INCLUSION, EQUALITY AND BIAS IN DESIGNING ONLINE MASS DELIBERATIVE PLATFORMS

Ruth Shortall  
TU Delft

Anatol Itten  
TU Delft

Michiel van der Meer  
Leiden University

Pradeep K. Murukannaiah  
TU Delft

Catholijn M. Jonker  
TU Delft, Leiden University

ABSTRACT
Designers of online deliberative platforms aim to counter the degrading quality of online debates and eliminate online discrimination based on class, race or gender. Support technologies such as machine learning and natural language processing open avenues for widening the circle of people involved in deliberation, moving from small groups to “crowd” scale. Some design features of large-scale online discussion systems allow larger numbers of people to discuss shared problems, enhance critical thinking, and formulate solutions. However, scaling up deliberation is challenging.

We review the transdisciplinary literature on the design of digital mass-deliberation platforms and examine the commonly featured design aspects (e.g., argumentation support, automated facilitation, and gamification). We find that the literature is heavily focused on developing technical fixes for scaling up deliberation, with a heavy western influence on design and test users skew young and highly educated. Contrastingly, there is a distinct lack of discussion on the nature of the design process, the inclusion of stakeholders and issues relating to inclusion, which may unwittingly perpetuate bias. Another tendency of deliberation platforms is to nudge participants to desired forms of argumentation, and simplifying definitions of good and bad arguments to fit algorithmic purposes. Few studies bridge disciplines between deliberative theory, design and engineering. As a result, scaling up deliberation will likely advance in separate systemic siloes. We make design and process recommendations to correct this course and suggest avenues for future research.

Keywords  digital deliberation · design · automated facilitation · argumentation tools · gamification

1 Introduction

Discrimination pervades all areas of society, not least the internet. For instance, hate speech, abusive language specifically attacking a person because of their race, colour, religion, ethnic group, gender, or sexual orientation, is a well-documented problem online. A Pew Research Center survey of 2021 finds that 41% of Americans have been personally subjected to harassing behaviour online, and increasingly, one in four experiences online harassment in severe forms (Pew Research Center, 2021). The policies and design characteristics of popular online platforms are frequently blamed for proliferating this kind of behaviour, due to the way they shape our interactions (Levy and Barocas, 2017). Platforms like Facebook or Twitter generally respond to offensive material reactively, censoring it (some argue, to the detriment of free expression) only after complaints are received too late to undo psychological harm to the recipients (Ullmann and Tomalin, 2020) and not effective in reducing the spread of conspiracy content (Faddoul et al., 2020). While social media and other platforms allow mass participation and sharing of political opinion, they limit exposure to opposing views (Kim et al., 2019), and have been shown to create echo chambers or filter bubbles (Bozdag and Van Den Hoven, 2015). Popular social media platforms are clearly unsuited to enabling respectful and reasoned discussions around urgent important, controversial and complex systemic challenges like climate change or energy (Gürkan et al., 2010).
In order to promote effective online discussions and counter discriminatory behaviour, researchers have proposed that discussion platforms be designed in accordance with deliberative ideals, to increase equity and inclusiveness (e.g. Zhang, 2010). They should in theory promote a greater degree of equality or civility between participants (Gastil and Black, 2007). Deliberation, in an ideal form, promises to eliminate discriminatory effects of class, race, and gender inequalities (Gutmann et al., 2004) and to redistribute power among ordinary citizens (Curato et al., 2019). Deliberative discussions, in the most general sense, can be held between any group of people. If based on a randomly selected mini-public model, Goodin (2000) argues, they can accurately reflect the views of a larger group had the process been carried out at that scale. They can provide a certain guarantee of ‘representativeness’ with inclusion of minority voices (Lafont, 2019; Curato et al., 2019). Deliberative online platforms ideally strive to promote respectful and thoughtful discussion. Their potential to reduce polarization, build civic capacity and produce higher quality opinions (Strandberg and Grönlund, 2012) are much discussed in the literature. Design features of participatory platforms, particularly those which promote deliberation are shown to be evaluated more favourably by citizens (Christensen, 2021).

Promoting high-quality mass deliberation online is arguably essential to enhance critical thinking and reflection, to build greater understanding of diverse perspectives and policy issues among participants, while contributing to widely supported solutions (Gürkan et al., 2010; Verdiesen et al., 2018). Fishkin (2020) argues that those who do not deliberate are likely to be ‘disengaged and inattentive’, and are not encouraged to think about the complexities of policy issues posing difficult trade-offs. Reversing this is particularly appealing now that there is a growing demand for citizen participation in urgent and important policy issues such as climate change or the energy transition (Schleifer and Diep, 2019), but also, since valuable and vital public ideas are inadequately reflected in current small-group deliberative practices (Yang et al., 2021). Indeed, the distribution of people’s ideas is shown to have a long tail, thus requiring the participation of masses of people to ensure the diversity of ideas is adequately captured (Klein, 2012). The number of participants in mini-publics is normally limited to several hundred at most, which tend to be divided into smaller groups for in-person deliberation. There is empirical evidence that participants from the wider public process the objective information presented in such a mini-public quite differently than the members of this mini-public itself (Suiter et al., 2020).

However, scaling up deliberation and moving it online, argues Aitamurto (2016), is entirely possible, by combining the concepts of crowdsourcing and democratic deliberation, considering that self-selection can be tempered by randomization of participants within the platform. Ito (2018) proposes a combination of crowd activities (contribution) and a hierarchy (management of that contribution). Yet, scaling up deliberations faces certain challenges. Some deliberative scholars conclude that the values of deliberation and large scale participation, and hence the combination thereof - mass deliberation - are inextricably in conflict (Cohen, 2009; Lafont, 2019). Critics note that publicity could seriously undermine the quality of deliberation. Moreover, in the current set-up of these systems, the more people that participate in a deliberation, the less likely it is for everyone to have equal time to explain their views, ask questions and receive answers, weigh new considerations and the like (Lafont, 2019). Therefore, political discourses via live chat for example under a Facebook comment are of significantly low deliberative quality (Fournier-Tombs and Di Marzo Serugendo, 2020). In mass deliberation, without appropriate support, it is impossible for humans to synthesise the large amounts of information that result. Disorganised opinions, which may not always be based on facts, need to be structured better by means of argument structuring or reasoning tools (Verdiesen et al., 2018). Moderator workload becomes too high in such cases, and facilitation may need to be automated to deal with tasks like argument summarization or consensus building (Lee et al., 2020). Reduced face-to-face interaction may lead to a loss of social cues and empathy between participants (Iandoli et al., 2014). Attracting users in general is a challenge: there is a low uptake in deliberative software online (Toots, 2019), and there are a myriad of reasons why citizens will not take the time and effort to deliberate in depth (Neblo et al., 2010). Hence, it remains a challenge to engage the wider population in intensive deliberative processes, and those that will engage can be expected to be unrepresentative of the rest of the population (Fishkin, 2020).

Online deliberative spaces remain in the experimental phase and come in all shapes and sizes with no clear consensus about what is the best model. There is a lack of nuanced discussion on the underlying democratic concepts forming the basis for these technologies and hence a danger that they may not uphold democratic ideals such as inclusion, equality, reflection or representativeness (Alnemri, 2020). To the contrary, they may actually strengthen pre-existing (unconscious) biases, i.e. prejudice based on gender, ethnicity, race, class or sexual preference. Further, the impact of motivation, skills or access to materials, as well as the social, political and economic context, on how people use online deliberative platforms should be considered by platform designers (Epstein et al., 2014).

The problem of bias in software is recognised e.g. (White, 2020; Vorvoreanu et al., 2019). Friedman and Nissenbaum (1996) identified three types of bias in computer systems: pre-existing bias, technical bias and emergent bias. By reviewing existing technologies, and becoming aware of particular values which may be embedded therein, we can better inform future design (Friedman et al., 2001) and support a ‘design for values’ approach that may promote
responsible innovation (van den Hoven et al., 2015). This paper hence reviews the literature on the design of online deliberative tools. In particular, we investigate:

- Which design characteristics receive the most attention in the literature?
- How much attention is given to dealing with different types of bias in each design case?
- What design process and types of test-users are employed?
- What are the implications for the future of designing online deliberative spaces for mass deliberation?

This paper is structured as follows: Section 2 explains the potential of design bias to impact inclusiveness of deliberative platforms, Section 3 describes the literature review methodology, Section 4 presents the results of the literature as well as discussion of the main design topics found. Section 5 provides conclusions, recommendations and reflections on future research.

## 2 How design bias could impact the inclusiveness of deliberative software

Biases relating to gender race, ethnicity, social class, sexual orientation are as pervasive in software as they are in everyday life and often go unnoticed. Bias in computer systems refers to design that systematically and unfairly discriminates against certain individuals or groups, by denying them opportunities or services, or causing an undesirable outcome (Friedman and Nissenbaum, 2017).

