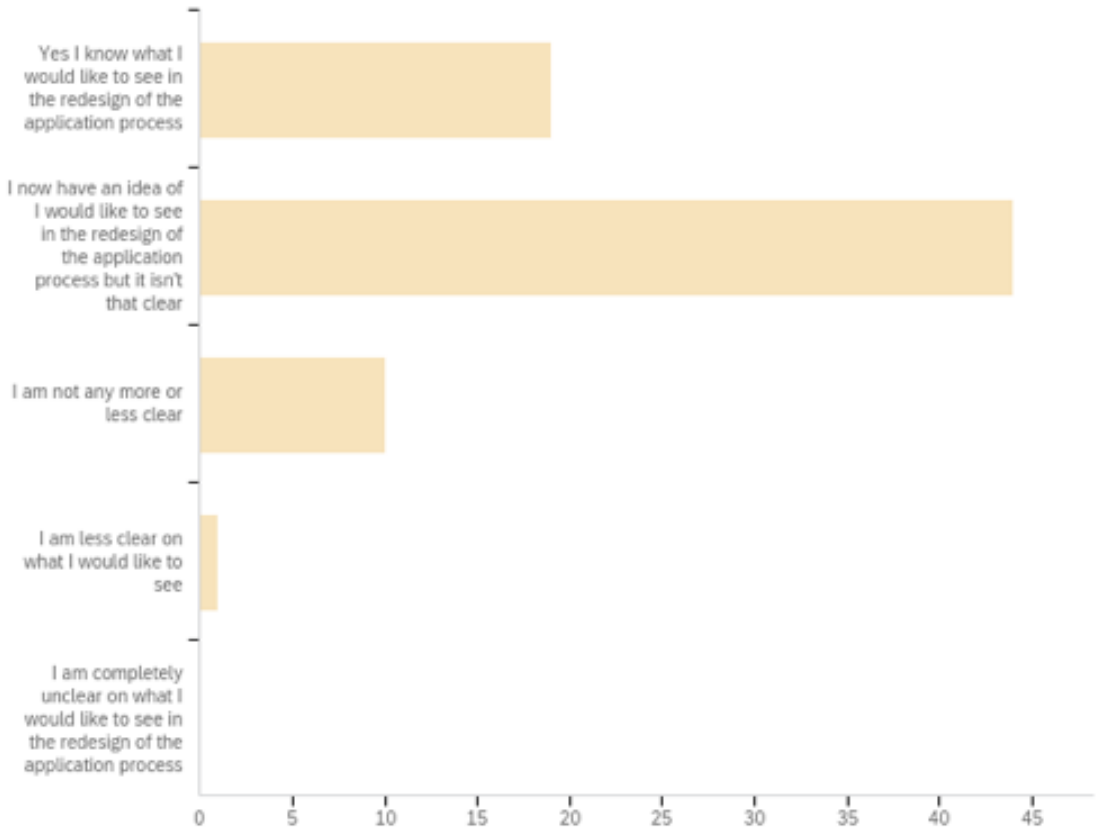


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	To what extent did this exercise make you more interested in improving the application process?	1.00	6.00	2.05	1.14	1.29	74

#	Answer	%	Count
1	I am definitely more interested	36.99%	27

2	I am somewhat more interested	43.84%	32
4	I am at the same level of interest	17.81%	13
5	I am somewhat less interested	0.00%	0
6	I am definitely less interested	1.37%	1
	Total	100%	73

Q3 - To what extent did this exercise give you a clearer idea of what you would like to see in the redesign of the application process?

