A REVIEW OF ONLINE ARGUMENT REPRESENTATION PLATFORMS

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Introduction

A distinction can be drawn between attempts to promote more deliberative and humble engagement on common forms of online communication and efforts to design novel platforms (Shane 2004, Davies 2009). Research into common forms of online communication focuses on lightly structured forums and social media platforms, often not designed explicitly to support deliberation (Loukis and Wimmer 2010). Davies and Chandler (2011) observe how this research has revealed the limitations of the open internet and lightly structured forums in supporting online deliberation, highlighting challenges including noise, information overload, negative behaviour and polarisation (Sunstein 2001). Researchers have pointed to design and structure as a means of addressing some of these issues and challenges (Pingree 2009, Coleman and Moss 2012, Manosevitch 2014).

The second strand of work on online communication focuses on the development of novel platforms that aim to support deliberation, often, but not exclusively, at scale (e.g. there is work on the effective support of small group deliberation online). A particularly vibrant sub-field that will be the focus of this paper is the use of different forms of argument mapping and visualisation techniques. The developers of these platforms are often influenced by fields outside of deliberative democratic theory, notably informal logic and collective intelligence. Although the literature highlights the promise of design (Pingree 2009, Coleman and Moss 2012), research into design has often been limited (Towne and Herbslep 2012), typically neglecting more experimental platforms and the more nuanced and novel forms of design

they utilise (Pingree 2009, Delborne et al 2011, Davies and Chandler 2011, Towne and Herbslep 2012).

This paper provides an analysis of platforms and tools that utilise novel design choices associated with argument mapping and visualisation to support large scale deliberation. In the first section, the paper discusses methodological challenges in studying this field and outlines the approach to identifying, collecting and reviewing relevant online deliberation platforms. The paper identifies 12 exemplary cases and explores these examples in greater detail. The main body of the paper analyses each of the platforms individually, explaining the background, objectives, design, existing research and applications of the platform.

Methodology

The Methodological Challenges of Studying Online Deliberation Platforms

A number of methodological challenges need to be navigated in analysing novel online deliberation platforms. The first issue we encounter concerns definition. In this paper, we will use the term "experimental online deliberation platform". The paucity of systematic analysis of such experimental platforms (Towne and Herbslep 2012) means that there is a lack of agreed definition and classification of this range of platforms. This challenge is exacerbated by the sense that the term "deliberation" is contested with no clear consensus on its basic characteristics (Coleman and Moss 2012). Furthermore, developers of the most successful and promising platforms are often influenced by fields distinct from deliberative democratic theory (Manosevitch 2014). Consequently, how developers talk about the objectives of the platform may differ from concepts familiar to deliberative theory. In this sense, the term "online deliberation", if it is used, may be used and understood differently by different developers, producing very different kinds of platforms. Finally, many platforms and tools do not support all elements we might typically associate with a process of deliberation, for example notably few platforms explicitly support decision making. In some cases, platforms have been used in collaboration with offline processes, or to support a particular task such as idea generation.

Since a precise definition for identifying experimental online deliberation platforms does not currently exist in the literature, this study adopts a broad and flexible understanding of the term “experimental online deliberation platform”. This allows the inclusion of platforms influenced by other fields that remain relevant to the study by virtue of the context of their use and design features. This also allows the inclusion of innovative platforms that support limited elements of the deliberative process. As a minimal definition, to qualify for inclusion in this study a platform should allow more than one participant to express ideas and arguments in the context of public debate. The design and structure of the platform must also be able to demonstrate some feature aimed at supporting deliberation that distinguishes it from the lightly structured format of typical forms of online communication.

The second challenge concerns our methodological approach to studying the design of platforms and design’s potential influence on deliberation. Current research into design has been limited and the methodological approaches adopted encounter challenges and are ill suited to the study of platforms utilising novel or experimental design choices. An initial challenge is the contested definition and conceptual criteria of deliberation (Naurin 2007). The move from conceptual criteria to evaluative standards presents further challenges in how deliberation, and the qualities associated with it, can be operationalised and meaningfully evaluated (see Neblo 2007). In a review of online deliberation literature, Coleman and Moss (2012) raise the concern that studies focus on different deliberative criteria and operationalise them differently, generating problems for judging the success of different platforms and comparing performance across platforms. These concerns are particularly relevant to the study of design and experimental platforms. Studies have operationalised deliberative criteria using measures that assume specific design choices. For example, Friess and Eilders (2015) discuss research measuring how often participants in a forum quote or refer to each other as a measure of reciprocity. Applying this measure to a platform utilising an argument map cannot produce results for a meaningful comparison For example, if specific authors are not identifiable for citation it may measure no reciprocity, or, since every argument is connected to another point in the map, it may measure absolute reciprocity. In some cases, researchers have counted words per message to judge, quite indirectly, how often participants justify their beliefs (Janssen and Kies 2005). This is a deeply problematic measure of justification, that would produce very different results in platforms that

deliberately limit the word count of contributions or emphasise voting over writing. The design choices of experimental online deliberation platforms vary significantly, thus existing approaches to operationalising deliberation that assume specific design choices would not be helpful for studying this group of platforms.

Studies exploring design, such as Davies and Chandler (2011) and Black (2011), have discussed broad design variables such as differences between synchronous and asynchronous communication, or anonymous and identifiable participants. This may be contrasted with the more nuanced range of design choices displayed by experimental platforms. These variables include various approaches to interface design, aesthetics, and choices concerning argument visualisation and representation. These variables may significantly impact the experience and behaviour of participants, the quality of deliberation and the success of the platform. A further element is the sense in which current approaches attempt to establish a causal relationship between a specific design choice and an outcome in terms of deliberative quality. This approach requires focusing on one design choice, controlling for confounding variables arising from other differences in design as well as external factors such as the context of its use. This is a challenging task: Karlsson's (2010) study of deliberation in 28 identically designed forums highlights the significance of contextual factors raising concerns regarding the capacity of current approaches to isolate the influence of design. It is also arguably an unhelpful approach when studying experimental online deliberation platforms, which vary greatly with respect to their design choices and the context of their application. Although Scheuer et al (2010) are discussing computer supported argumentation systems, their comments on the challenges facing empirical study are pertinent to online deliberation platforms, given the similar conditions of variety between systems and very different contexts of application. They write:

> A simple explanation for the lack of studies that systematically compare different argumentation system designs is that it is quite difficult to practically do such studies; varying factors in a controlled manner would require eliminating confound [variables], which is quite difficult when two existing software systems are compared as a whole. (Scheuer et al 2010:49)

In view of the methodological challenges discussed above this paper adopts an exploratory case study approach. An exploratory approach is most appropriate given the lack of existing research in this area and the flexible definition of the population of cases the study is adopting (Shields and Rangarajan 2013, Reiter 2013, Schutt 2015). This allows the study to explore the wider and more nuanced variety of design choices displayed by experimental platforms under the circumstances in which they are found (Yin 1994), allowing consideration of the impact of the design choices of the system as a whole. The study will focus on a small number of online deliberation platforms and tools that represent exemplary cases. Although this focus limits the capacity of the study to explore the full range of potential innovations, it allows for in-depth exploration of the experiences of the platforms and the potential of design. The following section will review experimental online deliberation platforms and discuss the criteria for selecting exemplary case studies.

Selecting Platforms

Technology demonstrations have documented a number of examples of experimental online deliberation platforms (for example Conklin (2008), Tauro et al (2008) Fishkin (2008), De Liddo and Buckingham-Schum (2010b)), and further examples have been identified and collected on the sites ParticipateDB and Participedia (Towne and Herbsleb 2012). ParticipateDB lists around 350 tools and services for web based participation (ParticipateDB 2017). Scheuer et al (2010) provide a review of computer supported argumentation systems, some of which relate to the criteria for online deliberation platforms outlined above. Mark Klein (2017) has produced an overview of collective intelligence tools, creating and briefly analysing a list of around 90 platforms, as well as a paper seeking to categorise available large scale online deliberation platforms (Klein 2015).

ParticipateDB provides a taxonomy of 24 classes of platform, the taxonomy defines platforms in terms of the organisation of information as well as their purpose:

Argument mapping
Audience response system
Budget simulator
Budget visualization

Collaborative document writing
Content management system (CMS)
Crowdfunding
Discussion forum
E-learning platform
E-voting
Electronic mailing list
Group decision support system (GDSS)
Ideation & brainstorming
Live video streaming
Online consultation suite
Online dialogue and deliberation
Online survey
Social media
Virtual townhall
Virtual whiteboard
Virtual world
Web conferencing
Weblog
Wiki
(ParticipateDB 2017)

In reviewing potential platforms, this study has used ParticipateDB, Mark Klein's analysis of collective intelligence tools, as well as a search for online deliberation platforms. The study identified minimal criteria to qualify for inclusion in the study, these were applied to the platforms identified from the search. ParticipateDB for example includes many platforms that utilise lightly structured forums or support activities distinct from deliberation, such as e-voting and e-learning, and were therefore not considered relevant to the current study. The review of potential platforms revealed a further need to consider practical issues in selecting platforms. Klein (2017) observes in his descriptions that many of the platforms and tools listed are no longer active (for example Ahoona), may not have been used, or have no evidence of large scale use (Cluxton). In such cases, there is limited material available for in-depth study

and opportunity for assessing the potential of design in addressing the challenges of online deliberation. In view of these issues, the selection of cases considers practical issues such as the availability of material and indications of substantial use of the platform. These considerations include ease of access, evidence that the platform has supported large scale use or sustained participation over a period of time, the availability of material and literature on the platform that provide evidence of the platforms application and influence.

In addition to basic criteria and practical considerations, the review below also considers trends in design approaches and notable applications of theoretical approaches influential in the field (such as informal logic and collective intelligence), for example, the use of argumentation schemes to organise and support real world debate (e.g Parmenides), and the use of gamification to support participant engagement (e.g @stake). The selection of exemplary cases aims to capture a range of approaches and particularly successful examples of these trends.

Reviewing and Categorising Platforms

There is little existing research to guide our review and categorisation of experimental online deliberation platforms. Klein's (2015) review of "Crowd Scale Online Deliberation" is a notable example of an overview of this area. Klein (2015) identifies five different categories of online deliberation systems. These are time-centric, question-centric, topic-centric, debate-centric and argument centric. This system of categorisation is based on how information is structured and visually represented. Scheuer et al (2010) provide a review of computer supported argumentation systems. While this review is not specific to deliberation systems, the categories and patterns identify similar features; for example, time-centric corresponds with chat and forums, debate-centric corresponds with containers, argument centric corresponds with graphs in Scheuer et al's analysis. Time centric systems, including blogs, chatrooms and web forums, may be understood as representing the more typical, lightly structured forums discussed in other literature (Towne and Herbsleb 2012). In question-centric platforms (examples provided include, stockoverflow.com, IdeaScale and Mindjet), a central question organises information, but there is no further organising or curating principle that ensures information is not repeated, nor is there a process to help identify preferable ideas or identify

critiques and critical discussion of ideas. Topic-Centric systems, such as wiki's, collect information around a topic, and are described as capturing consensus while controversial aspects of debate are moved to talk pages that are organised according to the time-centric principle described earlier. Debate-centric systems (examples include, whysaurus.com, Debatepedia.com, debatewise.org (Klein 2015)) present information in the form of pros and cons and are often curated to ensure an effective overview of a topic with minimum redundancy of information. Finally, Klein (2015) outlines argument-centric systems. These are systems that typically present information in the form of argument maps or trees, identifying central questions and ideas, followed by arguments for and against and reasons and evidence supporting those arguments.

Klein's (2015) discussion can be understood as an argument for a particular approach to online deliberation systems, specifically argument-centric systems of which he is a noted developer. The discussion provides a useful approach to navigating the range of potential online deliberation systems: time-centric and question-centric platforms describe lightly structured approaches that are not relevant to this study. Debate-centric and argument centric constitute two common approaches to organising information amongst platforms that are clearly relevant. In addition to the use of argument maps and the pro and con lists of debate-centric visualisations, the review identified two further general trends in approaches to design and visualisation techniques: annotation and group clustering. Some of the platforms and tools reviewed use annotation of existing web pages as an approach to deliberation (for example, Hypothesis and Rbutr). Annotation involves providing an extra layer of meaning to a given web page by allowing users to annotate it and see other annotations including links to other pages. Other platforms and tools represent information in terms of group clustering, in which participants are represented in spaces and grouped in such a way as to reflect their support for particular positions (for example ConsiderIt and Pol.is). Group clustering is another form of visual representation which allows users to view the positions of other individuals in a community, for example reflecting how strongly different users agreed or disagreed with a statement. Group clustering can give a representation of participants relative to positions without attempting to place those positions in the context of an argument structure relative to other positions. Such an

approach, can be understood as a visualisation technique that provides social information concerning the debate in contrast to information relating to the content of the argument.

Within these general trends, the platforms and tools reviewed display a range of more nuanced choices in relation to interface design, aesthetics, and the combination of other tools and techniques to support different aspects of deliberation. For example, while we can talk generally of the approach of argument mapping, the platforms and tools will differ in a number of respects: the ontology of the argument map may vary, with different choices on the elements that can be used to compose a map; choices over word limits or the visibility of replies and counter arguments; and the general look and aesthetics of the argument map. These factors may greatly influence the success of the platform and its ability to address certain challenges; for example, aesthetic considerations may impact the capacity of the platform to attract and maintain participant engagement. Our review of online deliberation platforms also found that platforms may combine different approaches to argument visualisation, and they may utilise other tools or design approaches that help address challenges or issues associated with a given approach to visualisation. For example, ConsiderIt combines both debate centric visualisations in the form of pro and con tables, but also displays group clustering and allows for further analysis of this data (for example the levels of support for positions based on the demographics of the group). The Deliberatorium features both argument centric and time centric systems of communication in the form of an argument map and a chat function. Finally, some approaches found in practice do not fit easily into any category of visualisation or design approach already identified. For example, Parmenides draws on argumentation schemes but organises information through the presentation of a dialogue with the participant.

The study seeks to select platforms that represent notable or successful examples of solutions to the challenge of online deliberation; platforms that combine these approaches and techniques in interesting ways, as well as novel and unique approaches. The purpose is to capture a sense of general and notable trends in design approaches and explore how they may address challenges of online deliberation. The study does not seek to make strong generalisations from the experiences of selected platforms, which given the diversity of the

population of cases and methodological approach would be problematic. In summary, the selection criteria are outlined below.