In the creation of software, Friedman and Nissenbaum (1996), identify three origins of bias. The first is pre-existing bias, which originates in social institutions, practices, and attitudes prior to the creation of the system. It enters the system implicitly or unconsciously via individuals or organisations who have significant influence over the design of the system. For instance, the IT sector (e.g., in USA) is undeniably male-dominated (White, 2020), with an under-representation of minority groups. Gender bias is shown to have clear impacts on software design (Vorvoreanu et al., 2019) machine intelligence (Leavy, 2018), chatbot design (McAllister et al., 2020). Interactions with gender biased web interfaces are shown to reduce inclusion and have a negative psychological impact on end-users experiencing the bias (Metaxa-Kakavouli et al., 2018; Vorvoreanu et al., 2019). The online platforms that shape so many of our interactions are usually not designed to reduce pre-existing biases (Levy and Barocas, 2017), examples being Airbnb (Cheng and Foley, 2018) or freelance marketplaces TaskRabbit and Fiverr (Hannák et al., 2017).

Technical bias refers to bias resulting from technical constraints or aspects of the software, such as hardware or software limitations, decontextualized algorithms, and the unwarranted formalisation of human constructs, such as discourse or judgements. For example, decision support tools used by judges and parole officers to assess a defendant’s likelihood to reoffend, were found to overestimate the recidivism risk of black defendants while underestimating that of white defendants (Dressel and Farid, 2018).

Emergent bias refers to bias that results from the context of use of software. The original context of a design may change due to changes in society or culture or mismatches between the users’ values and the design, which are not incorporated into the system. For example, law enforcement could become over-reliant on a software that is not highly accurate and treat it as if it were (Rashid et al., 2015).

Software tools that are designed to allow scaling up of deliberation heavily influence the format and operation of these deliberations (Wright and Street, 2007). Deliberative democracy ambitiously promises, among other things, to increase inclusion and eliminate discriminatory effects of class, race and gender inequalities (Gutmann et al., 2004). While face-to-face deliberation tends to only accommodate smaller groups of people, greater inclusion is theoretically possible by scaling up deliberation online, with the help of digital technologies. However, inclusion goes beyond providing better times and places of engagement. While deliberation also promises equal treatment, equal voice and respect for participants, it is argued that equity may be compromised in other ways (Beauvais, 2018).

Three main factors of power distortion in online deliberations are said to be gender, social status and knowledge (Monnoyer-Smith, 2012). However, little attention is paid to the effects of gendered behaviour (Afsahi, 2020), social inequality (Beauvais, 2018) or the implications of different communication or learning styles (Siu, 2017), all of which can influence inclusiveness of deliberation. Difficulties may arise with including certain social groups (minorities, the poor or less-educated) in deliberations (Asenbaum, 2016). Although access to online systems is improving, use of the internet is influenced by less obvious factors such as social class or sense of self-efficacy, which often affect people of colour or women (López and Farzan, 2017) or motivation, access to equipment, materials, skills or the social, political and economic context. These factors influence how people participate in online deliberative platforms yet may not be considered in the design of online deliberation platforms (Epstein et al., 2014).
While deliberation online may give people equal opportunity to participate, people still diverge in their facultative and rhetorical abilities (Beauvais, 2018). Populations with special needs may be excluded, including older adults, children, people with disabilities or who are illiterate (López and Farzan, 2017). Language may also be an issue in that if not all participants speak the same first language, this may lead to further inequalities (Velikanov, 2017).

Communication style and gendered behaviours are carried over into deliberative settings. The communication skills and style of expression required in deliberative settings tends to be characteristic of higher income white males and may not be characteristic of all social groups, leaving them at a disadvantage. For example, high-resource and digitally engaged individuals are generally more capable and active in discussions, leaving low-resource individuals at a disadvantage (Himmelroos et al., 2017; Force et al., 2020). Less-privileged, less-educated, or perhaps illiterate participants may feel they stand less chance in discussions with the more privileged, better educated, and well-spoken (Hendriks, 2016; Siu, 2017). Some citizens may believe complex issues are beyond their expertise and hence defer decisions to be made by experts (Font et al., 2015) and people may need training or education to help develop the capabilities to participate in a deliberative setting (Beauvais, 2018).

It is also shown that rather than sharing facts, people are often more convinced by stories about personal experiences (Kubin et al., 2021), which suggests that deliberative software that relies on the exchange of arguments, or factual statements may not achieve the desired goal of building respect for different points of view or empathy.

With regard to gender and communication, men are more likely to interrupt or ignore women and speak for longer and more often than women, who tend to be less assertive and more accommodating in deliberations (Siu, 2017). Women’s contributions may be marginalized or sexualised due to gender hostility (Kennedy et al., 2021). Women also tend to be more conflict avoidant and less willing to engage in argumentation required for deliberation, hence they may require a particular style of facilitation to ensure their inclusion (Afsahi, 2020).

Culture also influences design. In particular, western cultural and methodological standards currently dominate deliberation research (Min, 2014). However, certain cultures may favour different deliberation or argumentation styles e.g. cultures may be consensus-based or adversarial (Bächtiger and Hangartner, 2010). For example, Confucian societies may value social harmony over public disagreement. Other studies (Becker et al., 2019; Shi et al., 2019) have highlighted the wisdom of partisan and crowds. Under the right design principles, these groups produce high-quality outputs. Moreover, in Muslim countries men and women may deliberate separately (Min, 2014).

Hence, it is a great challenge for designers of deliberative software platforms to take account of a broader range of issues i.e. differences in gendered behaviour, communication style, cognitive ability, confidence or culture. Most commonly though, guiding values, norms and deliberative ideals are interpreted by platform developers and then translated and programmed into algorithms (Alnemr, 2020).

3 Method

A systematic literature review was performed on academic (English language) literature relating to digital deliberation design. Snowballing on relevant citations was also performed by using google search or else by using 'related literature' links in Google Scholar search. Searches for academic literature were performed on Google Scholar and searches between August 2020 and April 2021. Keyword combinations used for searches are shown in Table 1.

120 articles were found in the initial search. These were then screened for relevance, reducing the number of articles to 84. The screening criteria for academic articles were as follows:

- Article was about a design case study, i.e. it describes the design or proposed design of a digital deliberation tool or platform, or article analyses existing design(s).
- Article was peer reviewed.
- Article was a research article not an opinion article or letter to the editor.

For the sake of readability and brevity, not all references are included or cited in this paper, but are available on request from the first author. The references that are included in the paper are illustrative examples.

4 Results and discussion

4.1 Overview

A total of 84 papers were reviewed. Of these, 64 were about design case studies and rest analysed existing designs or suggested possible design features, e.g. Wright and Street (2007); Towne and Herbsleb (2012);
Table 1: Search strategy keywords

| Search terms                                      |
|--------------------------------------------------|
| 1. ‘online+deliberation’                         |
| 2. ‘digital+deliberation’                        |
| 3. ‘design’                                       |
| 4. ‘bias’ OR ‘inclusion’                         |

| Search expressions                               |
|--------------------------------------------------|
| 1. (1 OR 2) AND 3                                |
| 2. (1 OR 2) AND 4                                |
| 3. (1 OR 2) AND 3 AND 4                          |

Ruckenstein and Turunen (2020); Bozdag and Van Den Hoven (2015). The most popular topics were argumentation tools (16 papers), e.g. (Iandoli et al., 2014; Gold et al., 2018) automated facilitation (12 papers), e.g. (Wyss and Beste, 2017; Lee et al., 2020). In contrast, the topic of human facilitation (methods) in online deliberation platforms was discussed in 4 Papers e.g. (Velikanov, 2017; Epstein and Leshed, 2016). The time period for the found papers ran from 2005-2021. The first 6 years are dominated by the topics of general design and argumentation. Automated facilitation first appears as a topic in 2012, but becomes much more common from 2017 onwards.

Gamification was another topic drawing substantial interest with 8 papers, e.g. (Gastil and Broghammer, 2021; Gordon et al., 2016). Other papers covered the topics of information presentation (3 papers) (Brinker et al., 2015; Ramsey and Wilson, 2009; Semaan et al., 2015), sense-making tools for participants (Zhang, 2017), virtual reality (Gordon and Manosevitch, 2011), visual cues (Manosevitch et al., 2014) or reflection spaces (Ercan et al., 2019) (1 paper each). The remaining papers focused on general platform design or numerous design features in the same paper. In these papers, other popular themes of discussion included participant anonymity vs. identity e.g. (Gonçalves et al., 2020; Rose and Sæbø, 2010; Rhee and Kim, 2009) and the use of asynchronous vs real-time discussion or text-based vs. video deliberation e.g. (Osborne et al., 2018; Kennedy et al., 2021).

The USA (25 papers) is dominant in this field of research, followed by Europe (23 papers) and Asia (Japan, Korea, Singapore) (9 papers). The remaining papers were from Russia, Australia, Brazil, Israel, Canada and Afghanistan. (Note: some papers involved research in more than one country).

Of the 64 design case studies, 19 had no description whatsoever of the users or participants who tested or collaborated in the software design. The remaining case studies provided some information on one or more of the following: number of participants or users of the software, (mean) age, gender balance, ethnicity, education levels, political affiliation and profession of participants.