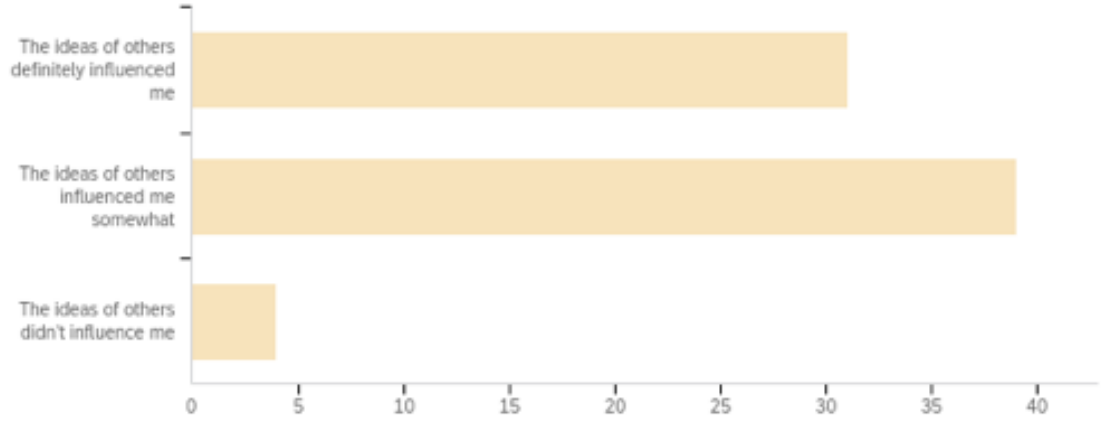


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	To what extent did this exercise give you a clearer idea of what you would like to see in the redesign of the application process?	1.00	4.00	1.91	0.66	0.44	74

#	Answer	%	Count
1	Yes, I know what I would like to see in the redesign of the application process	25.68%	19
2	I now have an idea of I would like to see in the redesign of the application process but it isn't that clear	59.46%	44
3	I am not any more or less clear	13.51%	10
4	I am less clear on what I would like to see	1.35%	1
5	I am completely unclear on what I would like to see in the redesign of the application process	0.00%	0

Total	100 %	74

Q4 - To what extent did seeing the ideas of others influence the ideas that you came up with?

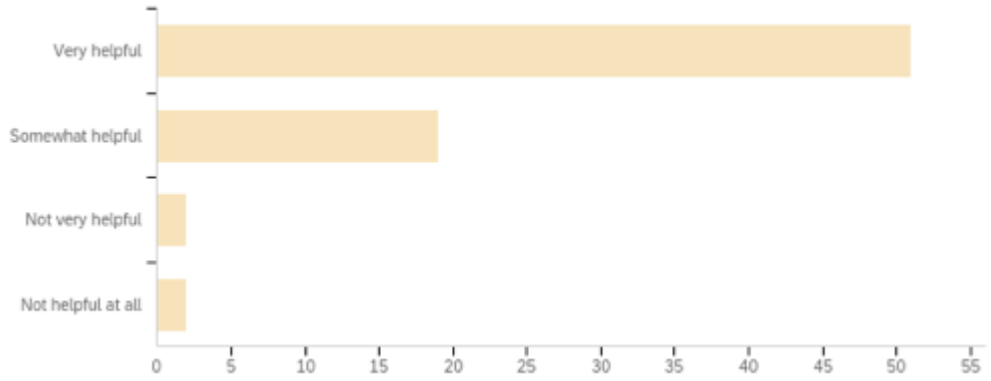


#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	To what extent did seeing the ideas of others influence the ideas that you came up with?	1.00	3.00	1.64	0.58	0.34	74

#	Answer	%	Count

1	The ideas of others definitely influenced me	41.89%	31
2	The ideas of others influenced me somewhat	52.70%	39
3	The ideas of others didn't influence me	5.41%	4
	Total	100%	74

Q5 - How helpful was the facilitator?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How helpful was the facilitator?	1.00	4.00	1.39	0.67	0.45	74