- The platform or tool meets the minimal criteria of supporting one or more aspect of online deliberation and demonstrating novel and relevant design features that distinguish it from lightly structured forums.
- Practical considerations: ease of access to the platform, evidence that the platform is successful and has received large scale or sustained participation, the availability of material and literature on applications of the platform.
- Instances where the design choices represent notable applications of common trends or unique approaches to visualisation and structure that can be linked to engaging with the challenges of online deliberation.

Where possible the platforms and tools available were trialled and reviewed according to the criteria above. From this process, a selection of platforms and tools were identified as exemplary case studies for further exploration.

Exemplary Cases of Online Deliberation Platforms

Twelve platforms and tools were selected as exemplary cases for further study, these are:

@stake
Arvina and Ova
BCisive/Rationale
Climate CoLab
Cohere/Evidence Hub
Consider It
Debategraph
Deliberatorium
Parmenides
Pol.is
Rbutr

Truthmapping

This section provides a description of each of these platforms; providing information on the background of the platform, design features, illustrative screenshots of the platform, and reviews existing studies and applications of the platform.

@Stake

Background, Objectives and Design of the Platform

@Stake is a "role playing online card game developed to foster empathy and collaboration" (eLab 2017a:1) and "enhance deliberation in real-world processes" (eLab 2017b:3). @Stake was developed by the Engagement Lab, an organisation that seeks to produce games for social change, participation and engagement (eLab 2017a: 1). The developers describe the game as relying on "rapid fire ideation, discussions facilitated through role playing, experimentation with ideas, and collaboration among a diversity of stakeholders" (eLab 2017b: 3).

@Stake is a card game that takes about one hour to play. It requires the division of large groups into smaller groups of 4- 5 players. Participants are assigned characters through cards. The card contains biographical information and an agenda, visible only to the participant. The agenda provides details of the character's objectives, with points attributed to each objective. One person of the group is elected as Decider for the round, with which comes various responsibilities. Tokens form a currency of the game, each player is given three tokens, with an additional three tokens in a pot and five tokens for the Decider.

Distribution of tokens (eLab 2017b: 4)

Character card (eLab 2017b: 11)

The rounds consist of the following stages:

Introduction: Participants introduce themselves in character

Brainstorm: The Decider announces the issue, participants have one minute to develop a proposal

Pitch: Moving clockwise from the Decider each player has a minute to pitch their proposal. They may use tokens to allow themselves extra time.

Deliberate: The Decider leads a follow up discussion, participants may ask each other about their proposals, offer counter arguments and suggest amendments to one another's plans. Tokens may be used to extend time.

The Decision: The Decider announces a winning proposal. The player who proposed this wins all the tokens in the pot, plus bonus tokens based on points on their agenda. All other players score points for their agenda items, if the winning proposal satisfied these requirements (determined by the Decider). The winner then becomes the Decider for the next round (or alternatively passes this on to someone else) (eLab 2017b: 5- 6)

@stake was initially developed as a face to face card game in 2014, the developers have since produced a digital mobile version (Engagement Lab 2017). This version simplifies the rules, reduces the need for facilitation and allows for easier tracking of ideas generated during the game and the experiences of the players (Gordon et al 2016). The game would appear to require bespoke cards for each event it is applied to, with characters and agendas relevant to the event. In contrast to many of the other platforms and tools explored in this thesis, the developers make explicit reference to deliberative democratic theory and the desire to support the goals and outcomes of deliberative democracy (Gordon et al 2016). @Stake and the other projects developed by Engagement Lab can be understood as the most explicit example of "gamification", as discussed in the collective intelligence literature, available amongst the platforms and tools reviewed. Although it aims to support deliberation and decision making in general, the developers also stress the role it can play in supporting empathy building between participants (Gordon et al 2016).

Images and Screenshots of the Platform

An example of the cards is reproduced below[1].

Literature and Applications of the Platform

In addition to information on the engagement lab website, the developers produced a paper for the 2016 CSCW (Computer Supported Cooperative Work) conference about the platform. This paper identifies a lack of research into "civic games", it outlines the rules and mechanics

[1] https://medium.com/engagement-lab-emerson-college/announcing-a-printable-stake-game-211f76804086#.uy36q159k

of the game and describes a pilot study comparing the game to a traditional ice breaker (Gordon et al 2016). The paper reports the findings of the pilot study as positive, finding that role playing may encourage participants to be more comfortable with public speaking and engagement, as well as greater capacity to empathise with others and retain information about their ideas and personalities (Gordon et al 2016). Michelson (2015) also reports on the results of playtests of the games; the platform was used as a warm up activity by architecture and planning design firm Utile in the Imagine Boston 2030 initiative. @Stake was also piloted in three Participatory Budgeting meetings in New York City in Autumn 2014 (eLab 2017a). A study of this event used participant observation, survey data, and follow up interviews to evaluate a number of issues including whether gameplay increased empathy, efficacy, affinity towards civic engagement, and future participation. One of the observations of this study was the sense in which some participants objected to spending time on a game (eLab 2017a). The game has been used in a variety of settings including organisational planning, UNDP policy meetings on youth unemployment in Moldova, Egypt and Bhutan, educators' curriculum design workshops, and several academic conferences (Gordon et al 2016:271, eLab 2017a).

Arvina and Ova

Background, Objectives and Design of the Platform

Arvina is web based discussion software, that "allow participants to debate a range of topics in real-time in a way that is structured but at the same time unobtrusive" (Lawrence et al 2012:1). Arvina and OVA were developed by the ARG-tech, Centre for Argument Technology at the University of Dundee. ARG-tech develops tools aimed at argument mining, argument visualisation and analysis and the use of artificial intelligence in dialogue. The centre has been influential in this field and has worked in collaboration with the BBC and IBM debating technologies (Reed 2017). Arvina and OVA are tools developed to support argumentation.

Arvina and OVA are an application of Argument Interchange Format (AIF) theory that has been used to support political debate. OVA (Online Visualisation of Argument) is a tool for analysing and mapping arguments online. The interface allows users to highlight text on a web page and extract this to a premise which can be used to support or challenge other premises. Missing premises (or enthymemes) can also be added by users. Arvina is a dialogue

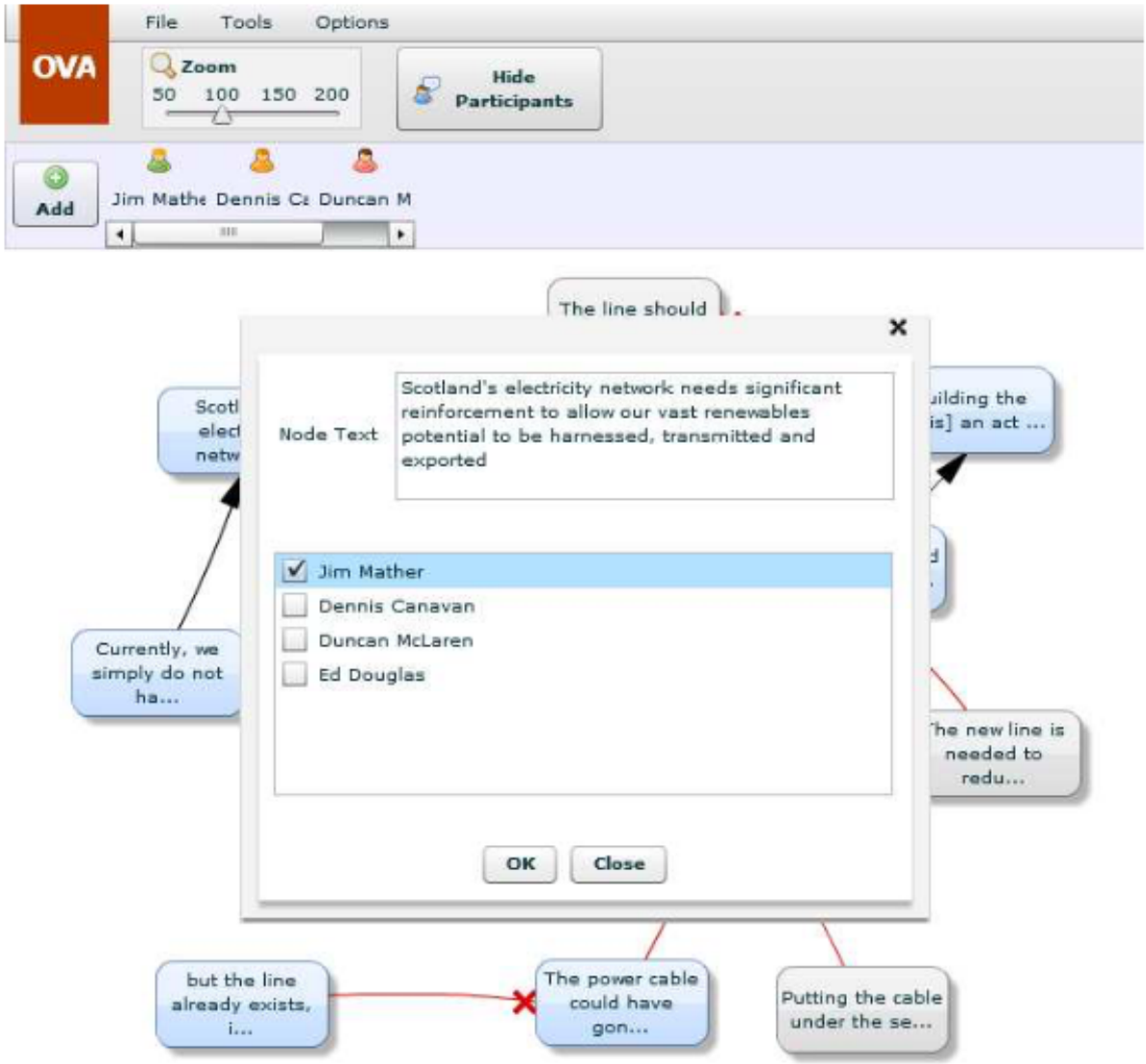
tool that uses google wave, an online tool which allows for real time communication and collaboration (Google 2010 in Snaith et al 2010:7). Arvina is a Wave application which builds on the Google API, allowing a user to choose a topic from any previously analysed AIF resources. The AIF resource is examined to determine the participants involved in the dialogue and a new robot is added to the wave representing each of these participants. The participants may be human or artificial, with artificial participants using knowledge assigned from the AIF resource.

Arvian and OVA are relevant to the current study for a number of reasons. Arvina and OVA represent an example of the use of artificial intelligence in online deliberation platforms, and an attempt to provide some formal structure to natural language argument that can be used across different platforms. Artificial intelligence and particularly the work of Chris Reed and ARG-tech were described by a number of other developers in this area as being particularly influential and promising as a direction for online deliberation. This is an area that is particularly relevant to issues of feasibility and scale as well as information management.

Images and Screenshots of the Platform

Figure 1. The Arvina Interface

Arvina Interface (Lawrence et al 2012:2)



Premise properties in OVA Showing Participants (Snaith et al 2010:5)

Literature and Applications of the Platform

Arvina and OVA were applied in the context of a proposal to build a transmission line for the Beauly to Denny power line through areas of outstanding natural beauty (Snaith et al 2010). The purpose of the study was to test the capacity for interchange between different formats, argument visualisation and dialogue format using AFI theory. The study observed that the tools demonstrate that formally describable processes of deliberation can be linked to the formally describable structures of knowledge. It claimed that much remained to be done to expand and refine the tools, and integrate the tools with other parts of the deliberative

process, such as inquiry and decision making. Lawrence et al (2012) tested Arvina's capacity to support human and artificial intelligence groups in mixed initiative argumentation. Lawrence et al (2015) discuss the challenges of current argument mining techniques to identify complex structural relationships between concepts, a lack of consistency in formatting, and a lack of large quantities of appropriately annotated arguments to serve to train and test tools. In efforts to address this, researchers have turned to other online tools (including several discussed in this study, Debategraph, Truthmapping and Rationale) and sought to convert them to AIF formats (Lawrence 2015).

BCisive/Rationale

Background, Objectives and Design of the Platform

BCisive allows the creation of decision maps to "capture discussion, organise ideas, explore options, test hypothesis and analyse reasoning" (BCisive Online 2017). Rationale claims to allow users to make argument maps to "structure arguments, analyse reasoning, identify assumptions and evaluate evidence" (Rationale Online 2017). BCisive and Rationale are tools developed by Austhink and represent commercial successors to Reason!Able (Scheuer et al 2010). The tools are currently run by the ReasoningLab; both tools allow for the collaborative construction of argument maps. The software code for the tools are identical, however the interface allows for different options in map construction (Kunsch et al 2014). BCsisive aims at supporting decision making while Rationale is used as an educational tool for supporting critical thinking and developing argument in essays.

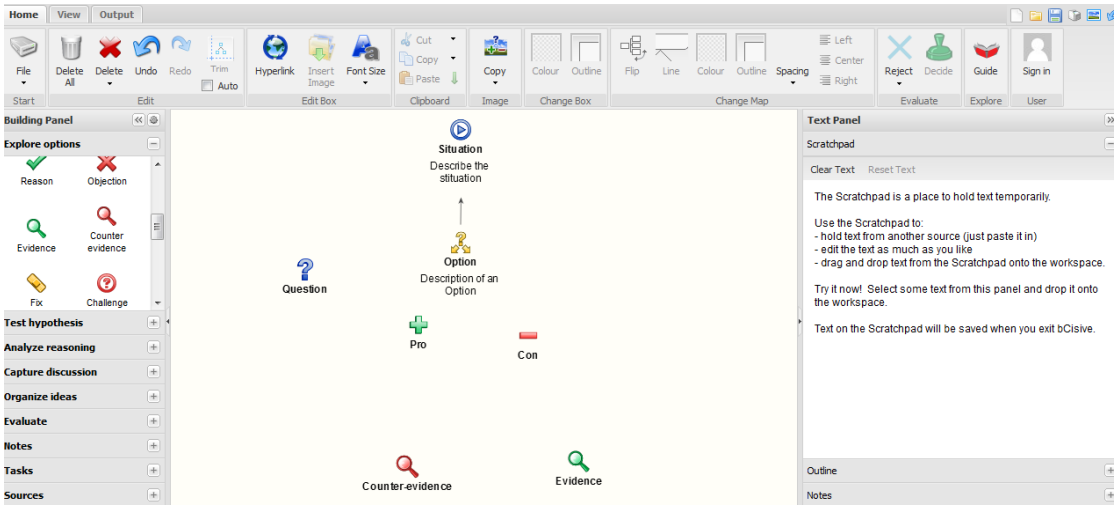
The descriptions for the argument visualisation ontology are different for each tool. The basic ontology of BCisive allows for the construction of maps from the following: Situations, Options, Pros, Cons, Reason, Objection, Evidence, Counter Evidence, Questions, Challenges and a Fix. In the case of Rationale, maps are based on the following ontology: contention, reason, objection, note, example and co-premise. There are further options to identify the nature of different types of evidence or basis including: Common belief, data, case study, assertion, law, quote, statistic, personal experience, and publication.