The number of participants or users mentioned in these design studies, which had varying time frames, ranged from 9 to 16000. The median number of participants/users was 86 and the mean was 324. Only 13 studies provided details about the gender balance of participants. In 9 of these studies, females made up less than 50% of participants. Only 3 studies reported information about the race or ethnicity of participants, which was shown to be skewed toward Caucasian in USA cases. The education levels of participants, when reported, was nearly always university level, probably because in the majority of cases where this information was reported, the test users were university students or staff. Only 10 studies reported the age range of participants. While a few studies used samples representative of the general population, for the most part, the age range for participants in these studies skewed young (under 40). In brief, where reported, the majority of test user groups seem to be young, male and WEIRD (Western, Educated, Industrialized, Rich, Democratic).
In the remainder of this section, we discuss the most common themes found in the literature in more detail, while reflecting on the potential for biases or power distortion to be embedded in the design of deliberative software tools, its impact on inclusion, and how this may or may not be mitigated.

4.2 Argumentation (Mining)

There is a trade-off between user accessibility and an understandable, well-structured discussion. Most online discussions happen on easy-to-use conversation-based platforms like forums, even though their ability to promote fair and transparent discussion is debatable (Klein, 2012; Black et al., 2011; Fishkin et al., 2018). For example, the structure of comments sections in news media websites is shown to affect the deliberative quality of discussions (Peacock et al., 2019). Posts organised temporally, rather than topically are more difficult to navigate and connect to each other and content tends to be repeated. Newer platforms visualise discussions and map out arguments, helping participants to clarify their thinking and better connect information (Popa et al., 2020; Gürkan and Iandoli, 2009). These platforms may require user training or supervision, but they also counter sponsored content and promote fair and rational assessment of alternatives (Iandoli et al., 2018).

Argumentation, where rational dialogue is considered to be the basis of conversation, is a key goal of deliberation (Fishkin, 2009). For this purpose, (online) deliberation platforms have put a sizable effort in reflecting this argumentation in their content. At the core of making the process of producing arguments and their interaction explicit is the notion of argument mapping (Kirschner et al., 2012). Here, the interplay of claims and premises are mapped into a structured format, for instance into a directed graph. However, no single model of argumentation exists, and different theories exist for the structured format (Van Eemeren et al., 2013; Reed, 2010). Next to the definition of arguments and their connections, even the granularity of the grammar is undecided. Hence, algorithms that are merely programmed to define what constitutes a positive, neutral and negative argument¹ (to train automated facilitators that act upon that information), as seen in the experiment of Yang et al. (2021), may seriously constrain the space and diversity of opinions.

Tangent to Argument Mapping is Issue Mapping (Kunz and Rittel, 1970), which aims to achieve a similar explicit structure of the content of a debate, but on a more abstract level, in order to create a shared understanding of the problem at hand. Instead of focusing on merely the logical structure of individual utterances, a debate is mapped out in terms of ideas, positions and arguments (Conklin, 2005) using an Issue-Based Information System (IBIS). While not without its own criticism (Isenmann and Reuter, 1997), IBIS remains a highly popular syntax in recent digital deliberation platforms. This popularity is reflected in the studies included in our search: 8 out of the 16 articles employ IBIS in their platforms. Other models include Bipolar Argument Frameworks (Cayrol and Lagasquie-Schiex, 2005), those using the Argument Interchange Format (Chesnevar et al., 2006), and various other custom models specific to the use case of the article. So far, no single model is accepted by all.

For argument information to be extracted from a conversation, trained moderators and mappers are required. In the process of facilitating, moderators may impose their own biases into the conversation (See Section 4.3). While users themselves could be tasked with inputting their ideas in the map (Pingree, 2009), the mapping procedure involves multiple cognitively challenging tasks, increasing the risk for errors. Mappers (those doing the mapping) are expected to keep up with the conversation, while keeping close attention to the map and perform clarification interactions with the discussants. Klein (2012) estimates requiring a human moderator for every 20 users, which severely limits the ability to scale up. Support technologies from AI, such as NLP, can be used to aid the moderation mapping procedure. While complete automation, at this point, is still infeasible and will probably impact the quality of the discussion, platforms have been experimenting with such methods, with varying results (Gu et al., 2018).

Specifically, for these platforms the design in itself is a matter of discussion. Easterday et al. (2009) propose various design criteria based on a case-study in a classroom and conclude that no platform existing at that time incorporates all desired features. De Cindio and Stortone (2013) adjust their platform to the case of governmental elections, and show that relatively small design choices, like the addition of a participatory contract and user authentication can have severe impacts in terms of user participation. Although their platform hosted a variety of deliberative features, they were relatively underused. Still, participants did show collaborative behaviour, seemingly supported by the existence of the participatory contract.

¹Yang et al. (2021) define: A positive case contains a discussion topic or point that leads to positive discussion and towards consensus. Usually such a post will be followed by several supporting posts. A neutral case represents an ordinary post or opinion that is supportive or objective to the topic opinion in online discussion. It may not play a vital role in leading to forum consensus, but will play a secondary role in the discussion. A negative case represents a post or opinion that contains bad words or detouring information that may distract topic posts or main ideas, even causing flaming or obstruction in online discussion.
If an argument map can be created, allowing users to browse the map is met with enthusiastic reactions in those proficient with the interface (Liddo and Shum, 2013). Still, additional steps can be taken to find the resolution of certain discussions. In an attempt to find winning arguments, Boschi et al. (2021) find technical bias stemming from their assumption that unfurled arguments are winning. The modelling choice of making leaf comments (i.e. comments without replies) winning, has a significant impact on which comments are considered to be of high quality. Even if no refuting reply is present, it does not necessarily mean that the argument is sound.

One of the benefits of traditional social media is that anyone can contribute. In large-scale deliberative platforms, this benefit would ideally be preserved when moving to argument-based systems. However, an argument map restricts social interaction between users, and may introduce a significant learning curve. Iandoli et al. (2016) show that these factors have a negative impact on user’s experience of platforms with argument maps in terms of mutual understanding, perceived ease of use and perceived effectiveness of collaboration. Similarly, Gürkan et al. (2010) found that users required significant moderation to input new ideas that fit the formalization of the argument map, and that user activity, such as “normal” conversations, moved outside of the deliberative platform.

To preserve the social interaction, platforms that mix the map and traditional conversation-based comments have been proposed (Fujita et al., 2017) and employed in practice (Gu et al., 2018; Velikanov, 2017). To make sure everyone can contribute to the discussion, Velikanov (2017) proposes the use of argumentative coaches. In an attempt to provide further insight into the discussion dynamics, metrics surrounding turn-taking, as well as high level thematic information can be added to these overviews (El-Assady et al., 2016). However, these systems are relatively new, and need more evaluation.

Deliberation has potential to be effective in societies where ethnic, religious, or ideological groups have historically each found their identity in rejecting the identity of the other (Dryzek et al., 2019). In order to reducing polarisation, extremism and citizens’ susceptibility for conspiracies online, mass deliberation needs to engage with, and integrate, different cultures and worldviews (Dryzek et al., 2019; Bago et al., 2020). Simply tweaking algorithms to show partisans more content from the opposition may aggravate extreme points of view rather than reducing it. More promising is to encourage people to deliberate about the accuracy of claims they have found online regarding the opposite side, and thereafter incorporate this information into algorithmic rankings to reduce the presence of false or hyperpartisan content (Finkel et al., 2020).

4.3 Facilitation

Having an independent moderator can vastly improve the quality of any discussion, since they can enforce social norms and deliberative ideals. For example, Ito (2018) finds a positive effect on discussion quality due to the ‘social presence’ of a facilitator in the online platform, along with facilitator support functions.

Studies dealing with human facilitation in online platforms looked at the impact of human moderation on e.g. conflict (Beck et al., 2018), or perceived fairness and legitimacy (Perrault and Zhang, 2019). Conflict may be managed through interface design that reveals moderators beliefs and values before a discussion (Beck et al., 2018). Excessive levels of moderation, however, may reduce perceived fairness and legitimacy because it can lead to self-censorship or the exclusion of under-represented populations, but it may be remedied by using crowdsourced moderation (Perrault and Zhang, 2019).

However facilitating larger scale online deliberations can be challenging and resource-intensive. Fishkin et al. (2018) note the problem with scaling up deliberation online mainly due to finding recruiting and training neutral (human) moderators. Moderators also suffer from human bias, as well as time and location constraints. Beck et al. (2018), for instance, show how human moderator’s beliefs and values may introduce bias into discussions.

Since human moderators may suffer from their own bias, automated facilitation techniques are an important new avenue of research. (Epstein and Leshed, 2016) found that online human facilitators’ main activities are managing the stream of comments and interacting with comments and commenters. Automated techniques (e.g. algorithms involving machine learning and natural language processing) can assist moderators with tedious tasks and give more equal voice to less willing participants. Reflecting this, a sizable portion of the literature we found deals with automated facilitation tools and how they may benefit online deliberation. Research on the use of automated facilitation techniques for online deliberation platforms relates to either facilitator assistance tools, which support human facilitators in their roles, or algorithms that completely replace human facilitators.