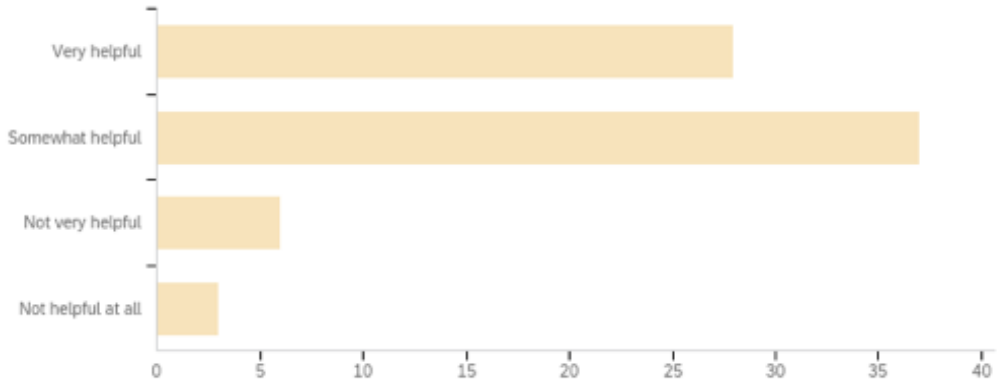
#	Answer	%	Count
1	Very helpful	68.92%	51
2	Somewhat helpful	25.68%	19
3	Not very helpful	2.70%	2
4	Not helpful at all	2.70%	2
	Total	100%	74

Q6 - Please rate on a scale of 0-10, 0 being "I totally disagree" and 10 being "I very much agree" Compared to other methods of generating ideas online this tool...

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	I can connect ideas more easily	0.00	10.00	5.90	2.43	5.89	58
2	I can be inspired by the ideas of others more easily	1.00	10.00	6.28	2.25	5.06	58
3	I can discuss a complex topic more easily	1.00	10.00	5.51	2.53	6.43	57

4	I feel like the ideas I come up with are better	0.00	9.00	5.19	2.29	5.26	58
5	I can participate at my own pace	1.00	10.00	7.76	2.07	4.29	58
6	I can answer honestly	1.00	10.00	8.19	1.96	3.84	58

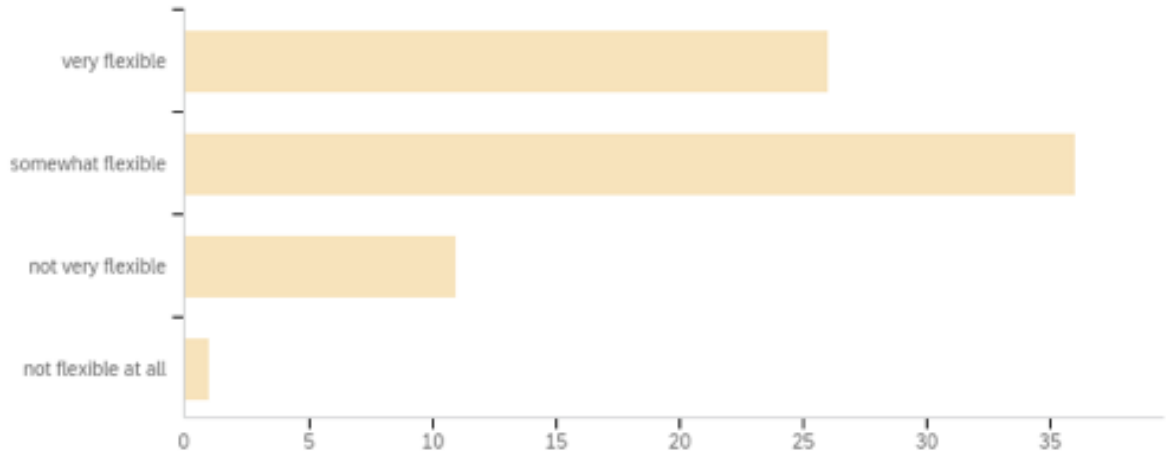
Q7 - To what extent was the visual map helpful for thinking of where improvements to the process are needed?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	To what extent was the visual map helpful for thinking of where improvements to the process are needed?	1.00	4.00	1.78	0.76	0.57	74

#	Answer	%	Count
1	Very helpful	37.84%	28
2	Somewhat helpful	50.00%	37
3	Not very helpful	8.11%	6
4	Not helpful at all	4.05%	3
	Total	100%	74