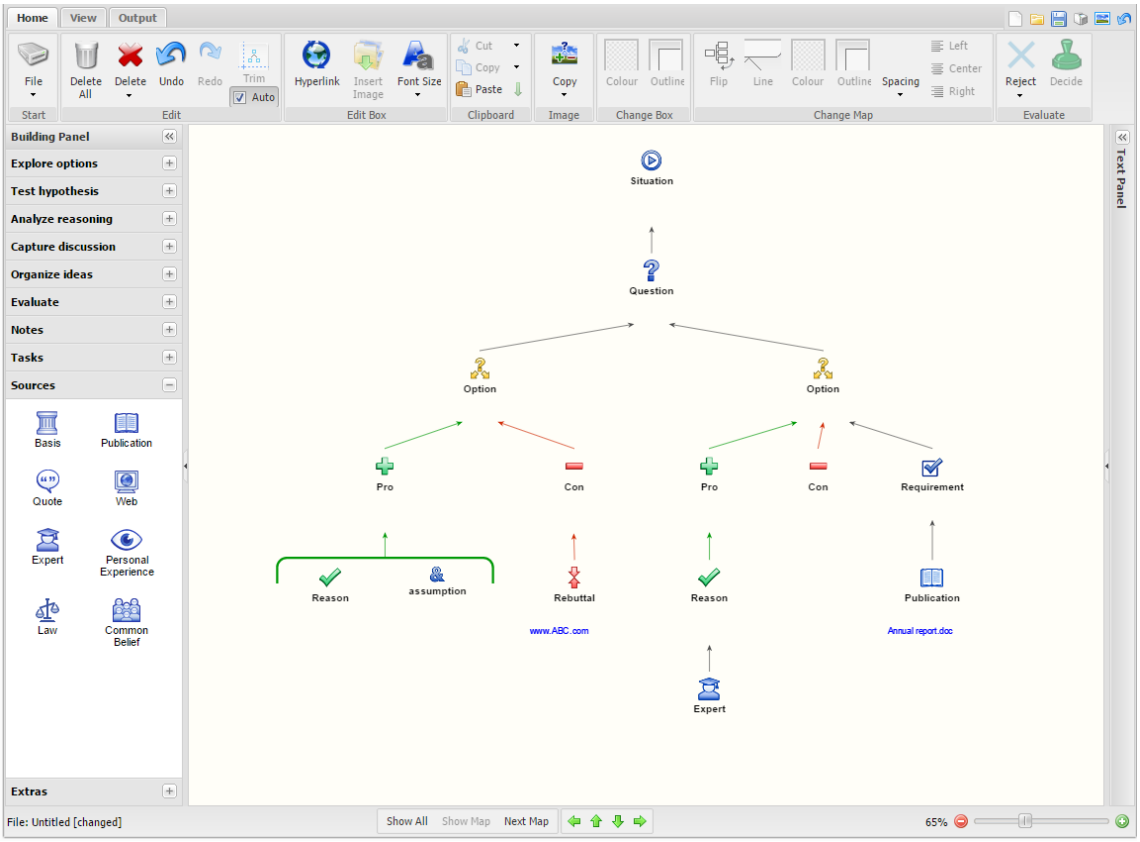
Bcisive and Rationale are characteristic of the argument mapping tools available in online deliberation. They allow relatively extensive options in constructing argument maps,

including task specific items. Participants are free to construct maps and use categories however they choose, however there are prompts. For example, the “rabbit rule” prompt alerts participants if something is mentioned in the conclusion that is not mentioned in the reasosn (Twadry 2004). The developers involved in Rationale are currently developing the use of probabilistic judgements in argument maps, which would affect the way the system organises the map. This is particularly relevant to the challenge of information management (how well platforms can manage different data types). In addition to these features the developers are also developing ways of allowing real time collaboration on argument maps in which authors can see the changes their partners intend to make in relation to an argument map. In this sense Bcisive and Rationale are good examples of argument mapping approaches with more novel features to support decision making and critical thinking.

Images and Screenshots of the Platform

BCisive

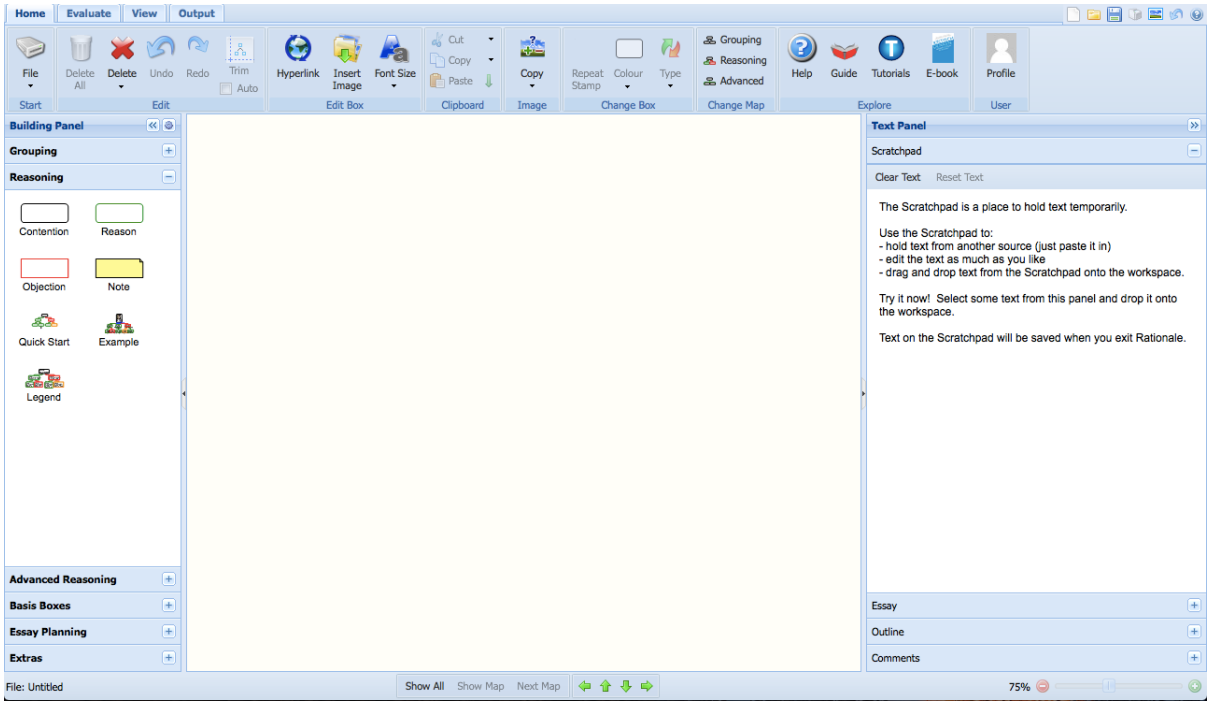




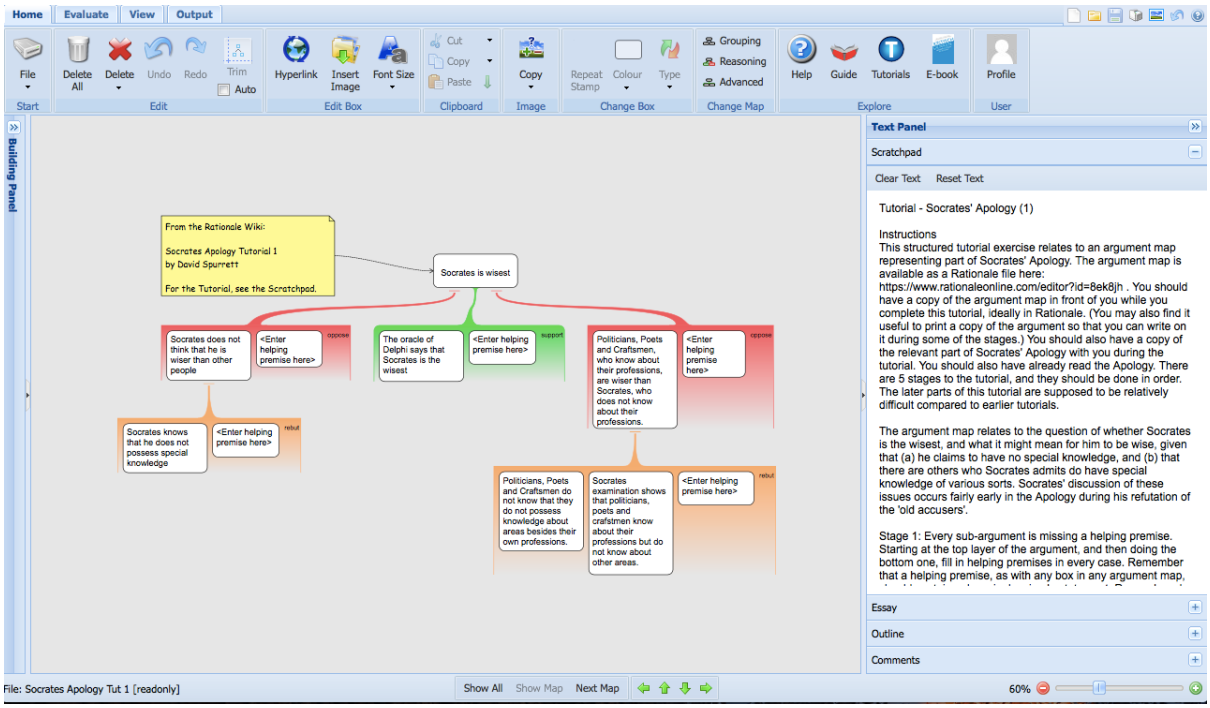
Argument map interface for BCisive[2]

[2] https://www.bcisiveonline.com/editor/

Rationale



Rationale argument map editor interface[3]



Rationale argument map example[4]

[3] https://www.rationaleonline.com/editor/

[4] https://www.rationaleonline.com/editor/#?id=8ek8jh

Literature and Applications of the Platforms

A literature review reveals seven papers on Rationale, Bcisive and an earlier version of rationale called Reason!Able. Scheuer et al (2010) include Rationale and Reason!Able in their review of CSA systems. Kunsch et al (2014) compares the use of Bcisive and Rationale in the context of education for business students. They suggest that Rationale was preferable for demonstrating the basics of argument mapping, while BCisive was better to analyse business cases and present findings due to its capacity to conduct more complex analysis and compatibility with formats such as PowerPoint. Lengbyer (2014) uses rationale to explore the use of argument mapping to support decision making in specific cases rather than for general educational purposes. There is discussion of the use of Rationale to support lawyers in Australia (Drummond 2006 in Van Gelder 2007) and helping judges with expert testimony (van Driel and Prakken 2010), the later concluding that it was more likely to be helpful for educational and training purposes. Rationale has been tested in other educational settings finding positive results when testing students' critical thinking skills (Tawdry 2004) and understanding of the material (Davies 2009b). The literature has tended to focus on Rationale or its earlier versions in an educational context. BCisive appears to be a later development intended for use in the private sector as a tool for supporting decision making in organisations (Reasoning Lab 2017). There has been more take up for the Rationale tool, which has been used in various education settings by students and as part of courses, notably in Amsterdam and Australia (Reasoning Lab 2017). There are free online versions available for both tools.

Climate CoLab

Background, Objectives and Design of the Platform

Climate CoLab is developed by the MIT Center for Collective Intelligence. It describes the aims of the project as attempting to address wicked problems, specifically climate change, through collective intelligence. The project appeals to the idea that it is creating an open problem solving platform drawing on the success of projects such as Wikipedia (Malone et al 2009).

Climate CoLab involves contests where participants can put forward and discuss ideas to address the problem of climate change. A contest consists of different stages and elements. People can propose solutions to specific problems identified on the site, such as land

management and energy supply. There is a further stage whereby proposals are integrated toward the development of a comprehensive plan that could be feasibly adopted as national policy. A final stage considers whether the comprehensive plan meets established targets (Malone et al 2009). The proposals are assessed by expert judges, though there are plans to replace this process with a form of crowd-based assessment. For the first three years Climate CoLab involved one or two contests per year, from 2013 they introduced contest families of 17 or more contests that seek to break down the issues of climate change which are then integrated (Malone et al 2017).

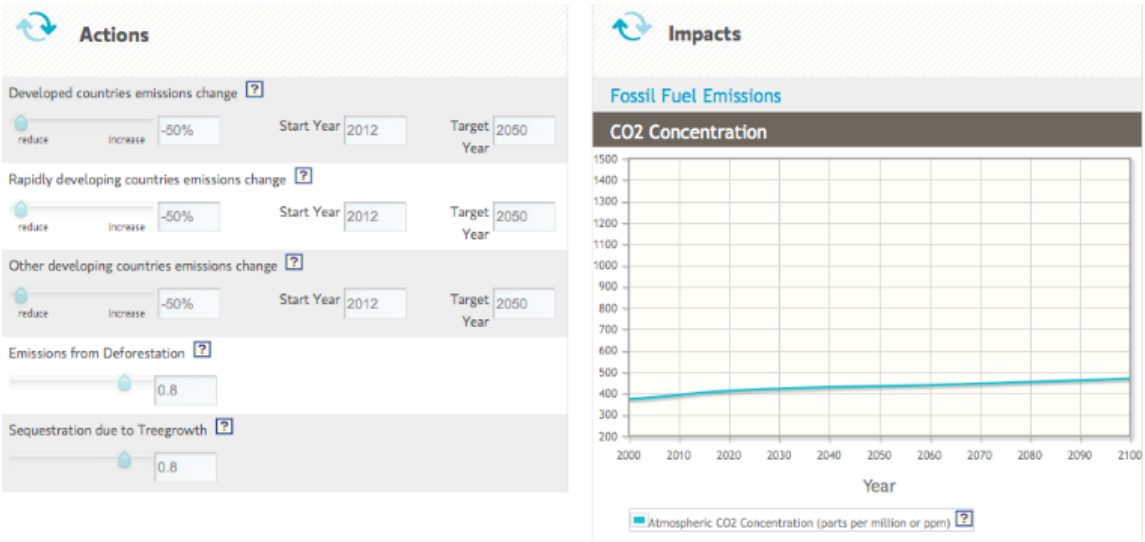
Climate CoLab involves three design elements supporting collective decision making: model based planning, online debates and voting. Model based planning allows participants to use simulation models to provide information about the impact of different proposals. The literature describes how the system uses the C-LEARN model, an online version of C-ROADS, a climate change policy simulator (Malone et al 2009). C-LEARN takes as input a set of regional commitments to emission reductions and produces as outputs projections of carbon concentration, temperature change and sea level rise. These outputs are then used to drive eleven additional models used by Climate CoLab, which predict anticipated economic costs, qualitative impact to human and physical systems (such as agriculture, water and health).