Tools to assist facilitation tasks may include making sense of large discussions (Zhang, 2017), discussion summaries, recommending contextually appropriate moderator messages (Lee et al., 2020), visualizing dialogue quality indicators (Murray et al., 2013), to structure an issue-based information system (Ito et al., 2020) or analysing deliberative quality (Fournier-Tombs and Di Marzo Serugendo, 2020). Other tools allow crowd-based idea or argument harvesting.
Algorithms can also completely replace facilitators and take on the roles of initiating discussions, informing the group, resolving conflict, or playing devil’s advocate (Alnemr, 2020). For instance, (Fishkin et al., 2018) created a platform with an automated moderator “bot” which enforces a speaking queue for participants. The platform also incorporates nudges to encourage participants to follow an agenda. As well as this, active speakers are transcribed in real time and monitored for offensive content. Participants can give the bot feedback about whether to block a user or advance the agenda. Artificial discussion agents can also speed up the learning process for participants on complex issues, help participants to better engage with each other, especially those with opposing views and mine potential new topics for discussion from the conversations (Stromer-Galley et al., 2012). For example, Wyss and Beste (2017) designed an artificial facilitator (Sophie) for asynchronous discussion based on argumentative reasoning. They add the automatic facilitator to an asynchronous forum (in argument tree format) with the purpose of creating and accelerating feedback loops according to the argumentative theory of reasoning. They theorised that this would force participants to recognize flaws in their personal reasoning, motivate them to justify their demands, and ensure that they consider the viewpoints of others. Yang et al. (2021) train their algorithm on solutions human facilitators used in online discussion systems in the past. This means that the algorithm learns how to identify a given ‘problem’ in a discussion (e.g. “a post or opinion that contains bad words or detouring information that may distract topic posts or main ideas”) and then applies a ‘solution’ (e.g. “remove such a post from discussion or hide it in order to smooth the forum discussion”).

While such tools are useful and reduce the workload of human facilitators in large scale deliberations, it is important that we weigh up replacing human bias with the inherent bias of the algorithms behind automated moderators. Nonetheless, only a few authors in the literature we found take up this discussion. Alnemr (2020) critiques the developments of Stromer-Galley et al. (2012) and Wyss and Beste (2017), noting that algorithms underpinning automated facilitation lack the ability to use discretion as humans do, about how to ensure inclusion, and to enforce certain deliberative norms in a sensitive way. They argue that expert-driven design does not allow citizens to define and agree on deliberative ideals and that instead these ideals are imposed on them by the algorithm, whose design is not transparent. In a review of Finnish moderator tools in various platforms, Ruckenstein and Turunen (2020) warn that some designs may force moderators to operate more like machines and prevent them from using their own skills and judgement, leaving them frustrated in their work. Wyss and Beste (2017) caution that, when designing (automated) facilitators, it is crucial to find a balance between interfering and not interfering in the discussion and this can depend on the context. More research in this regard is needed.

Few studies deal with the issue of gender, or gendered behaviour in relation to facilitation approaches or the design of automated facilitation tools in deliberative software. One study, (Kennedy et al., 2021) found that the gender of human facilitators impacted discussion outcomes, that a text-based environment may be favourable to female participants since it prevents interruptions, but that non-white and participants over 65 were less active in such discussions. Three papers deal with the topic of learning styles or argumentative capability of participants: (Velikanov, 2017) make some preliminary technical and non-technical design suggestions (e.g. argument coaches or facilitator incentives) to address the topic of differing levels of factual preparedness and argumentative capability as well as the issue of linguistic differences. (Epstein and Leshed, 2016) described heuristics that can be used by moderators to respond to different levels of participatory literacy and hence improve the overall quality of the comments. In their study, (Wyss and Beste, 2017) show the importance of personality factors on the success of the automated facilitator: the effectiveness of the automated facilitator in creating favourable learning conditions for participants was dependent on whether participants were conflict-avoidant or had a high need to evaluate.

### 4.4 Gamification or other format of interaction

Gamification of deliberation platforms has gained attention in recent years. The rationale to profit from gamification (as a design influencer of motivation and engagement) is interlinked with previous analyses of non-participation (Jacquet, 2017), especially reluctance to participate that is related to one’s own abilities, capacities or one’s general perception of online deliberation spaces. Online deliberation spaces have high barriers to entry for the public (Epstein and Leshed, 2016) and are “typically one-off experiments that occur within the confines of a single issue over a short period of time” (Leighninger, 2012). Logically, the initial focus of designers at this stage is certainly to reduce thresholds for large groups to participate, and increase activity and engagement to deliberation. Hassan (2017) hopes that gamification would offer a remedy to the challenge of low levels of civic participation, but also motivating public officials and government agencies to be more willing to engage in digital deliberative projects and reducing their neg-
The functionalities of gamified environments are many. Some use reward-based approaches to award users based on activities, or stimulating inter-user competition (Hassan, 2017) others may use collaborative reward structures that provide incentives for reaching a consensus or taking collective action (Gastil and Broghammer, 2021). Others again try to steer users to formulate opinions that fit the discussion phase and to increase the response time of answering questions (Ito, 2018), or to promote civility among users (Jhaver et al., 2017).

Popular reward functions that have been applied in digital deliberations are deltas (Jhaver et al., 2017), batches (Bista et al., 2014), award scores (Yang et al., 2021) or discussion points/virtual money (Ito, 2018). Gastil and Broghammer (2021) provide a further comprehensive list of gamification mechanisms suitable for online tools that include deliberation, such as competition over resources; material rewards; scarcity of rewards; artificial time constraints; social tools (chats); peer rating system, shared narratives; learning modules; progress bars; leaderboards and missions.

Few case studies have been conducted so far that measure the effects of gamification. Bista et al. (2014) for example used different batches as awards for a gamified community for Australian welfare recipients who were encouraged to communicate with each other and with the government. According to the authors, gamification increased participant’s reading and commenting actions, and helped the researchers to obtain accelerated feedback on the ‘mood’ in the community.

Johnson et al. (2017) conducted some field experiments where they observed local consultation events. They found issues with equality, turn taking, providing evidence in discussions, elaboration of stakeholder opinions and the documentation of the event. They then designed a new gamified setup to facilitate the event, where people are forced to take turns and refer to a physical map for making decisions. Results follow from qualitative statements from participants and facilitators. A turn-taking mechanism, combined with restricting the topic of conversation through “cards” prevented talks from going off-topic. Because of reasoning prompts, the participants naturally explained the reasoning behind their decisions. The researchers observed improved empathy and respect, as well as the change of viewpoints following some discussions. This reduced the workload for facilitators, as groups of participants regulated themselves according to the rules of the game. However, the adoption of the results following the experiment by government officials remained poor, as they preferred pointing to their own (non-collaborative) consultations, and found the rich and diverse viewpoints to be more “usable.”

Jhaver et al. (2017), who studied the subreddit ChangeMyView, observed that gamification mechanisms in the form of deltas increase civility and politeness between users. This is particularly obvious for new members of the community as well as for high-scorers. Even though there is a competitive element that allows high performers to compete with one another, the focus of the community is on meaningful conversations, and thus, according to the authors, the users are not explicitly judged by their delta scores. These findings are in line with Hamari et al. (2014) that conclude that positive outcomes from gamification depend on the context and the characteristics of users.

Downsides of gamification methods have also been reported: features that allow participants to build reputation via upvoting for instance, can motivate them to participate. However, while having voting mechanisms may seem democratic, in reality this could be far from the case. Humans tend to be highly influenced by the opinions of others: for instance, studies show that comments with an early upvote are 25% more highly rated in the end, regardless of their quality (Maia and Rezende, 2016). See also Muchnik et al. (2013). Some users might also be driven solely to achieve high scores and gaming the gamification rather than to actually contribute to the deliberation goal (Bista et al., 2014). Such occurrences might lead designers to “hide” the rules of mapping points to member status, which then raises issues of transparency.

Gamification can be an important addition to developing digital deliberation interfaces, and if embedded with social norms, and moderation mechanisms, it can improve a digital space to foster productive discourse. Competition generated by gamification should not be upfront. Nor should it be unidirectionally focused on those members who are already achieving strong results (Jhaver et al., 2017). Civic gamification designers should focus on understanding the psychology (intrinsic motivation) of why citizens would participate in an online deliberation in the first place, for gamification efforts to provide value (Hassan, 2017). Moreover, gamification leads to more data processing, which does
not necessarily mean that this data informs decision-makers in ways that represent public opinion. Cherry-picking and biases might occur in terms of privileging what they see as ‘facts’, and ‘evidence’ such as ‘user engagement’, ‘likes’ or ‘scores’ etc., because decision-makers succumb commonly more to these types of aggregated data than to qualitative attributes (Johnson et al., 2017).