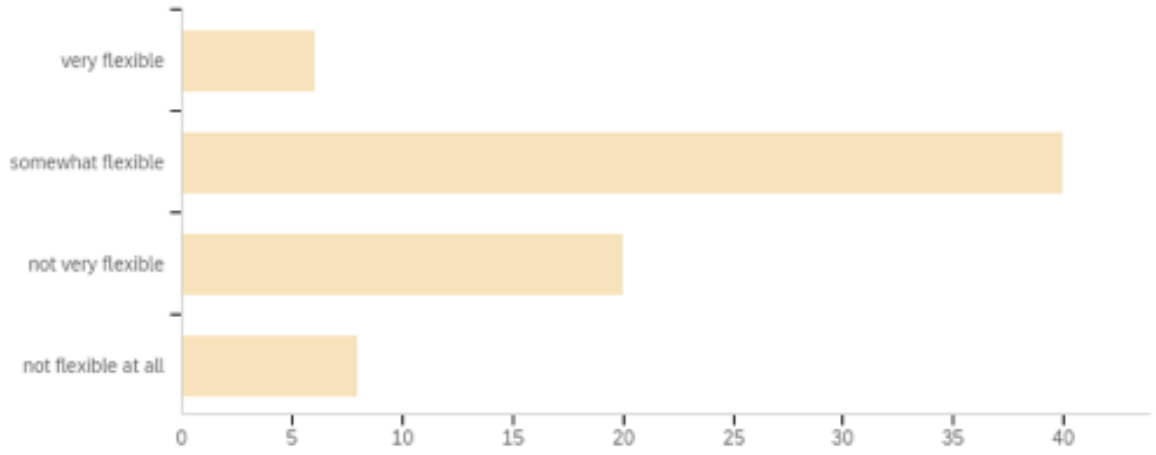
Q8 - How would you rank the flexibility of writing the note? For example, did you feel too constrained to write what you wanted, or were you able to write freely?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How would you rank the flexibility of writing the note? For example, did you feel too constrained to write what you wanted, or were you able to write freely?	1.00	4.00	1.82	0.72	0.52	74

#	Answer	%	Count
1	very flexible	35.14%	26
2	somewhat flexible	48.65%	36
3	not very flexible	14.86%	11
4	not flexible at all	1.35%	1
	Total	100%	74

Q9 - How would you rank the flexibility of connecting the tab to the map? For instance, did you feel like your placement represented your preference or did you feel too constrained by the tool?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How would you rank the flexibility of connecting the tab to the map? For instance, did you feel like your placement represented your preference or did you feel too constrained by the tool?	1.00	4.00	2.41	0.79	0.62	74

#	Answer	%	Count
1	very flexible	8.11%	6
2	somewhat flexible	54.05%	40

3	not very flexible	27.03%	20
4	not flexible at all	10.81%	8
	Total	100%	74

D. Tab Usage in User Study

OurStory was developed to enable a new dynamic in DSD focus groups, namely the ability for stakeholders to engage remotely and provide contextual feedback directly onto the system being discussed through Tab annotation. Our hypothesis was that Tab annotation onto a system map would provide a helpful diagnostic for where paint points in the system may be. We would like to demonstrate an example of how this worked during our user study. Below are two examples of the Tabs populated during focus group sessions.