Online debates utilise a system similar to Deliberatorium and Compendium (see later), providing greater structure than traditional forums and classifying each contribution as (1) a question, (2) a position (proposed solution to the question), (3) an argument for, or (4) an argument against. Some debates capture arguments and information that cut across issues that underlie a number of different plans, thus plan creators are encouraged to specify what positions their plans take on cross cutting issues (Iandoli et al 2008). Finally participants can vote on debate positions and plans that they prefer, allowing users to identify promising proposals for the contests. Cash prizes are awarded to the proposals that are judged to be the best overall in the contest.

Climate CoLab is relevant to the current study for the following reasons: Climate CoLab is an ambitious and well established platform that has a large number of participants. The platform provides a decision making mechanism in addition to idea generation and debate. Through

the climate change policy simulator and the use of judges and moderators, the platform also seeks to verify information provided in debate and ground claims made into a shared understanding of the facts. These features are of particular relevance to the theme information management, and issues concerning how platforms deal with contested knowledge, moderation and different data types. The project is also well resourced as it is able to award $10 000 to the best overall proposal per contest. This is significant when thinking about feasibility and scale and the sustainability of online deliberation platforms. The platform uses a number of different techniques to address different challenges in online deliberation and represents an interesting approach drawing from the field of collective intelligence.

Images and Screenshots of the Platform



Introne et al (2011:5)

Simulation Model

Climate CoLab Debate Interface (Introne et al 2011:6)

Literature and Applications of the Platform

The Climate CoLab has been conducting contests since 2009 and these applications have been documented in different research papers (see for example, Malone et al 2009, Introne et al 2011). The project has over 85 000 participants including 200 experts on climate change and related fields (Malone et al 2017). Duhaime et al (2015) used online surveys and an analysis of web activity to develop a picture of the characteristics and behaviour of the Climate CoLab security. It found that the community was geographically diverse, and tended to be highly educated and experienced with climate change issues. It also found that those outside the usual conversations about climate change are influenced by and contribute effectively to collective problem solving. Members who did not have graduate education previous climate change experience or did not live in the United States reported significantly higher levels of learning, belief change and increase in climate related activity as a result of participation, and these members, and women, were at least as likely to submit high quality proposals (Duhaime et al 2015). Through the later implementation of contest webs, Malone et al (2017) explored whether participants would reuse their own and other's work effectively, and whether participants would be able to explore multiple combinations of interchangeable parts (of solutions). The results of their experiment were found to be positive, observing their system facilitated widespread knowledge sharing and reuse, and the combining of solutions at multiple points of aggregation (Malone et al 2017).

Cohere/Evidence Hub

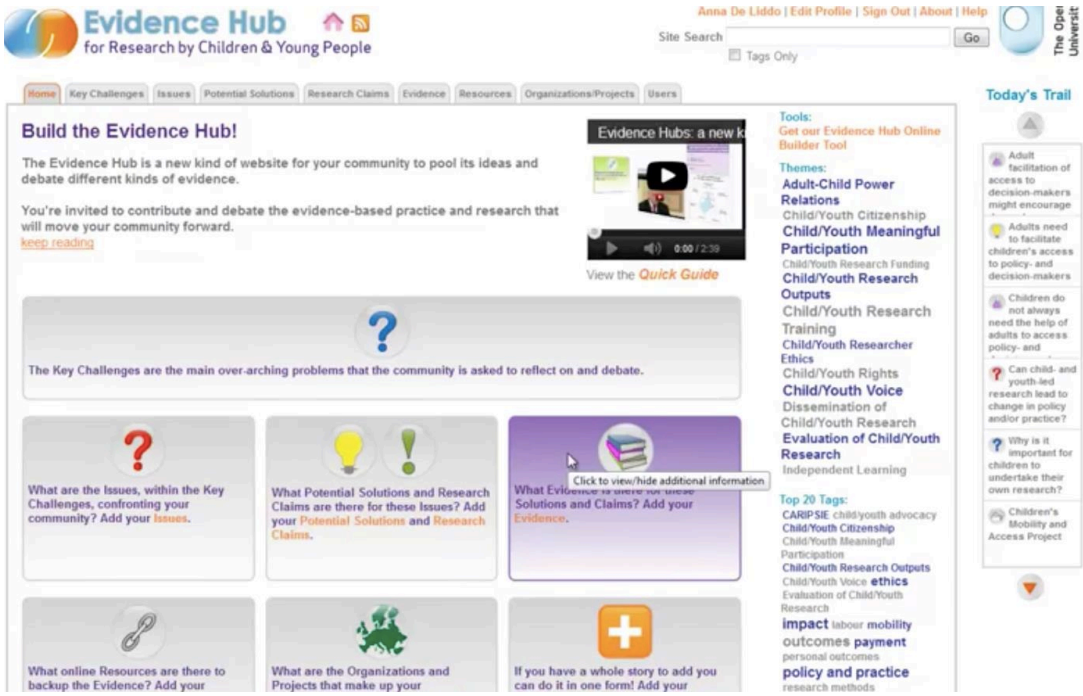
Background, Objectives and Design of the Platform

Cohere is a project developed by the Knowledge Media Institute at the Open University. It is a visual tool to create, connect and share ideas. De Liddo and Buckingham Shum (2010b) identifies contested collective intelligence as a distinct area of collective intelligence, with Cohere developed as a prototype for testing their design rationale for these ideas. Evidence Hub is part of this project and aims to provide a platform for collaborative knowledge building based on the concept of contested collective intelligence (De Liddo and Bukingham Shum 2013), allowing users to pool and map knowledge around a specific issue or theme.

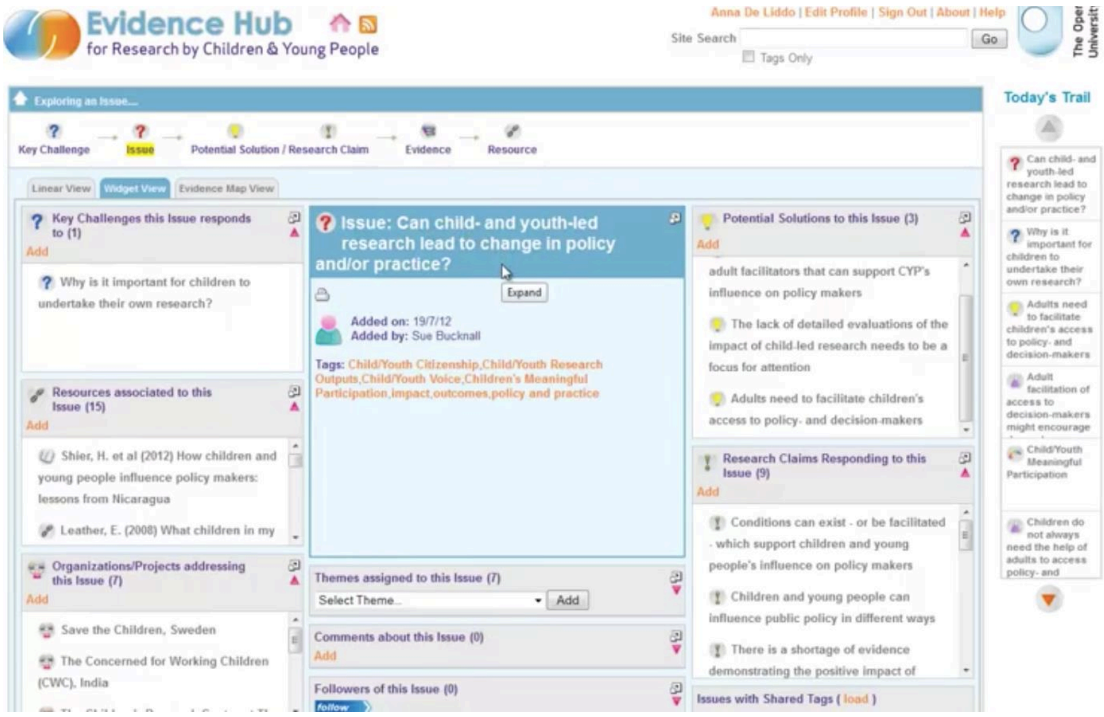
The evidence hub organises information according to the following categories: key challenges, potential solutions, research claims, evidence and counter evidence, and resources on the web. In addition to this attempt to pool relevant knowledge around different individuals and researchers working on projects, this is mapped geographically and also according to themes and questions.

Evidence Hub is an ambitious project that utilises a number of different approaches, including annotation, argument visualisation, chat functions for debates to support collaboration and deliberation as well as providing a resource to collect evidence around a given debate. Its use of various approaches to argument visualisation and information management make it an interesting case for further exploration. The developers draw explicitly on collective intelligence literature as well as informal logic theorists such as Walton (Evidence Hub 2017) and the tools can be understood as a mature and influential example of an application of these theories in practice.

Images and Screenshots of the Platform



Mapping Argumentation Chains in the Evidence Hub[5]



Evidence Map[6]

<u>Literature and Application of the Platform</u>

The E-Hub website describes examples of hubs running in collaboration with external partners, including the Community of Practice for the Institute of Health Visiting (a closed Hub) and the Systems Learning & Leadership Hub (University of Bristol). Open University Community Hubs include the Open University in Scotland's Work & Learning Hub, and the Open University's Faculty of Education and Language Studies department through their Hubs for Reading for Pleasure, and Research by Children and Young People (Evidence Hub 2017). De Liddo and Buckingham Shum (2013) describe the concept of Evidence Hub and its development in response to experiences following its use in the context of health care and education. This work highlighted a pervasive challenge of a trade-off between the need for structure to maximise the signal-to-noise-ratio and permitting people to make contributions

[5] http://rcyp.evidence-hub.net/?max=20&orderby=date&sort=DESC&filternodetypes=Challenge#home-list

[6] http://rcyp.evidence-hub.net/explore.php?id=861572362500105612001342686197

with very little indexing or structure that requires less learning. They suggest that this is a problem that is far from solved.

Consider It

Background, Objectives and Design of the Platform

ConsiderIt "helps individuals make sense of complex issues through familiar deliberative activities" (ConsiderIt 2017). It is described as a novel platform for supporting public deliberation on difficult decisions (Kriplean et al 2012, Kriplean et al 2011). The platform allows users to create forums and introduce questions or proposals for a community to address. The community can then contribute to this forum by identifying their position on a scale of agree/disagree or high priority/low priority, and selecting the most important pro and con points for a given position. ConsiderIt then presents a visual representation of the community as a whole, it shows opinions along a scale of agree to disagree, along with a list of ranked pros and cons.

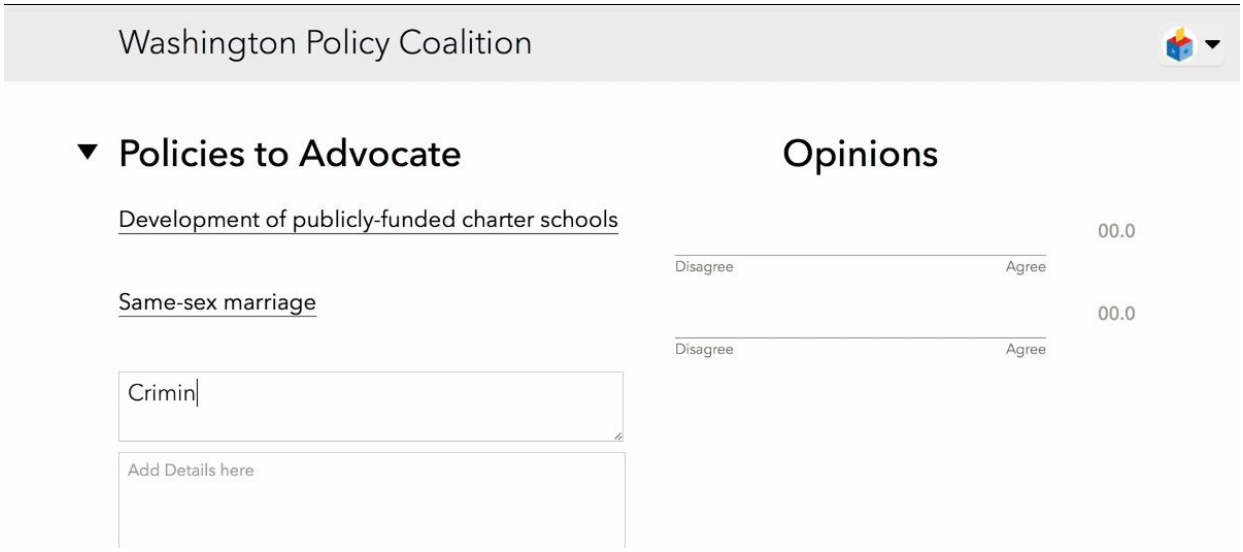
ConsiderIt combines a number of different approaches to visualising argument and debate. It represents pros and cons to a given proposal, but it also maps groups to show the social context of an individual's position. Users can interact with this visualisation to identify groups with shared opinions and points of consensus amongst otherwise disparate parties. In this sense, the system allows people to voice their opinions while also giving them the opportunity to recognise areas of agreement with political opponents. ConsiderIt also allows for potentially more nuanced understanding of differences by allowing participants to articulate different pros and cons and also place levels of priority on arguments and proposals. The developers argue this supports empathy, mutual understanding and areas of consensus. For example, if 80% of people who oppose an idea share the same two concerns that can be resolved, this suggests an opportunity for addressing the conflict (Freelon et al 2012). The developers of the platform have also attempted to address the problem of verification of facts in online deliberation, albeit externally in applications of the platform.