4.5 Identity

Choosing between identification or anonymity in digital deliberations creates a number of trade-offs. With anonymity, a more egalitarian environment is possible since people feel more freedom to express their honest, even if unpopular, point of view. Removing visual cues of gender, age and race promotes equal treatment of individuals (Kennedy et al., 2021). Harmful social dynamics are reduced and people stay more focussed on the task at hand (Iandoli et al., 2014). Anonymity can also allow civil servants or people with neutrality obligations to participate. However, anonymity can imply a loss of accountability and respectfulness or civility in online discussions seems to be (negatively) influenced by anonymity (Sarmento and Mendonça, 2014). Reducing anonymity may have a positive effect on respectfulness and thoughtfulness (Coleman and Moss, 2012) and increases transparency, but has a possibly negative effect on engagement (Rhee and Kim, 2009) — people tend to contribute less to the discussion overall when they are identifiable. This can also raise questions of privacy on the platforms. Gonçalves et al. (2020) indicate how easy it is to build a profile of each participant by following, or studying the tracks they unconsciously leave behind while discussing, proposing ideas, deliberating, interacting with the others as well as their behaviour in a gamified environment.

However, it has also been found that when users share a common social identity in an online community, they are more susceptible to group influence and stereotyping, despite participant anonymity (Jhaver et al., 2017). It can also happen that even if anonymity decreases barriers to entry, it can lead to less reflection and more extreme contributions, therefore the role of environmental and social cues for establishing social norms in online deliberation is important. Manosevitch et al. (2014) show that visual/cognitive cues like banners can prime participants to be aware that they are in a deliberative context. Such cues may encourage e.g. reflection, considering a range of opinions, and being true to one’s self and hence improve the deliberative quality of the discussion. Incorporating the focus theory of normative conduct (Cialdini et al., 1990) into platform cue design may improve online dialogue by enforcing three different types of norm: descriptive, injunctive and personal. Respectively, these norms motivate behaviour by promising either rewards or sanctions externally imposed by others; by providing frequency information about the behaviour of others and reflecting individuals’ commitment with their internalized values.

4.6 Timing

Choosing between a synchronous or asynchronous environment creates a trade-off between a more ‘real-life’ discussion experience and a more reflective, inclusive, egalitarian or accessible discussion. Real-time chat or video is more spontaneous and dynamic and this helps build rapport between participants. Asynchronous communication, on the other hand, allows more time for self-reflection (Rose and Sæbø, 2010), removes location or time restrictions, and increases access for people with slower internet speeds. It is a way to “level the playing field” between the more and less informed public (Neblo et al., 2010), and has been shown to encourage women to participate more by removing interruptions (Kennedy et al., 2021). Some research indicates that asynchronous discussions are likely to produce higher quality deliberations overall (Esau et al., 2017).

4.7 Information presentation and media types

How information is presented and formatted can influence the quality of online deliberations. Ramsey and Wilson (2009) show how the choice of information presented (e.g. maps) is in itself a political process and that cues should accompany sources of information that encourage participants to critically view them in relation to the perspective of the provider of the information rather than as objective pieces of evidence. Diversity of information is also important, they argue, and this is also noted by Semaan et al. (2015), who add that serendipitous exposure will further increase the deliberative quality of online discussion. The richness of media in the deliberative platform may also impact on the discussion, according to Brinker et al. (2015), with one-way media producing favourable outcomes for learning and knowledge gain and richer or mixed media providing favourable outcomes for developing social ties, building mutual understanding and encouraging reflection on values as well as facts, and formulating arguments.
5 Conclusion, recommendations and future research

In this literature review, we aimed to investigate which design characteristics of online deliberative platforms receive the most attention, to find out how potential design bias is dealt with in the design process and to reflect on future research and design implications for online platforms for mass deliberation.

Mass online deliberation platforms may hold the key to the inclusive, egalitarian, respectful and fruitful discussion space that current popular platforms fail to provide, but face challenges due to the large number of users and information produced and a possible loss of quality in deliberation. Automated facilitation and argumentation tools are possible solutions to these challenges and reflecting this, we find that in our literature search, by far the most attention is given to these design topics.

Since argumentation is regarded as a key goal of deliberation, argumentation tools are currently the focus of extensive research and experimentation. Yet there remains much work to be done in relation to tools that assist with the cognitively challenging tasks involved in mapping the arguments, deciding which arguments should win, teaching diverse participants to use argumentation itself and allowing for social interaction in parallel, so that such platforms can be as attractive as popular social media. A heavy focus on designs that emphasise argumentation may exclude people with limited argumentation skills or that prefer other types of expression. Although beyond the scope of this paper, a perspective found to be missing in our literature search relates to a critique of logical argument structuring (e.g. Durnova et al. (2016)), which argues that a discursive approach may be more appropriate since it recognises the subjectivity of actors, their different forms of knowledge and interpretations from which they create meaning.

Automated facilitation tools also receive a lot of attention and are being availed of to tackle problems related to scaling up deliberation such as managing comments, maintaining respectfulness, encouraging participation, making sense of vast amounts of information or monitoring the discussion progress and quality. However, while such tools may aim to circumvent human facilitator bias, issues of algorithmic bias are hardly discussed in the papers we found. There is also very little discussion about the values or interpretation of deliberative democracy that underpins automated facilitation tools. Further research is needed to address the implications of gender for deliberations or how design can cater for different deliberative abilities or motivation among participants of different backgrounds. Furthermore, the skills of reformulating provocative content, mirroring perspectives, posing circular questions or playing the devil’s advocate, are only a few of the important techniques a trained facilitator can employ to support argumentatively disadvantaged participants or to redirect a discussion that reaches a dead end. In our literature review, we find that automatic facilitation tools currently lack the functionality for such nuanced interventions on a large scale.

Although facilitation and argumentation tools may overcome certain challenges to mass deliberation, other design aspects are also important for ensuring inclusion and equality in online (mass) deliberation. Substantial attention is also given to gamification features in the literature, which address a different issue, that of encouraging participation online and fostering feelings of connection and empathy. Some research has begun on how to accommodate different communication and learning styles, the use of gamification as an addition to argumentation or a way to build rapport between online participants. Experimental work on different gamification designs (e.g. competitive design, collaborative design, etc.) shows promise, in particular in increasing engagement. More research on how gamification can promote different communication styles of different deliberative ideals is further needed. Until now, literature fails to demonstrate a wide array of comparative studies (Hassan, 2017) and it is unclear how different user-groups utilize gamification functions to their advantage in certain contexts.

Other design features such as allowing anonymity or asynchronous participation may be useful for curbing discrimination based on social cues in online platforms. In general, however, much research is needed on how to facilitate and accommodate different genders or cultures in deliberation, how to deal with the implications of pre-existing social inequalities, how to build motivation and self-efficacy in certain groups, and how to deal with differences in cognitive abilities and cultural or linguistic differences. It is also crucial to examine the impact of design features on the uptake of the software tools as well as the quality of deliberation.

All researchers and software developers are bound to have their own pre-existing unconscious biases. Our review shows that the characteristics (age, gender, education, ethnicity/race, etc.) of test users is rarely reported in case studies we found and the design of deliberation tools mainly takes place in a western context. Based on our findings, deliberative platforms are more likely to reflect the values and needs of a young, male, and WEIRD demographic. As argued by Min (2014), this means that scholars risk making generalizations from a small (atypical) segment of the world’s population. This increases the likelihood of certain pre-existing biases becoming embedded into platform design. Technical bias may also arise due to how argumentation tools or algorithmic facilitation tools are designed and emergent bias may also arise due to a cultural mismatch of these platforms if used in non-western cultures. Further, some deliberative tools may suffer from emergent bias in that they were originally developed for smaller scale delib-
ation between experts, or people with high education levels familiar with particular argumentation styles for example, thus unintentionally closing down public debates.

In order to ensure that a fair interpretation of deliberative ideals is reflected in platform design, rather than an expert-driven interpretation (Alnemr, 2020), the use of design methodologies such as participative or value-sensitive design is recommended. Design methodologies that involve stakeholder participation are more likely to reflect the needs and values of the intended users. However, the selection of stakeholders must be carefully executed. Universal design (see López and Farzan (2017)) may be particularly interesting, since it involves the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.

A large number of papers in this literature review focus on technical fixes for scaling up deliberation, and there is less space given to discussion on the nature of the design process, the inclusion of stakeholders and issues relating to inclusion. Few studies bridge the required disciplines. Our review highlights the importance of breaking the silos between disciplines like computer science, social sciences, especially political science (and deliberative democratic theory in particular), sociology (in particular social inclusion concepts), psychology, decision science and design in order to create the most effective and inclusive deliberation platforms going forward.

Funding

This work has been supported by the Dutch research council and (partially) funded by the Hybrid Intelligence Center, a 10-year programme funded by the Dutch Ministry of Education, Culture and Science through the Dutch Research Council.

References

Afsoun Afsahi. Gender Difference in Willingness and Capacity for Deliberation. Social Politics: International Studies in Gender, State & Society, 02 2020. ISSN 1072-4745. doi:10.1093/sp/jxaa003. URL https://doi.org/10.1093/sp/jxaa003. jxaa003.