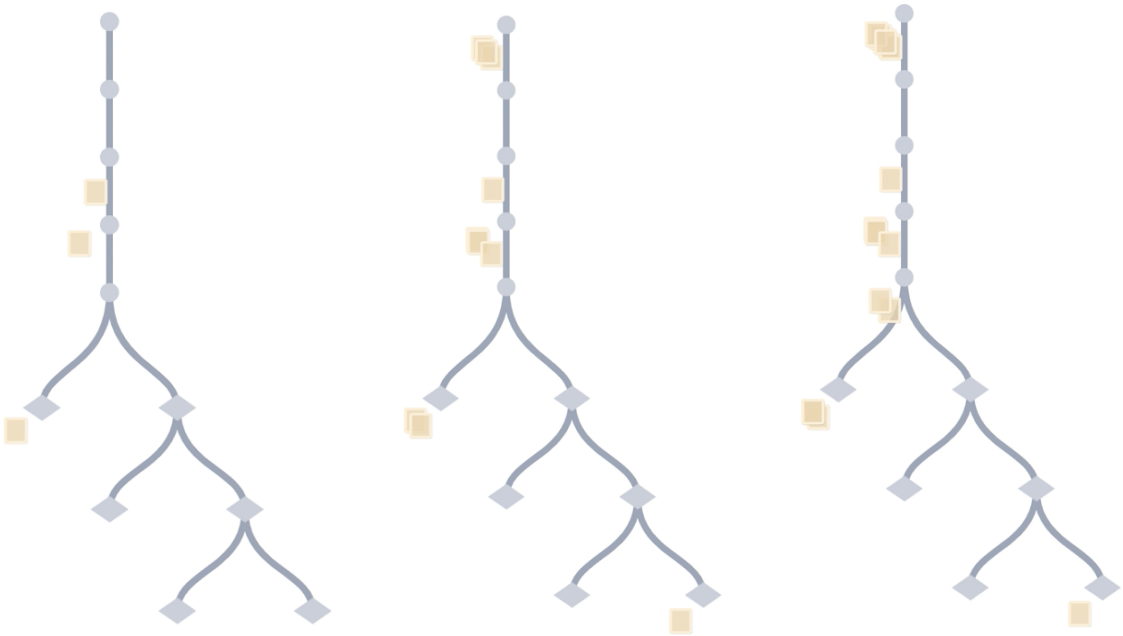


Figure 32: focus group session on February 26th at 1:15 pm, 1:22 pm, and 2:02pm

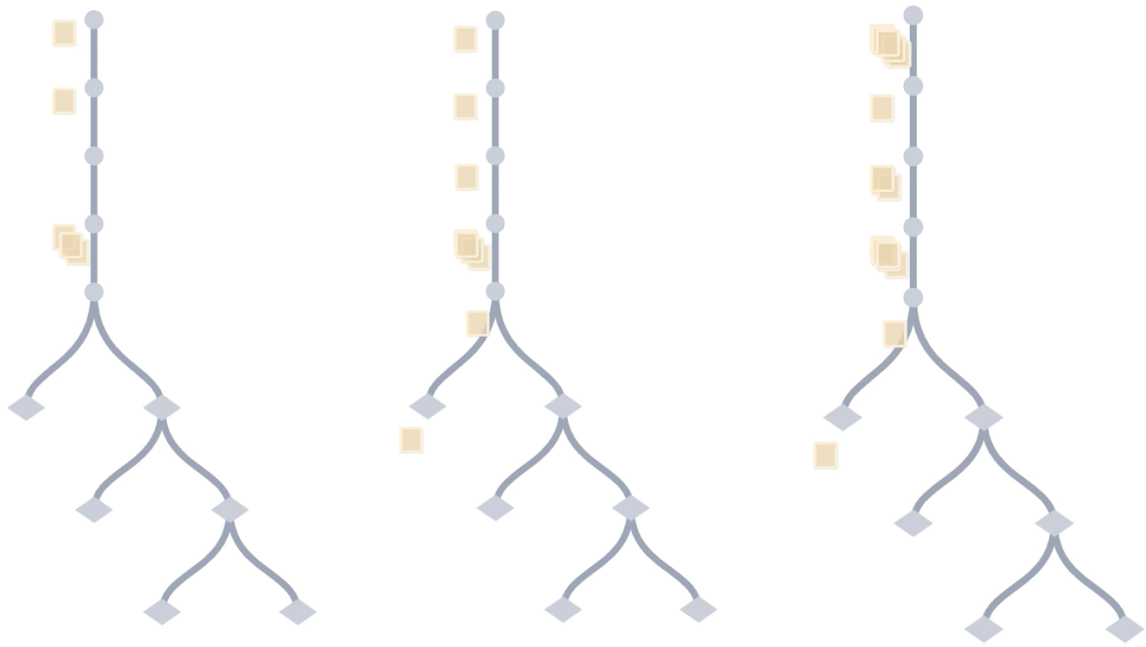


Figure 33: focus group session on February 29th at 1:35pm, 1:44pm, and 2:15pm

What is interesting to note in Figures 33 and 34 is that while Tabs were populated in different locations on the map, two locations seemed to collect many Tabs in both sessions. We notice process steps 1 and 4 both received the most Tabs in each session. These examples indicate that Tab annotation in individual sessions can differ based off of stakeholder experience, however, larger trends can still emerge. Refer to Figure 26 in section 6.2.3 for a visual of all of the Tabs combined from all sessions.