The features described above distinguish ConsiderIt from the other available examples of platform visualisations using pros and cons tables. ConsiderIt has also been described as using gamification in its approach to tutorials and aesthetics. Given the sophistication of its design

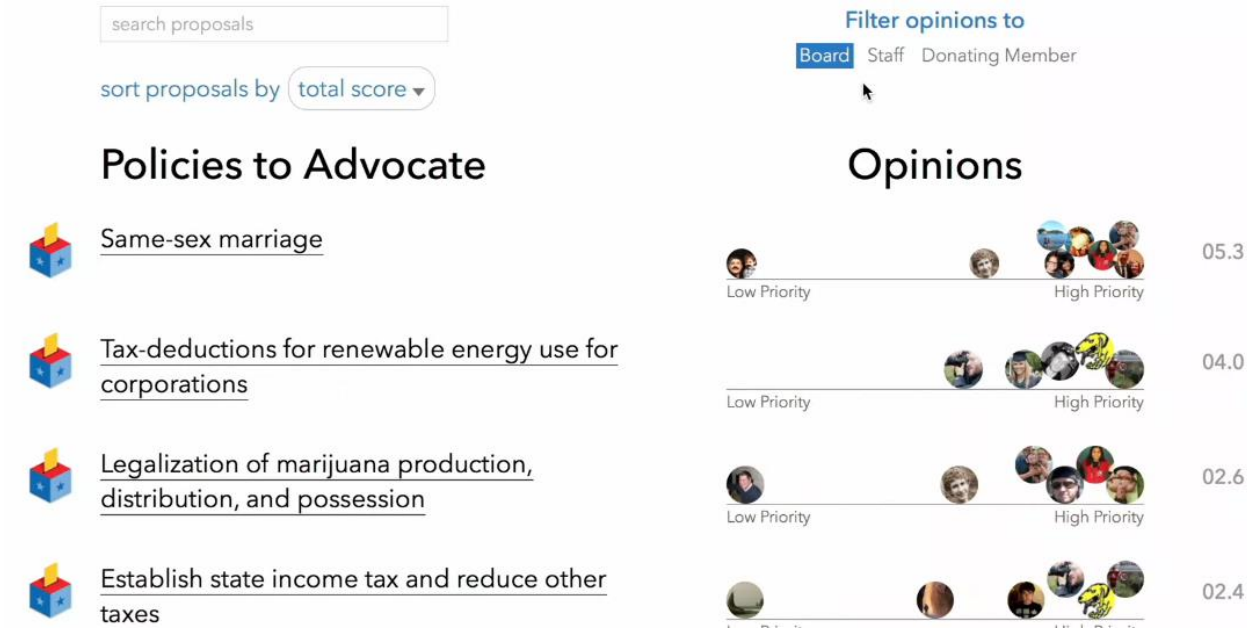
choices and the well documented applications of its use, it makes an interesting case for further exploration.

Images and Screenshots of the Platform

The screenshots below illustrate the design of ConsiderIt, and the process of generating and contributing to a forum discussion.

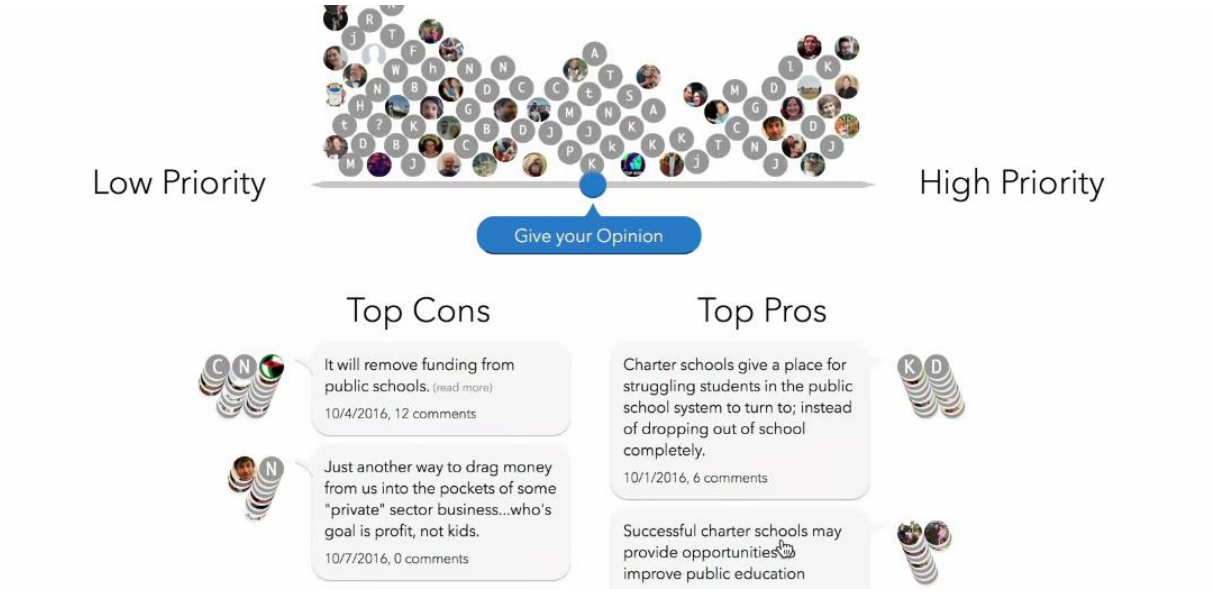


Displaying a user creating a forum and policies for a community to discuss[7]

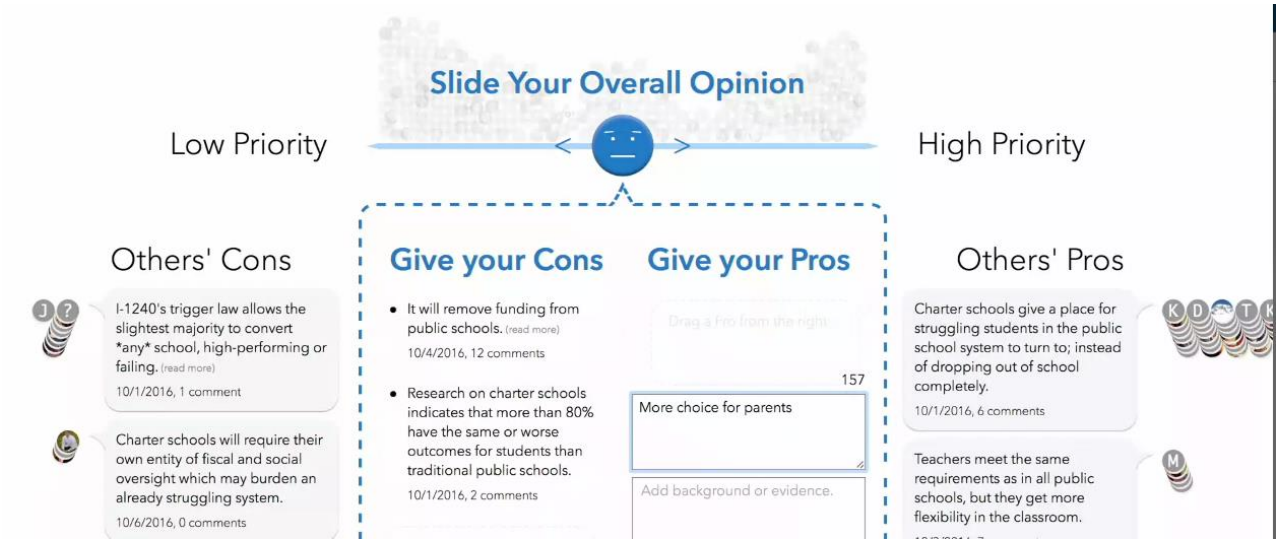


[7] https://consider.it

Displays the representation of a community in relation to the priority that is placed on given topics of discussion or policies [8]



Displaying the visualisation of a specific topic or policy, allowing users to see top pros and cons and the general consensus of the group[9]



Displaying a user introducing an argument[10]

[8] https://consider.it
[9] https://consider.it
[10] https://consider.it

Literature and Applications of the Platform

The literature on ConsiderIt shows it has been applied and tested in a number of situations. It began as part of a project called the "Living Voters Guide", that included an experiment in a U.S state election allowing residents to debate nine ballot measures (Kriplean et al 2012). Although the Living Voters Guide is no longer active the platform continues to be applied in other citizen engagement projects and it is also available for free for public use and through a paid plan with additional features (ConsiderIt 2017). Research has tested how well the platform encourages engagement with different views (Freelon et al 2012), participants' perceptions of different standpoints and their own knowledge of the subject (Stiegler and de Jong 2015). These studies have generally found positive results for the platform, additionally different variations of the platform have been tested in the context of a debate on Greece and the European Union (Stiegler and de Jong 2015). The developers of the platform have also engaged with the problem of verification and the trustworthiness of sources and claims appealed to in online deliberation (Freelon et al 2012 and Kriplean et al (2014)). Kriplean et al (2014) trialled the use of librarians as fact checkers in one example of the Living Voters Guide. The trial used a quantitative analysis of the use of the fact checking services, finding 14.2% of claims were subject to fact checking requests, and half of these concerned claims of fact while the others involved claims of principle or other claims that were not verifiable (Kriplean et al 2014). The trial also evaluated the experience of participants and librarians. It found that two thirds of those who had had their submissions fact checked felt the process had been fair (none claimed that it had been unfair), while many users expressed desire for better communication with the fact checkers (for example the ability to respond to the results of the fact check). The librarians reported positive experiences of the process, they felt they were able to conduct fact checking in a neutral manner, although some highlighted the fact that they felt they lacked the legal expertise to correctly respond to some issues. While the study found the process was broadly successful, they acknowledged problems with applying this approach to large scale deliberation (Kriplean et al 2014). Travis Kriplean (the developer of the platform) also describes how the platform has been used with the bit coin community and other open source communities, in large organisations to support strategic planning efforts and in schools as an educational tool to support critical thinking. He also describes

future plans to use the tool in join initiatives project in Hawaii, involving the Hawaiian language in a number of schools.

Debategraph

Background, Objectives and Design of the Platform

Debategraph is described as a service which allows individuals and "communities of any size to externalize, visualize, question and evaluate all of the considerations that any member thinks may be relevant to the topic at hand" (Debategraph 2017). The visualisations present colour coded maps based on the following criteria: issues (or questions), positions, arguments for or against. The maps are open to editing by the general public, and the ideas submitted in the map can be rated by others. The strongest arguments are indicated by the width of the arrows connecting the ideas in the map. The ontology of the argument map is not explicitly grounded in a particular theory of argumentation; the basic building blocks of the map share similarities with other argument maps, however it develops a much more complex range of connections between ideas and relationships between maps. In addition to an extensive range of connections, the maps also flow into one another, allowing participants to navigate from one issue to another. The ontology of the Debategraph is outlined in the visualisations below:

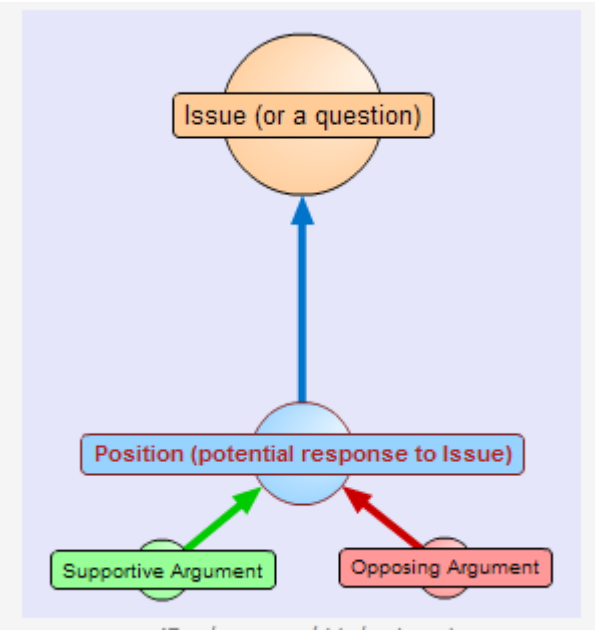
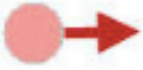
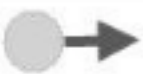


Illustration of the basic ontology of the argument map[11]

Following this basic ontology the system develops a more elaborate set of connections between ideas, identified with different coloured arrows. The table below details the range of connections available for ideas.

	Map Home	The starting point of a map / debate – which may include many issues – that describes the broad subject area addressed by the map / debate.
	Issue	An issue or question arising within the map / debate.
	Position	A potential answer or option suggested in response to an Issue or question.
	Component	A distinct part of a complex position; identified separately and analyzed on its own merits.
	SupportiveArgument	An argument that supports another idea (for example a position or another argument).
	OpposingArgument	An argument that opposes another idea (for example a position or another argument).
	ArgumentGroup	A broad set of arguments that can be interpreted as net supportive or net opposing depending on the relative weight attached to each—e.g. when a humanitarian case is made in favour of waging a war (to relieve suffering under a dictatorship) AND against waging the war (innocent people will die).
	PartArgument	A co-premise that works with other co-premises to support an argument or conclusion.

[11] http://debategraph.org/Stream.aspx?nid=400384&vt=bubble&dc=focus

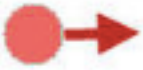
	Decision	A decision taken in response to an Issue
	Task On Schedule	A task that is expected to be completed on time
	Task at Risk of Delay	A task that is falling behind schedule.
	Task Overdue	A task that is overdue.
	Task Completed	A task that has been completed.
	Protagonist	A significant actor in a map / debate (to whom arguments may be attributed).
	Map Note	A note about the map structure, moderation policy, development schedule, etc.

Table detailing relationships between items on a map[12]

In addition to the hierarchical structure forming the basis of the maps, there are also a series of connections called “cross links” which provide links between maps or information about the map itself (for example instances of inconsistencies or equivalence). These are detailed in the table below.

[12] http://debategraph.org/Stream.aspx?nid=400384&vt=bubble&dc=focus

	Advocacy	Identifies an idea advanced by a particular Protagonist
	Causation	Signals that one element causes another element to occur
	Categorization	Places a map within particular category on the main public Debategraph.
	Citation	Cross-relates a Protagonist to another element on which the Protagonist is cited (*NB: Citation cross-relations are only displayed when navigating via the Protagonist*)
	Consistency	Signals that one element is consistent with another
	Contingency	Signals that a Task is contingent upon another Task.
	Equivalence	Signals that two elements are essentially equivalent
	Explanation	Signals that one element explains another element
	Grounding	Asserts that the one element provides the grounds for another
	Inconsistency	Signals that one element is inconsistent with another

	Pointer	Cross-links two elements without implying any semantic relationship between the elements (*NB: Pointer cross-relations are only displayed when navigating from the Source to the Target*)
	Relevance	Indicates that one element is related to another in an unspecified way
	Responsibility	Identifies that a Protagonist is responsible for a task
	Variation	Asserts that one element is a variation of another element

Table showing "cross links", relationships between items on the map and other maps[13]

Debategraph provides a side menu offering further help in construction of maps and additional details; there are alternative ways of viewing the maps which allow for the inclusion of images and videos. The maps can be embedded on other sites, with changes made to a map on a given site shared across the other maps. The maps can be navigated such that when a user clicks on a particular element of the map, the perspective of the map changes revealing further connections. In this sense Debategraph hopes to capture the interconnected nature of many issues that are subject to argument mapping.