Tanja Aitamurto. Crowdsourced democratic deliberation in open policymaking: Definition, promises, challenges. In Crowdsourced democratic deliberation in open policymaking: Definition, promises, challenges. International Reports on Socio-Informatics (IRSI), Proceedings of the CSCW 2016–Workshop: Toward a Typology of Participation in Crowdwork, volume 13, pages 67–78, 2016.

Nardine Alnemr. Emancipation cannot be programmed: blind spots of algorithmic facilitation in online deliberation. Contemporary Politics, 26(5):531–552, 2020. doi:10.1080/13569775.2020.1791306. URL https://doi.org/10.1080/13569775.2020.1791306.

Hans Asenbaum. Facilitating inclusion: Austrian wisdom councils as democratic innovation between consensus and diversity. Journal of Public Deliberation, 12(2):7, 2016.

André A Bächtiger and Dominik Hangartner. When deliberative theory meets empirical political science: Theoretical and methodological challenges in political deliberation. Political Studies, 58(4):609–629, 2010.

Bence Bago, David G Rand, and Gordon Pennycook. Fake news, fast and slow: Deliberation reduces belief in false (but not true) news headlines. Journal of experimental psychology: general, 149(8):1608, 2020.

Edana Beauvais. Deliberation and equality. The Oxford handbook of deliberative democracy, pages 144–155, 2018.

Jordan Beck, Bikalpa Neupane, and John M Carroll. Managing conflict in online debate communities: Foregrounding moderators’ beliefs and values on kialo, Nov 2018. URL osf.io/cdfq7.

Joshua Becker, Ethan Porter, and Damon Centola. The wisdom of partisan crowds. Proceedings of the National Academy of Sciences, 116(22):10717–10722, 2019.

Sanat Kumar Bista, Surya Nepal, Cécile Paris, and Nathalie Colineau. Gamification for online communities: A case study for delivering government services. International Journal of Cooperative Information Systems, 23(02):1441002, 2014.

Laura W Black, Howard T Welser, Dan Cosley, and Jocelyn M DeGroot. Self-governance through group discussion in wikipedi: Measuring deliberation in online groups. Small Group Research, 42(5):595–634, 2011.

Gioia Boschi, Anthony P Young, Sagar Joglekar, Chiara Cammarota, and Nishanth Sastry. Who has the last word? understanding how to sample online discussions. ACM Transactions on the Web (TWEB), 15(3):1–25, 2021.

Engin Bozdag and Jeroen Van Den Hoven. Breaking the filter bubble: democracy and design. Ethics and Information Technology, 17(4):249–265, 2015.
David L Brinker, John Gastil, and Robert C Richards. Inspiring and informing citizens online: A media richness analysis of varied civic education modalities. *Journal of Computer-Mediated Communication*, 20(5):504–519, 2015.

Claudette Cayrol and Marie-Christine Lagasquie-Schiex. On the acceptability of arguments in bipolar argumentation frameworks. In *European Conference on Symbolic and Quantitative Approaches to Reasoning and Uncertainty*, pages 378–389. Springer, 2005.

Mingming Cheng and Carmel Foley. The sharing economy and digital discrimination: The case of airbnb. *International Journal of Hospitality Management*, 70:95–98, 2018.

Carlos Chesnevar, Sanjay Modgil, Iyad Rahwan, Chris Reed, Guillermo Simari, Matthew South, Gerard Vreeswijk, Steven Willmott, et al. Towards an argument interchange format. *The knowledge engineering review*, 21(4):293–316, 2006.

Henrik Serup Christensen. A conjoint experiment of how design features affect evaluations of participatory platforms. *Government Information Quarterly*, 38(1):101538, 2021.

Robert B Cialdini, Raymond R Reno, and Carl A Kallgren. A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *Journal of personality and social psychology*, 58(6):1015, 1990.

Joshua Cohen. Reflections on deliberative democracy. In *Philosophy, Politics, Democracy*, pages 326–347. Harvard University Press., Cambridge, MA, 2009.

S Coleman and GS Moss. Under construction: the field of online deliberation research. *Journal of Information Technology & Politics*, 9(1):1–15, 2012.

Jeff Conklin. *Dialogue mapping: Building shared understanding of wicked problems*. John Wiley & Sons, Inc., 2005.

Nicole Curato, Marit Hammond, and John B Min. Power in deliberative democracy. *Cham: Palgrave Macmillan*, 2019.

Fiorella De Cindio and Stefano Stortone. Experimenting liquid feedback for online deliberation in civic contexts. In *International Conference on Electronic Participation*, pages 147–158. Springer, 2013.

Julia Dressel and Huny Farid. The accuracy, fairness, and limits of predicting recidivism. *Science advances*, 4(1):1–6, 2018.

John S Dryzek, André Bächtiger, Simone Chambers, Joshua Cohen, James N Druckman, Andrea Felicetti, James S Fishkin, David M Farrell, Archon Fung, Amy Gutmann, et al. The crisis of democracy and the science of deliberation. *Science*, 363(6432):1144–1146, 2019.

Anna Durnova, Frank Fischer, and Philippe Zittoun. Discursive approaches to public policy: Politics, argumentation, and deliberation. In *Contemporary approaches to public policy*, pages 35–56. Springer, 2016.

Matthew W Easterday, Jordan S Kanarek, and Maralee Harrell. Design requirements of argument mapping software for teaching deliberation. *Online deliberation: Design, research, and practice*, pages 317–23, 2009.

Mennatallah El-Assady, Valentin Gold, Annette Haitli-Janisz, Wolfgang Jentner, Miriam Butt, Katharina Holzinger, and Daniel A Keim. Visarge: A visual text analytics framework for the study of deliberative communication. In *PolText 2016-The International Conference on the Advances in Computational Analysis of Political Text*, pages 31–36, 2016.

Dmitry Epstein and Gilly Leshed. The magic sauce: Practices of facilitation in online policy deliberation. *Journal of Public Deliberation*, 12(1), 2016.

Dmitry Epstein, Mary Newhart, and Rebecca Vernon. Not by technology alone: The “analog” aspects of online public engagement in policymaking. *Government Information Quarterly*, 31(2):337–344, 2014.

Selen A Ercan, Carolyn M Hendriks, and John S Dryzek. Public deliberation in an era of communicative plenty. *Policy & politics*, 47(1):19–36, 2019.

Katharina Esau, Dennis Friess, and Christiane Eilders. Design matters! an empirical analysis of online deliberation on different news platforms. *Policy & Internet*, 9(3):321–342, 2017.

Marc Faddoul, Guillaume Chaslot, and Hany Farid. A longitudinal analysis of youtube’s promotion of conspiracy videos. *arXiv preprint arXiv:2003.03318*, 2020.

Eli J Finkel, Christopher A Bail, Mina Cikara, Peter H Ditto, Shanto Iyengar, Samara Klar, Lilliana Mason, Mary C McGrath, Brendan Nyhan, David G Rand, et al. Political sectarianism in america. *Science*, 370(6516):533–536, 2020.

James Fishkin. Cristina lafont’s challenge to deliberative minipublics. *Journal of Deliberative Democracy*, 16(2), 2020.
James Fishkin, Nikhil Garg, Lodewijk Gelauff, Ashish Goel, Kamesh Munagala, Sukolsak Sakshuwong, Alice Siu, and Sravya Yandamuri. Deliberative democracy with the online deliberation platform. In The 7th AAAI Conference on Human Computation and Crowdsourcing (HCOMP 2019). HCOMP, 2018.

James S Fishkin. Virtual public consultation: Prospects for internet deliberative democracy. Online deliberation: Design, research, and practice, pages 23–35, 2009.

Joan Font, Magdalena Wojcieszak, and Clemente J Navarro. Participation, representation and expertise: Citizen preferences for political decision-making processes. Political Studies, 63:153–172, 2015.

Devon Net Zero Task Force, Rebecca Sandover, Alice Moseley, and Patrick Devine-Wright. Rapid review: The feasibility of an online citizens’ assembly to support devon’s transition to net zero, 2020. URL https://www.devonclimateemergency.org.uk/wp-content/uploads/2020/12/Rapid-Review-Online-Deliberation.pdf. Accessed: 2021-07-23.

Eleonore Fournier-Tombs and Giovanna Di Marzo Serugendo. Delibanalysis: Understanding the quality of online political discourse with machine learning. Journal of Information Science, 46(6):810–822, 2020.

Batya Friedman and Helen Nissenbaum. Bias in computer systems. ACM Transactions on Information Systems (TOIS), 14(3):330–347, 1996.

Batya Friedman and Helen Nissenbaum. Bias in computer systems. Computer Ethics, 14(3):215–232, 2017.

Batya Friedman, Peter Kahn, and Alan Borning. Value sensitive design: Theory and methods. University of Washington technical report, December 2001.

Katsuhide Fujita, Takayuki Ito, and Mark Klein. Enabling large scale deliberation using ideation and negotiation-support agents. In 2017 IEEE 37th International Conference on Distributed Computing Systems Workshops (ICDCSW), pages 360–363. IEEE, 2017.

John Gastil and Laura Black. Public deliberation as the organizing principle of political communication research. Journal of Public Deliberation, 4(1), 2007.

John Gastil and Michael Broghammer. Linking theories of motivation, game mechanics, and public deliberation to design an online system for participatory budgeting. Political Studies, 69(1):7–25, 2021.

Valentin Gold, Brian PL USS, Mennatallah El-Assady, Fabian Sperrle, Katarzyna Budzynska, Annette Hautli-Janisz, and Chris Reed. Towards deliberation analytics: stream processing of argument data for deliberative communication. In Proceedings of COMMA Workshop on Argumentation and Society, pages 1–3, 2018.

Fabrício Matheus Gonçalves, Alysson Bolognesi Prado, and Maria Cecília Calani Baranauskas. Opendesign: Analyzing deliberation and rationale in an exploratory case study. In ICEIS (2), pages 511–522, 2020.

Robert E Goodin. Democratic deliberation within. Philosophy & Public Affairs, 29(1):81–109, 2000.

Eric Gordon and Edith Manosevitch. Augmented deliberation: Merging physical and virtual interaction to engage communities in urban planning. New Media & Society, 13(1):75–95, 2011.

Eric Gordon, Becky Michelson, and Jason Haas. @ stake: A game to facilitate the process of deliberative democracy. In Proceedings of the 19th ACM Conference on Computer Supported Cooperative Work and Social Computing Companion, pages 269–272, 2016.

Wen Gu, Ahmed Moustafa, Takayuki Ito, Minjie Zhang, and Chunsheng Yang. A case-based reasoning approach for automated facilitation in online discussion systems. In 2018 Thirteenth International Conference on Knowledge, Information and Creativity Support Systems (KICSS), pages 1–5. IEEE, 2018.

Ali Gürkan and Luca Iandoli. Common ground building in an argumentation-based online collaborative environment. In Proceedings of the International Conference on Management of Emergent Digital EcoSystems, pages 320–324, 2009.

Ali Gürkan, Luca Iandoli, Mark Klein, and Giuseppe Zollo. Mediating debate through on-line large-scale argumentation: Evidence from the field. Information Sciences, 180(19):3686–3702, 2010.

Amy Gutmann, Dennis F Thompson, et al. Why Deliberative Democracy? Princeton University Press, 2004.

Juho Hamari, Jonna Koivisto, and Harri Sarsa. Does gamification work?—a literature review of empirical studies on gamification. In 2014 47th Hawaii international conference on system sciences, pages 3025–3034. Ieee, 2014.

Anikó Hannák, Claudia Wagner, David Garcia, Alan Mislove, Markus Strohmaier, and Christo Wilson. Bias in online freelance marketplaces: Evidence from taskrabbit and fiverr. In Proceedings of the 2017 ACM conference on computer supported cooperative work and social computing, pages 1914–1933, 2017.

Lobna Hassan. Governments should play games: Towards a framework for the gamification of civic engagement platforms. Simulation & Gaming, 48(2):249–267, 2017.
Carolyn M Hendriks. Coupling citizens and elites in deliberative systems: The role of institutional design. *European Journal of Political Research*, 55(1):43–60, 2016.

Staffan Himmelroos, Lauri Rapeli, and Kimmo Grönlund. Talking with like-minded people—equality and efficacy in enclave deliberation. *The Social Science Journal*, 54(2):148–158, 2017.

Luca Iandoli, Ivana Quinto, Anna De Liddo, and Simon Buckingham Shum. Socially augmented argumentation tools: Rationale, design and evaluation of a debate dashboard. *International Journal of Human-Computer Studies*, 72(3):298–319, 2014.

Luca Iandoli, Ivana Quinto, Anna De Liddo, and Simon Buckingham Shum. On online collaboration and construction of shared knowledge: Assessing mediation capability in computer supported argument visualization tools. *Journal of the Association for Information Science and Technology*, 67(5):1052–1067, 2016.

Luca Iandoli, Ivana Quinto, Paolo Spada, Mark Klein, and Raffaele Calabretta. Supporting argumentation in online political debate: Evidence from an experiment of collective deliberation. *new media & society*, 20(4):1320–1341, 2018.

Severin Isenmann and Wolf D Reuter. Ibis—a convincing concept… but a lousy instrument? In *Proceedings of the 2nd conference on Designing interactive systems: processes, practices, methods, and techniques*, pages 163–172, 1997.

Takayuki Ito. Towards agent-based large-scale decision support system: the effect of facilitator. In *Proceedings of the 51st Hawaii International Conference on System Sciences*, pages 351–360, 2018.

Takayuki Ito, Rafik Hadfi, Jawad Haqbeen, Shota Suzuki, Atsuya Sakai, Naoki Kawamura, and Naoko Yamaguchi. Agent-based crowd discussion support system and its societal experiments. In *International Conference on Practical Applications of Agents and Multi-Agent Systems*, pages 430–433. Springer, 2020.

Vincent Jacquet. Explaining non-participation in deliberative mini-publics. *European Journal of Political Research*, 56(3):640–659, 2017.

Shagun Jhaver, Pranil Vora, and Amy Bruckman. Designing for civil conversations: Lessons learned from change-myview. Technical report, Georgia Institute of Technology, 2017.

Ian G Johnson, Alistair MacDonald, Jo Briggs, Jennifer Manuel, Karen Salt, Emma Flynn, and John Vines. Community conversational: Supporting and capturing deliberative talk in local consultation processes. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*, pages 2320–2333, 2017.

Ryan Kennedy, Anand E Sokhey, Claire Abernathy, Kevin M Esterling, David MJ Lazer, Amy Lee, William Minozzi, and Michael A Neblo. Demographics and (equal?) voice: Assessing participation in online deliberative sessions. *Political Studies*, 69(1):66–88, 2021.

Hyunwoo Kim, Eun-Young Ko, Donghoon Han, Sung-Chul Lee, Simon T Perrault, Jihee Kim, and Juho Kim. Crowdsourcing perspectives on public policy from stakeholders. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems*, pages 1–6, 2019.

Paul A Kirschner, Simon J Buckingham-Shum, and Chad S Carr. Visualizing argumentation: Software tools for collaborative and educational sense-making. Springer Science & Business Media, 2012.

Mark Klein. Enabling large-scale deliberation using attention-mediation metrics. *Computer Supported Cooperative Work (CSCW)*, 21(4-5):449–473, 2012.

Emily Kubin, Curtis Puryear, Chelsea Schein, and Kurt Gray. Personal experiences bridge moral and political divides better than facts. *Proceedings of the National Academy of Sciences*, 118(6), 2021.

Werner Kunz and Horst WJ Rittel. *Issues as elements of information systems*, volume 131. Citeseer, 1970.

Cristina Lafont. Democracy without shortcuts. *Constellations*, 26(3):355–360, 2019. doi:https://doi.org/10.1111/1467-8675.12432. URL: https://onlinelibrary.wiley.com/doi/abs/10.1111/1467-8675.12432

Susan Leavy. Gender bias in artificial intelligence: The need for diversity and gender theory in machine learning. In *Proceedings of the 1st international workshop on gender equality in software engineering*, pages 14–16, 2018.

Sung-Chul Lee, Jaeyoon Song, Eun-Young Ko, Seongho Park, Jihee Kim, and Juho Kim. Solutionchat: Real-time moderator support for chat-based structured discussion. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, pages 1–12, 2020.

Matt Leighninger. Mapping deliberative civic engagement. *Democracy in motion: Evaluating the practice and impact of deliberative civic engagement*, 19, 2012.

Karen Levy and Solon Barocas. Designing against discrimination in online markets. *Berkeley Technology Law Journal*, 32(3):1183–1238, 2017.
Anna De Liddo and Simon Buckingham Shum. Improving online deliberation with argument network visualization. In *Digital Cities* 8, 2013. URL [http://oro.open.ac.uk/38003/](http://oro.open.ac.uk/38003/). 6th International Conference on Communities and Technologies.

Claudia López and Rosta Farzan. Designing for digital inclusion: A post-hoc evaluation of a civic technology. In *International Conference on Social Informatics*, pages 572–588. Springer, 2017.

Rousiley CM Maia and Thaiane AS Rezende. Respect and disrespect in deliberation across the networked media environment: examining multiple paths of political talk. *Journal of Computer-Mediated Communication*, 21(2):121–139, 2016.

Edith Manosevitch, Nili Steinfeld, and Azi Lev-On. Promoting online deliberation quality: cognitive cues matter. *Information, Communication & Society*, 17(10):1177–1195, 2014.

Patrick McAllister, James Kerr, Michael McTear, Maurice Mulvenna, Raymond Bond, Karen Kirby, Joseph Morning, and Danní Glover. Towards chatbots to support bibliotherapy preparation and delivery. In Asbjørn Følstad, Theo Araujo, Symeon Papadopoulos, Effie Lai-Chong Law, Ole-Christoffer Granmo, Ewa Lugner, and Petter Bae Brandtzaeg, editors, *Chatbot Research and Design*, pages 127–142, Cham, 2020. Springer International Publishing. ISBN 978-3-030-39540-7.

Danaë Metaxa-Kakavouli, Kelly Wang, James A Landay, and Jeff Hancock. Gender-inclusive design: Sense of belonging and bias in web interfaces. In *Proceedings of the 2018 CHI conference on human factors in computing systems*, pages 1–6, 2018.