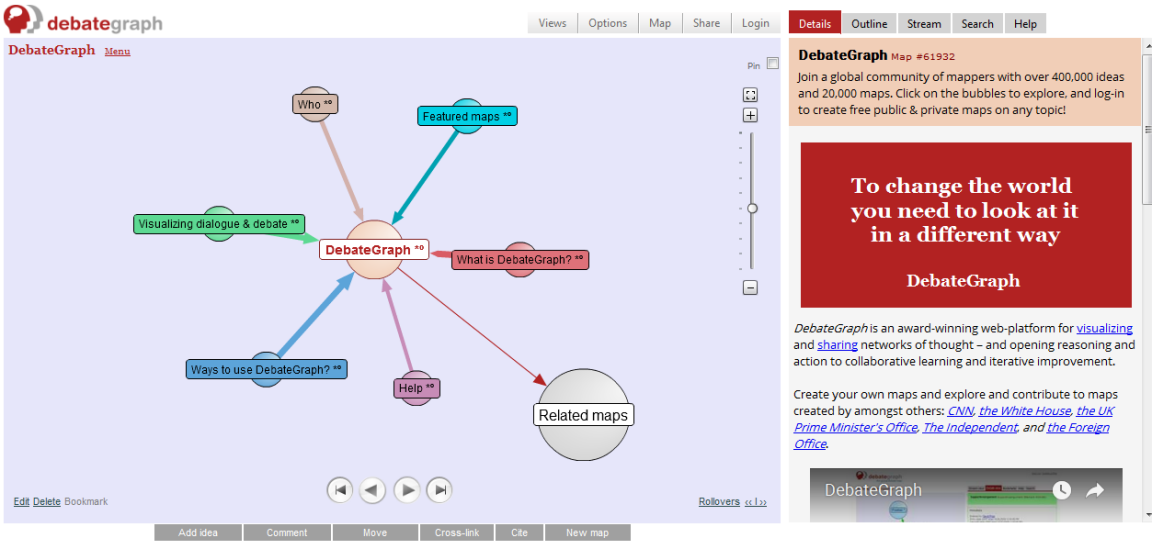
In comparison to platforms taking a similar approach to argument mapping and visualisation, Debategraph could be said to offer a richer experience in relation to the kinds of media it supports, the options it allows for visualisation and navigation, and the aesthetic of the platform. The platform includes a number of novel features not found in more basic argument mapping platforms, notably the maps' capacity to rearrange themselves around particular points as users navigate and the extensive ontology of the maps. This provides an interesting approach to issues of framing and structuring debate. Of the platforms reviewed, Debategraph is one of the most successful in relation to applications by other organisations

[13] http://debategraph.org/Stream.aspx?nid=400384&vt=bubble&dc=focus

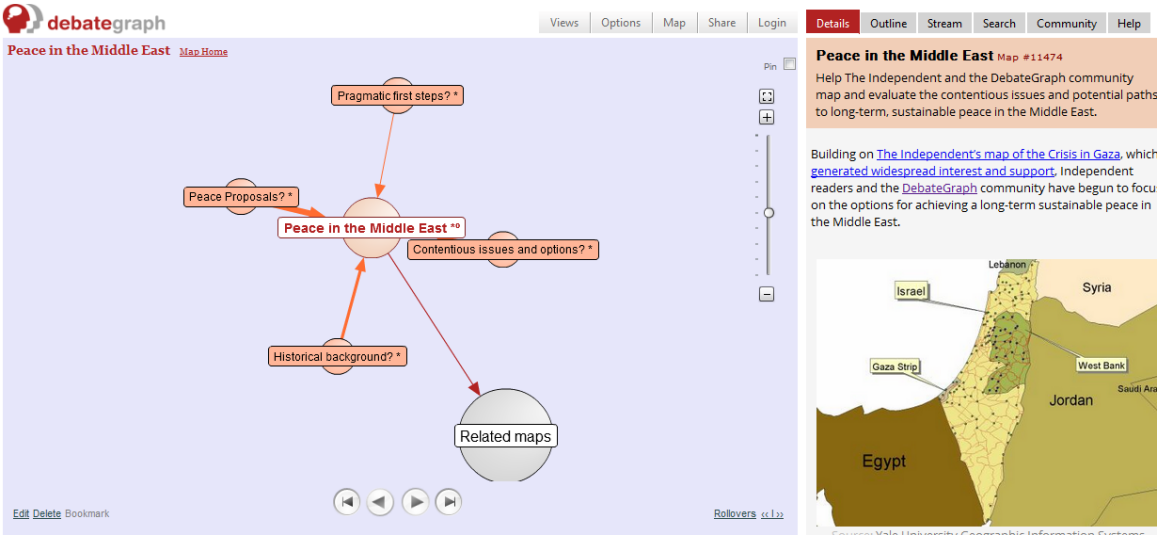
and existing research and literature. The relative success of the platform and novel design choices make it very relevant for the purposes of the current study.

Screenshots and Images of the Platform

The screenshots below provide illustrations of the design of debategraph.



Opening page of Debategraph[14]



Example of Debategraph map[15]

[14] http://debategraph.org/home

[15] http://debategraph.org/Stream.aspx?nid=11474&vt=bubble&dc=focus

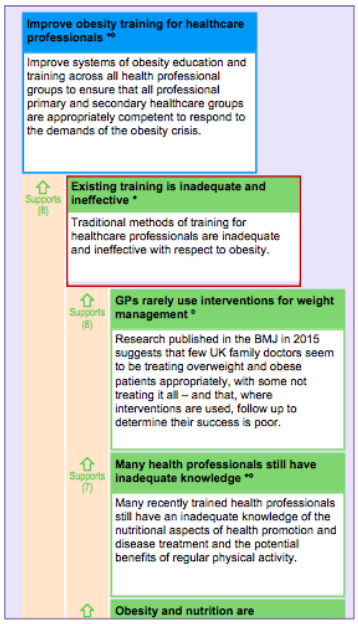


Figure 2. A DebateGraph proposal (blue box) is backed up by a number of supporting arguments (green boxes).

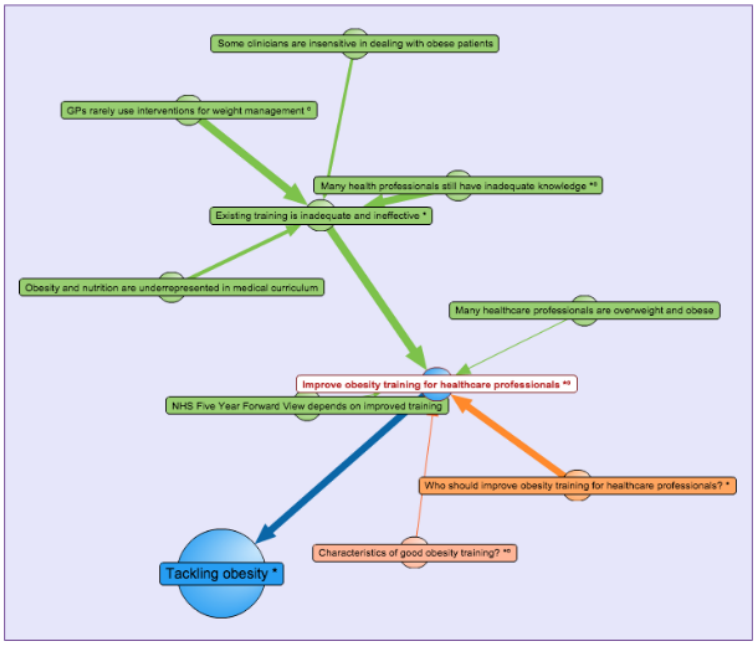


Figure 3. Zooming out from the proposal in Figure 2 reveals that it is part of a wider discussion on improving obesity training in healthcare professionals.

(Tambouris et al 2011:4)

Literature and Applications of the Platform

The Debategraph site claims that the platform is being used in over 100 countries and lists applications in areas including "education, health, governance, media, conferences, group facilitation, conflict resolution and public consultation and planning" (Debategraph 2017). It has been used by organisations such as CNN, the White House (on open government), the UK Prime Minister's Office (on media policy), The Independent, Bill and Melinda Gates Foundation (on global health), and the Foreign Office (Bullen and Price 2015, Debategraph 2017). Tambouris et al (2011) observe that Debategraph is one of the most mature and stable examples of argument visualisation tools, and there have been studies using the tool in a number of different contexts. Bullen and Price (2015) explore the use of Debategraph in supporting analysis of complex policy problems, specifically obesity. One policy maker involved in the study emphasised the potential of Debategraph as a method of collecting various different types of data on an issue and presenting it clearly, with less interest in its capacity to support debate (Capehorn in Bullen and Price 2015). Crossley-Frolick (2017) explores the use of debategraph in educating undergraduate political science students. A class used debategraph to engage in debates concerning complex issues such as policy on climate change and sex trafficking. Crossley-Frolick found that the tool did improve students'

understanding of the topic, yet the students reported issues with the navigation system and ease of use of the platform. A further issue highlighted was privacy, as users who were not part of the class began editing debates. Tambouris et al (2011) studied the experiences of policy makers and experts using Debategraph in the context of European legislation. In this study Debategraph was used in conjunction with other software called WAVE. The study found mixed results again with the usability of the platform, though participants noted that ease of use improved after a short learning period. Participants noted that the platform was attractive and would be most appropriate for analysis and drafting and evaluation of policy, as well as consultation on policy, while it would be less useful for formulation or implementation of policy (Tambouris et al 2011). Scheuer et al (2010) note Debategraph's support for large scale argumentation and large community use. They highlight potential problems with graphical representation being used for debates, notably that they might feel unnatural and unintuitive and depending on the topic and number of participants, the boxes and arrows may be substantial leading to the maps becoming cluttered and hard to read.

Deliberatorium

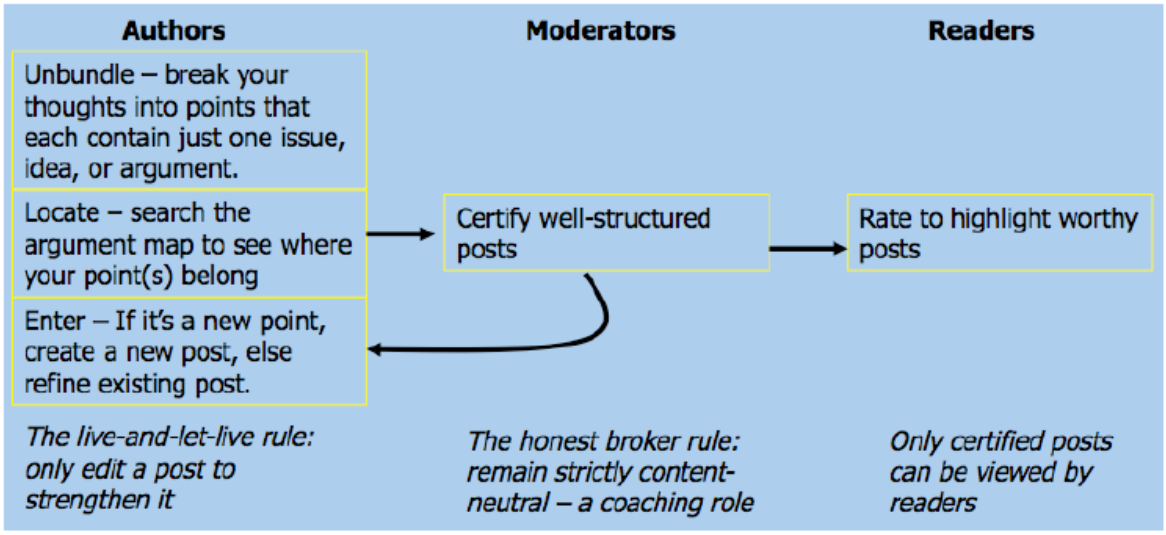
Background, Objectives and Design of the Platform

The Deliberatorium (formerly known as the Collaboratorium) is described as an "innovative internet tool whose goal is to enable better collaborative deliberation" (Deliberatorium 2017). The project is developed and led by Mark Klein at MIT and draws on the field of collective intelligence and specifically the IBIS to map arguments. Discussion is organised by topic and broken down into the following components:

Issue: A problem that needs to be solved
Idea: An approach for addressing that issue
Argument: A point for (pro) or against (con) an idea (Deliberatorium 2017)

The literature on the deliberatorium describes the following expectations of authors, that authors submit a single issue, idea or argument, that it not replicate a point that has already been made, and should be attached to the appropriate part of the map. Posts should only be edited to strengthen them, if one disagrees one should create a new post that counters the

idea (the live and let live rule) (Klein 2011). To guide argumentation, moderators evaluate posts for correct structure and validity (Scheuer et al 2010:8)



The map-building process used by the Deliberatorium.

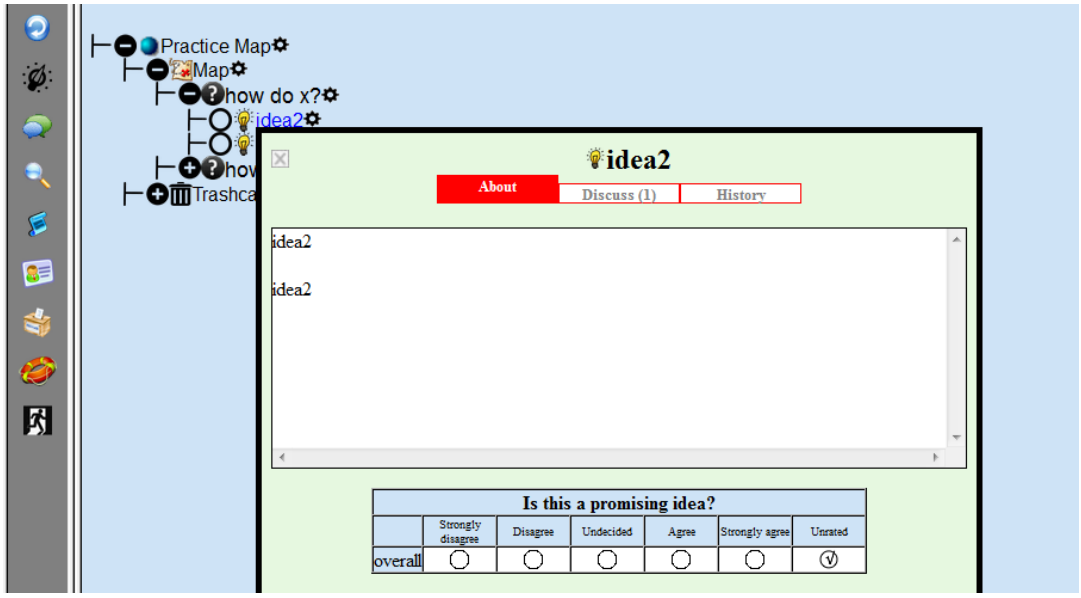
(Klein 2011:5)

It is estimated that 1 moderator for every 20 contributors is required for sufficient maintenance of the Deliberatorium (Klein 2011). In addition to the map there is a chat room area for less formalised conversation.

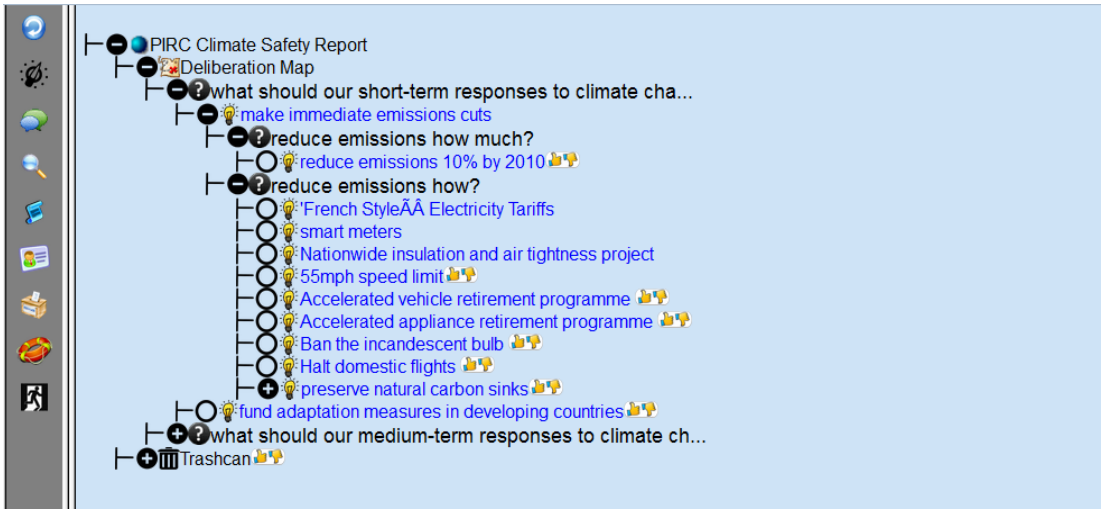
The platform provides a good example of the argument mapping approach, based on the IBIS approach common in collective intelligence literature. It is supported by applications in practice that demonstrate its use in large scale discussions leading to a decision (discussed in greater detail below). The developers directly describe the intention to address challenges relating to feasibility and scale, participant behaviour and citizen capacity as well as information management. The platform is also a notable example of the combination of synchronous and asynchronous communication to support deliberation (Delborne et al 2011).

Images and Screenshots of the Platform

The screenshots below provide an illustration of the visual representation and aesthetics of the delibratorium. The Scholio project is currently working on the aesthetics of Deliberatoirum.



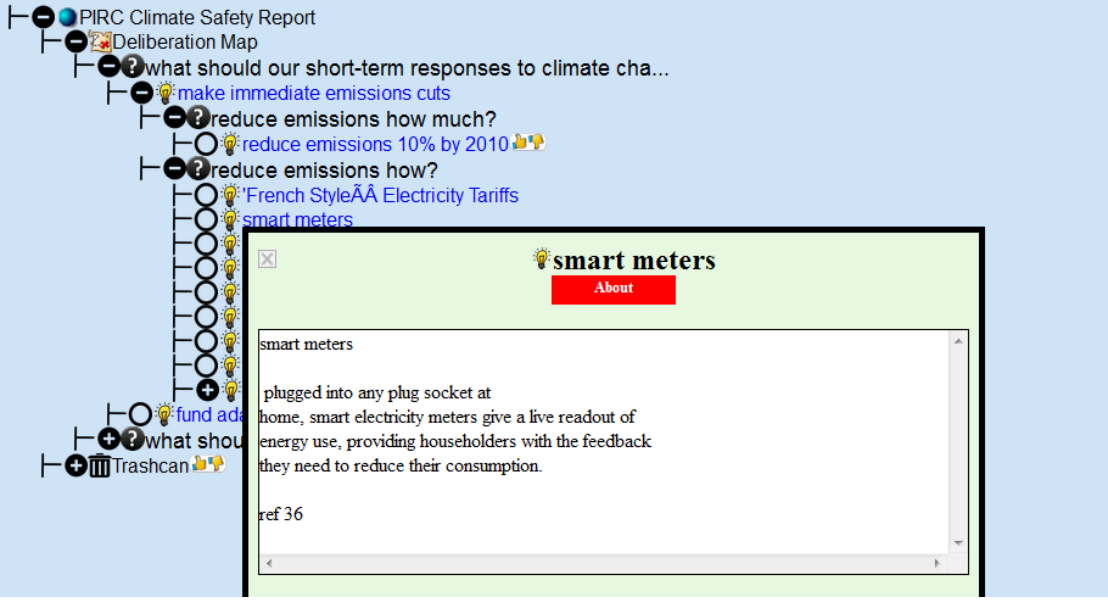
Displaying how users can introduce an idea and vote on it[16]



Displaying the general argument map[17]

[16] http://franc2.mit.edu:8000/ci/show-top

[17] http://deliberatorium.mit.edu/



Displaying a user clicking on an individual idea in an argument map to get further detail[18]

Literature and Applications of the Platform

The Deliberatorium has been tested and applied in a number of settings. Initially "The Carbon Offsetting Thought Experiment" attempted to translate a 13 page discussion into a much more succinct 8 item deliberation map (Klein et al 2012). The first major evaluation of the Deliberatoirum involved 220 masters students at the University of Naples in a debate about bio fuels. The experiment focused on whether the demands of structure would put off participants, and whether moderators were able to deal with the demands of large scale participation. The research reported that neither of these concerns were problematic and they observed very high levels of user participation (Klein 2011). The students created a map that was judged by content experts to represent a remarkably comprehensive and well organised review of the key issues and options around bio fuel adoption (Klein 2011). Further evaluations of the Deliberatorium have taken place with Intel Corporation, US Bureau of Land Management, the University of Zurich and HMC Inc (Klein 2011). The Deliberatorium has been used by the Italian Democratic Party in an internal party debate over electoral reform. This experiment involved 400 people, with two groups of 160 participants assigned to discuss the topic through either the Deliberatorium or through a standard forum. It found that the restricted structure of discussion did not affect users' retention rate nor their average daily

[18] http://deliberatorium.mit.edu/

activity, while the argument map reduces the quantity of ideas posted by users, the ideas posted tended to be more developed in terms of supporting arguments (Klein et al 2012). This suggests certain advantages and disadvantages to the tool that may determine where it is best applied. Scheuer et al (2010) discuss Collaboratorium, an earlier version of Deliberatorium, describing how the platform supports the notion of collective intelligence by allowing participants to rate contributions, the highest rated being considered the community's decisions.

Parmenides

Background and Objectives of the Platform

Parmenides is described as an "e-participation forum... a system for deliberative democracy that allows the government to present policy proposals to the public and lets the public submit their opinion on the policy and its justification" (Parmenides 2017, Cartwright et al 2009). In other literature Parmenides has been described as a platform that collects arguments for and against a given proposal (Atkinson et al 2004).

Parmenides is informed by informal logic, specifically a modification of the argumentation schemes of Walton and the Belief Desire Intention architecture (Atkinson 2006). This guides the platforms heavily structured interface design. The platform webpage explains that "Parmenides exploits two methods of argument representation: Argumentation schemes to structure policy proposals and argumentation frameworks to diagrammatically analyse the opinions submitted by users" (Parmenides 2017). It consists of four main components: a debate creator (administrators can create a debate by instantiating elements of the argumentation scheme); the Parmenides interface (allowing people to participate and submit their opinions); administration tools (allowing argumentation schemes to be added); and analysis tools (allowing information submitted to be analysed using argumentation frameworks and value-based argumentation frameworks) (Cartwright et al 2009).

Parmenides dialogue structure sees the justification for an action as involving the following argumentation scheme: an understanding of the current situation; a view of the situation which will result from the performance of the action; features of the new situation which are considered desirable (the aspects which the action was performed in order to realise); the

social goals which are promoted by these features (the reasons why they are desirable) (Atkinson et al 2004). From this scheme, a series of potential ways of 'attacking' a proposal are identified.

Table 1. Table of Attacks

Attack	Variants	Description
1	2	Disagree with the description of the current situation
2	7	Disagree with the consequences of the proposed action
3	6	Disagree that the desired features are part of the consequences
4	4	Disagree that these features promote the desired value
5	1	Believe the consequences can be realized by some alternative action
6	1	Believe the desired features can be realized through some alternative action
7	1	Believe that an alternative action realizes the desired value
8	1	Believe the action has undesirable side effects which demote the desired value
9	1	Believe the action has undesirable side effects which demote some other value
10	2	Agree that the action should be performed, but for different reasons
11	3	Believe the action will preclude some more desirable action
12	1	Believe the action is impossible
13	2	Believe the circumstances or consequences as described are not possible
14	1	Believe the desired features cannot be realized
15	1	Disagree that the desired value is worth promoting

(Atkinson et al 2004:314)

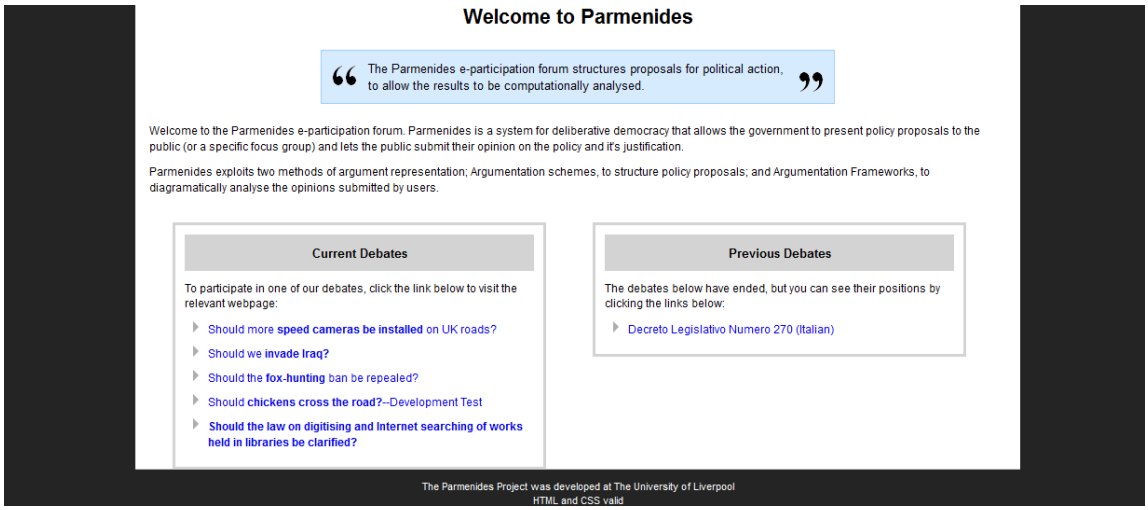
Attacks 12, 13, 14 and 3 (detailed in the table above) are neglected on the grounds that the developers felt that an argument proposed through their system could be presumed to be sound and describe actions that were possible. The remaining attacks are used for the structuring of an interface that guides the user through a justification for a proposal, giving users the opportunity to disagree at selected points and collecting information on where most users disagree with a proposal. Attacks 7, 8, 9 and 11 are used in the structure as the basis to allow users to submit alternative proposals for action (Atkinson et al 2004). In addition to the platform itself there are further tools to support information gathering with Parmenides including a debate creator, profiling information of those who participate and analysis tools (Parmenides 2017).

Parmenides is unique amongst online deliberation platforms in its approach of taking users through a heavily structured dialogue process. It represents an interesting application of informal logic theory to the problem of online deliberation. Applications of the platform

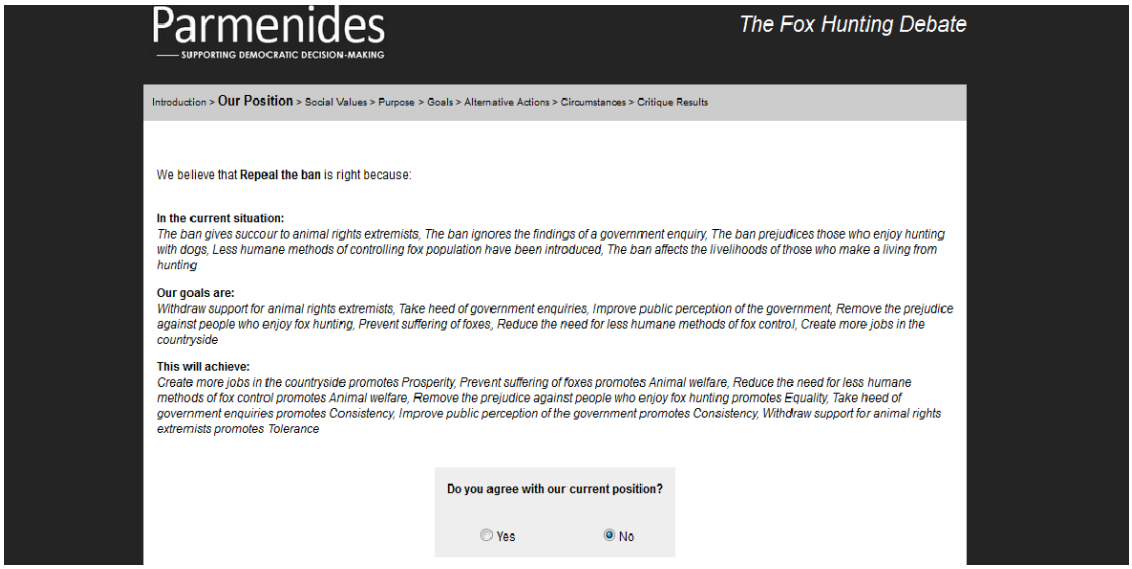
however are limited and the current publicly available version of the platform is restricted to four specific debates.

Images and Screenshots of the Platform

The design of Parmenides is illustrated below with the example of a fox hunting debate.