Seong-Jae Min. On the westernness of deliberation research. *Journal of Public Deliberation*, 10(2):5, 2014.

Laurence Monnoyer-Smith. The technological dimension of deliberation: A comparison between online and offline participation. *Connecting Democracy: Online Consultation and the Flow of Political Communication*, pages 191–208, 2012.

Lev Muchnik, Sinan Aral, and Sean J Taylor. Social influence bias: A randomized experiment. *Science*, 341(6146):647–651, 2013.

Tom Murray, Leah Wing, B Woolf, Alexander Wise, Shijun Wu, Lori Clark, Lee Osterweil, and Xiaoxi Xu. A prototype facilitators’ dashboard: Assessing and visualizing dialogue quality in online deliberations for education and work. In *Submitted to 2013 International Conference on e-Learning, e-Business, Enterprise Information Systems, and e-Government*, 2013.

Michael A Neblo, Kevin M Esterling, Ryan P Kennedy, David MJ Lazer, and Anand E Sokhey. Who wants to deliberate—and why? *American Political Science Review*, 104(3):566–583, 2010.

Debora M Osborne, Jacqui H Byrne, Debbie L Massey, and Amy NB Johnston. Use of online asynchronous discussion boards to engage students, enhance critical thinking, and foster staff-student/student-student collaboration: A mixed method study. *Nurse education today*, 70:40–46, 2018.

Cynthia Peacock, Joshua M Scacco, and Natalie Jomini Stroud. The deliberative influence of comment section structure. *Journalism*, 20(6):752–771, 2019.

Simon T Perrault and Weiyu Zhang. Effects of moderation and opinion heterogeneity on attitude towards the online deliberation experience. In *Proceedings of the 2019 CHI conference on human factors in computing systems*, pages 1–12, 2019.

Pew Research Center. The state of online harassment, January 2021.

Raymond J Pingree. Decision structure: A new approach to three problems in deliberation. *Online deliberations: design, research, and practice*, pages 309–316, 2009.

Eugen Octav Popa, Vincent Blok, and Renate Wesselin. Discussion structures as tools for public deliberation. *Public Understanding of Science*, 29(1):76–93, 2020.

Kevin S Ramsey and Matthew W Wilson. Rethinking the ‘informed’participant: Precautions and recommendations for the design of online deliberation. *Online deliberation: Design, research, and practice*, pages 259–267, 2009.

Awais Rashid, Karenza Moore, Corinne May-Chahal, and Ruzanna Chitchyan. Managing emergent ethical concerns for software engineering in society. In *2015 IEEE/ACM 37th IEEE International Conference on Software Engineering*, volume 2, pages 523–526. IEEE, 2015.

Chris Reed. How dialogues create arguments. *ISSA Proceedings*, 2010.

June W Rhee and Eun-mee Kim. Deliberation on the net: Lessons from a field experiment. *Online deliberation: Design, research, and practice*, pages 223–232, 2009.

Jeremy Rose and Øystein Sæbø. Designing deliberation systems. *The information society*, 26(3):228–240, 2010.
Minna Ruckenstein and Linda Lisa Maria Turunen. Re-humanizing the platform: Content moderators and the logic of care. *new media & society*, 22(6):1026–1042, 2020.

Rayza Sarmento and Ricardo Mendonça. Disrespect in online deliberation: inducing factors and democratic potentials. Available at SSRN 2475060, 2014.

D Schleifer and A Diep. Strengthening democracy: What do americans think, 2019.

Bryan Semaan, Heather Faucett, Scott P Robertson, Misa Maruyama, and Sara Douglas. Designing political deliberation environments to support interactions in the public sphere. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*, pages 3167–3176, 2015.

Feng Shi, Misha Teplitskiy, Eamon Duede, and James A Evans. The wisdom of polarized crowds. *Nature human behaviour*, 3(4):329–336, 2019.

Alice Siu. Deliberation & the challenge of inequality. *Daedalus*, 146(3):119–128, 2017.

Kim Strandberg and Kimmo Grönlund. Online deliberation and its outcome—evidence from the virtual polity experiment. *Journal of Information Technology & Politics*, 9(2):167–184, 2012.

Jennifer Stromer-Galley, Nick Webb, and Peter Muhlberger. Deliberative e-rulemaking project: challenges to enacting real world deliberation. *Journal of Information Technology & Politics*, 9(1):82–96, 2012.

Jane Suiter, Lala Muradova, John Gastil, and David M Farrell. Scaling up deliberation: Testing the potential of mini-publics to enhance the deliberative capacity of citizens. *Swiss Political Science Review*, 26(3):253–272, 2020.

Maarja Toots. Why e-participation systems fail: The case of estonia’s osale.ee. *Government Information Quarterly*, 36(3):546–559, 2019.

W Ben Towne and James D Herbsleb. Design considerations for online deliberation systems. *Journal of Information Technology & Politics*, 9(1):97–115, 2012.

Stefanie Ullmann and Marcus Tomalin. Quarantining online hate speech: technical and ethical perspectives. *Ethics and Information Technology*, 22(1):69–80, 2020.

Jeroen van den Hoven, Pieter E Vermaas, and Ibo van de Poel. Design for values: An introduction. *Handbook of ethics, values, and technological design: Sources, theory, values and application domains*, pages 1–7, 2015.

Frans H Van Eemeren, Rob Grootendorst, Ralph H Johnson, Christian Plantin, and Charles A Willard. *Fundamentals of argumentation theory: A handbook of historical backgrounds and contemporary developments*. Routledge, 2013.

Cyril Velikanov. Can deliberative governance become inclusive? In *Proceedings of the 18th Annual International Conference on Digital Government Research*, pages 531–540, 2017.

Ilse Verdiesen, Virginia Dignum, and Jeroen Van Den Hoven. Measuring moral acceptability in e-deliberation: A practical application of ethics by participation. *ACM Transactions on Internet Technology (TOIT)*, 18(4):1–20, 2018.

Mihaela Vorvoreanu, Lingyi Zhang, Yun-Han Huang, Claudia Hilderbrand, Zoe Steine-Hanson, and Margaret Burnett. From gender biases to gender-inclusive design: An empirical investigation. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, pages 1–14, 2019.

SK White. Women in tech statistics: The hard truths of an uphill battle, 2020. URL https://www.cio.com/article/3516012/women-in-tech-statistics-the-hard-truths-of-an-uphill-battle.html. Accessed: 2021-02-08.

Scott Wright and John Street. Democracy, deliberation and design: the case of online discussion forums. *New media & society*, 9(5):849–869, 2007.

Dominik Wyss and Simon Beste. Artificial facilitation: Promoting collective reasoning within asynchronous discussions. *Journal of Information Technology & Politics*, 14(3):214–231, 2017.

Chunsheng Yang, Takayuki Ito, and Wen Gu. Toward machine learning-based facilitation for online discussion in crowd-scale deliberation. In *Proceedings of the Annual Conference of JSAI 33rd Annual Conference, 2019*, pages 3H3E304–3H3E304. The Japanese Society for Artificial Intelligence, 2019.

Chunsheng Yang, Wen Gu, Takayuki Ito, and Xiaohua Yang. Machine learning-based consensus decision-making support for crowd-scale deliberation. *Applied Intelligence*, pages 1–12, 2021.

Amy X. Zhang. Systems for improving online discussion. In *Adjunct Publication of the 30th Annual ACM Symposium on User Interface Software and Technology*, UIST ’17, page 111–114, New York, NY, USA, 2017. Association for Computing Machinery. ISBN 9781450354196. doi:10.1145/3131785.3131845. URL https://doi.org/10.1145/3131785.3131845.

Weiyu Zhang. Simulating the ideal edeliberation: the roles of inclusion, equalization and rationalization. *Online Deliberation*, page 117, 2010.
A Platforms mentions

Out of a total of 106 unique platforms, only 11 were mentioned more than once. The functions are Gamification (G), Argumentation (A) and Facilitation (F). See Table 2 for these platforms. A full list is available on request.

Table 2: Platform mentioned more than once in our review.

| Platform         | Count | Function | Academic/Commercial | Active                          |
|------------------|-------|----------|---------------------|---------------------------------|
| Deliberatorium   | 6     | G,A,F    | Academic            | Yes, but inaccessible           |
| COLLAGREE        | 5     | A,F      | Academic            | Yes, merged into D-Agree        |
| Regulation Room | 4     | F        | Academic            | No                              |
| ConsiderIt       | 3     | A        | Commercial          | Yes                             |
| Cohere           | 2     | A        | Academic            | Yes, but discontinued development|
| Kialo            | 2     | A, F     | Commercial          | Yes                             |
| liquidfeedback   | 2     | A        | Commercial          | Yes                             |
| MOOD             | 2     | -        | Academic            | No                              |
| PICOLA           | 2     | F        | Academic            | No                              |
| Reflect!         | 2     | -        | Academic            | Yes                             |
| @Stake           | 2     | G        | Academic            | Yes                             |