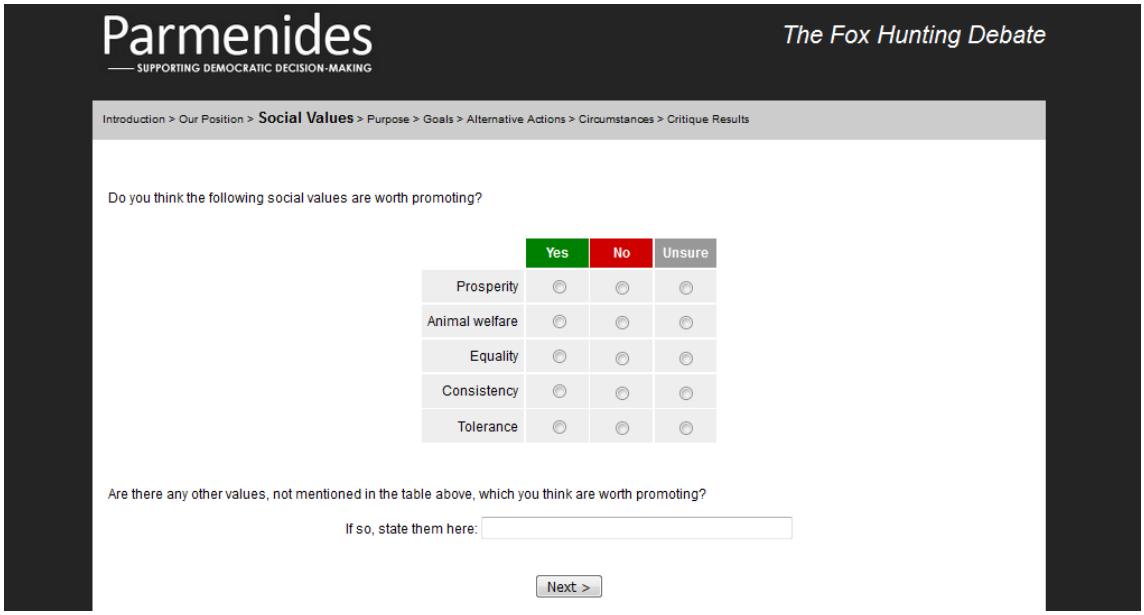
Displaying home page of the Parmenides platform[19]



Displaying introduction to specific topic, in which a user gives their initial response[20]

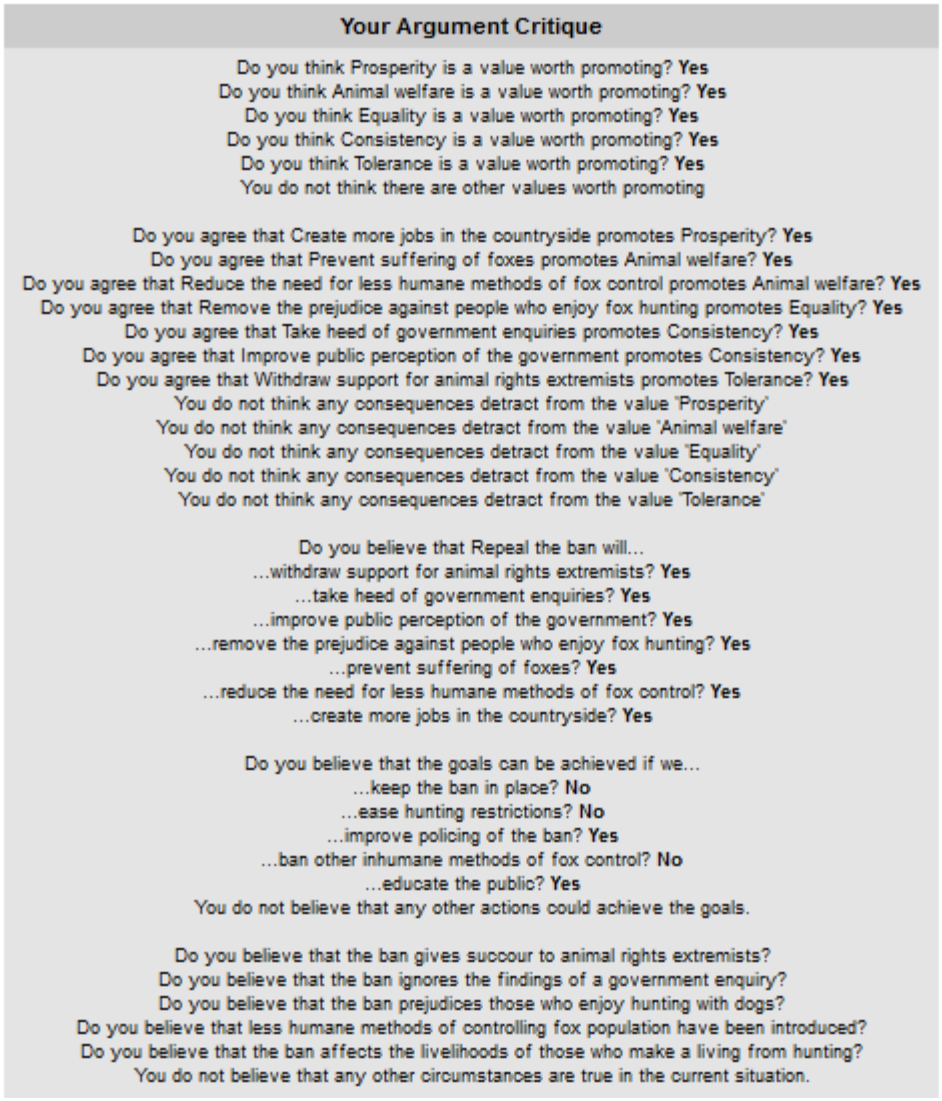
[19] http://cgi.csc.liv.ac.uk/~parmenides/foxhunting/

[20] http://cgi.csc.liv.ac.uk/~parmenides/



Displaying an example of the structured interface, in which a user indicates their commitment to particular values, and is given the option of including any additional values relevant to the topic[21]

[21] http://cgi.csc.liv.ac.uk/~parmenides/foxhunting/



Parmenides (2017) Displays a summary of a user's responses to a particular argument[22]

Literature and Applications of the Platform

A version of Parmenides is publicly available and allows for the exploration of four current debates, including fox hunting and speed cameras, and a record of one previous debate. Although the literature discusses Parmenides use in the context of e-participation and e-democracy (Atkinson et al 2004, Cartwright et al 2009), the application of the tool in this area has been limited and the focus of its current use has moved towards private application in the field of law. Atkinson et al (2004) argued that Parmenides was usable by its target audience and can be used to identify points of disagreement, and record them so that the weight of opinion on various issues can be gauged. Cartwright and Atkinson (2008) document

[22] http://cgi.csc.liv.ac.uk/~parmenides/foxhunting/

the development of tools for e-democracy, including allowing the system to collect opinions on different topics, analyse data, and demographic profiling of users. The paper describes the intention to conduct large scale field tests to validate the effectiveness of the system.

Pol.is

Background, Objectives and Design

Pol.is "helps organisations understand themselves by visualizing what their members think (Pol.is 2017). It aims to allow the gathering of open ended feedback from large groups of people. Users click "agree", "disagree" or "pass" in response to statements others have contributed. Users are able to submit their own comments; however, they are not allowed to reply directly to a comment. Pol.is runs statistical analysis on these voting patterns, surfacing opinion groups, comments that brought groups together and comments that found broad consensus (Pol.is 2017). It then provides a visual representation of these groups and clusters of opinion. The decision to represent clusters of opinion rather than placing those opinions in the context of an argument map and not allowing direct responses to messages distinguishes Pol.is from many other approaches to online deliberation and online communication in general.

Pol.is was conceived during the time of the Arab Spring and Occupy Wall Street movement, and sought to develop a comment system that could scale up and retain coherence with large groups of people. The developers of Pol.is claim that the design choice of not allowing replies is key to making it possible to make sense of large groups; it is claimed that arguments do not scale, and the moment one begins to track a conversation between individuals, and other people's responses to specific comments, then that sense of scale breaks down (Megill 2016).

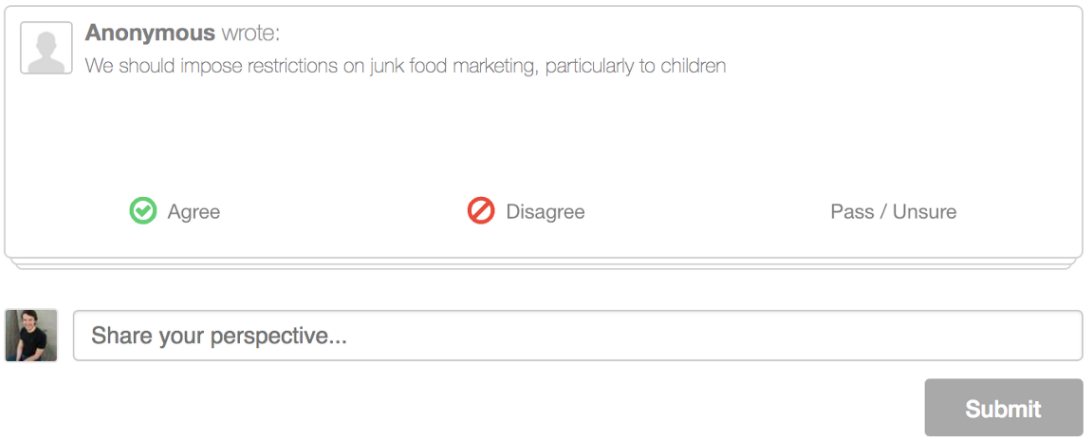
The developers further state the aims of ensuring people feel safe, listened to, that people may participate at any time in the life cycle of the conversation, that they have a sense of what others felt and minority opinions are preserved and represented (Pol.is 2017). In allowing structured responses (agree, disagree, pass) and no direct replies it is claimed that problems of trolling and other negative behaviour are addressed. The visual representation aims to ensure that participants can see all voices represented as well as any points of consensus, particularly amongst otherwise disparate groups. In this sense, it is claimed the

problems of echo chambers and filter bubbles are addressed through these choices around visual representation (Pol.is 2017). In order for Pol.is to be more effective in representing the different views of a collective group it encourages participants to respond rather than submitting original comments. One of the ways it does this is by using a fuzzy search to show users other comments that may be similar to the one they are typing.

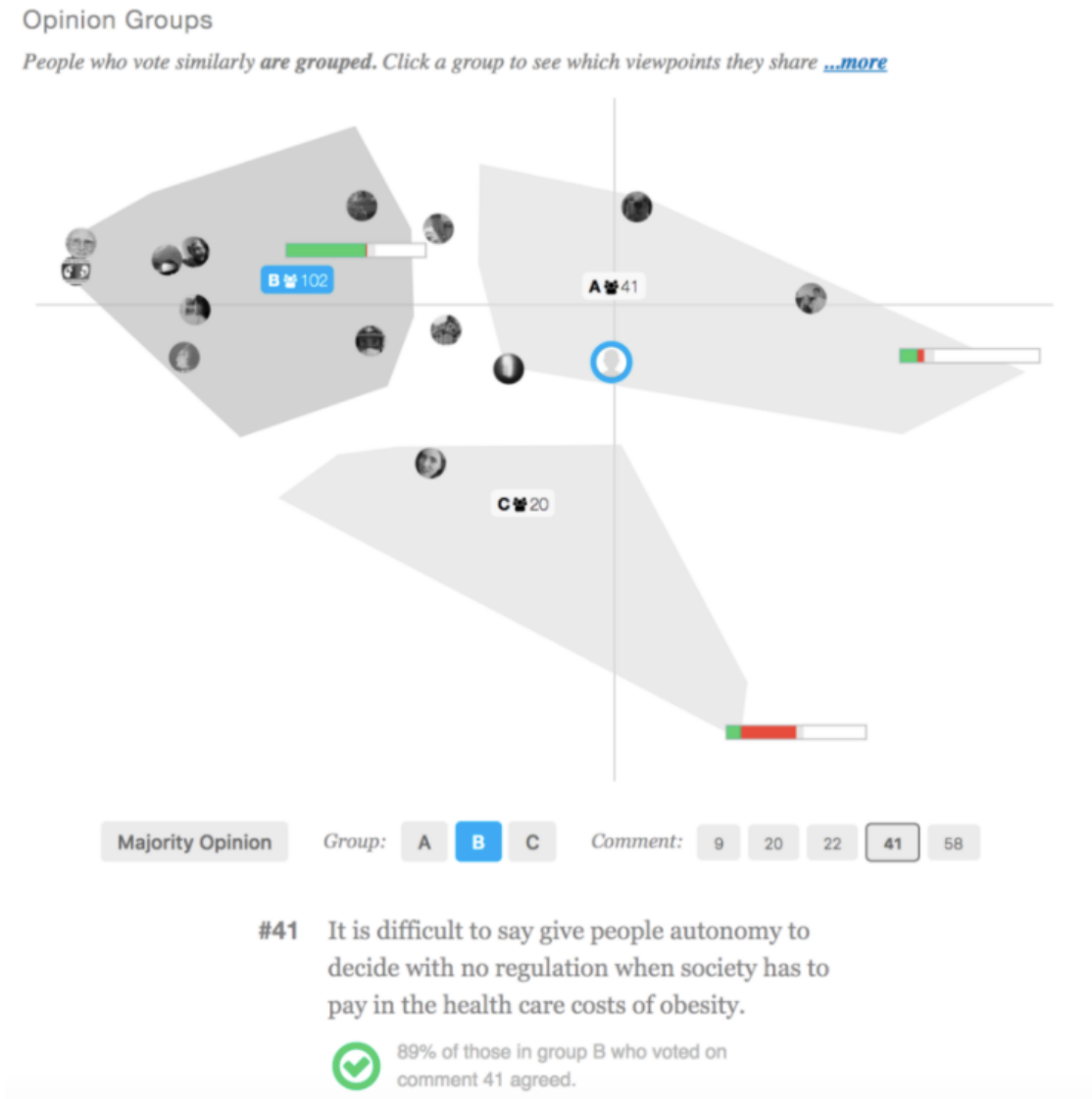
Pol.is represents an interesting example of the use of AI in online deliberation. It has been successfully applied in a number of contexts, notably in decision making in Taiwan. A number of design choices make it unusual amongst online deliberation platforms; notably the fact that the platform does not attempt to directly support the critical work of placing opinions within the context of an argument structure, and the decision not to allow direct replies to messages. The platform is notable for its unique design and its successful applications.

Images and Screenshots of the Platform

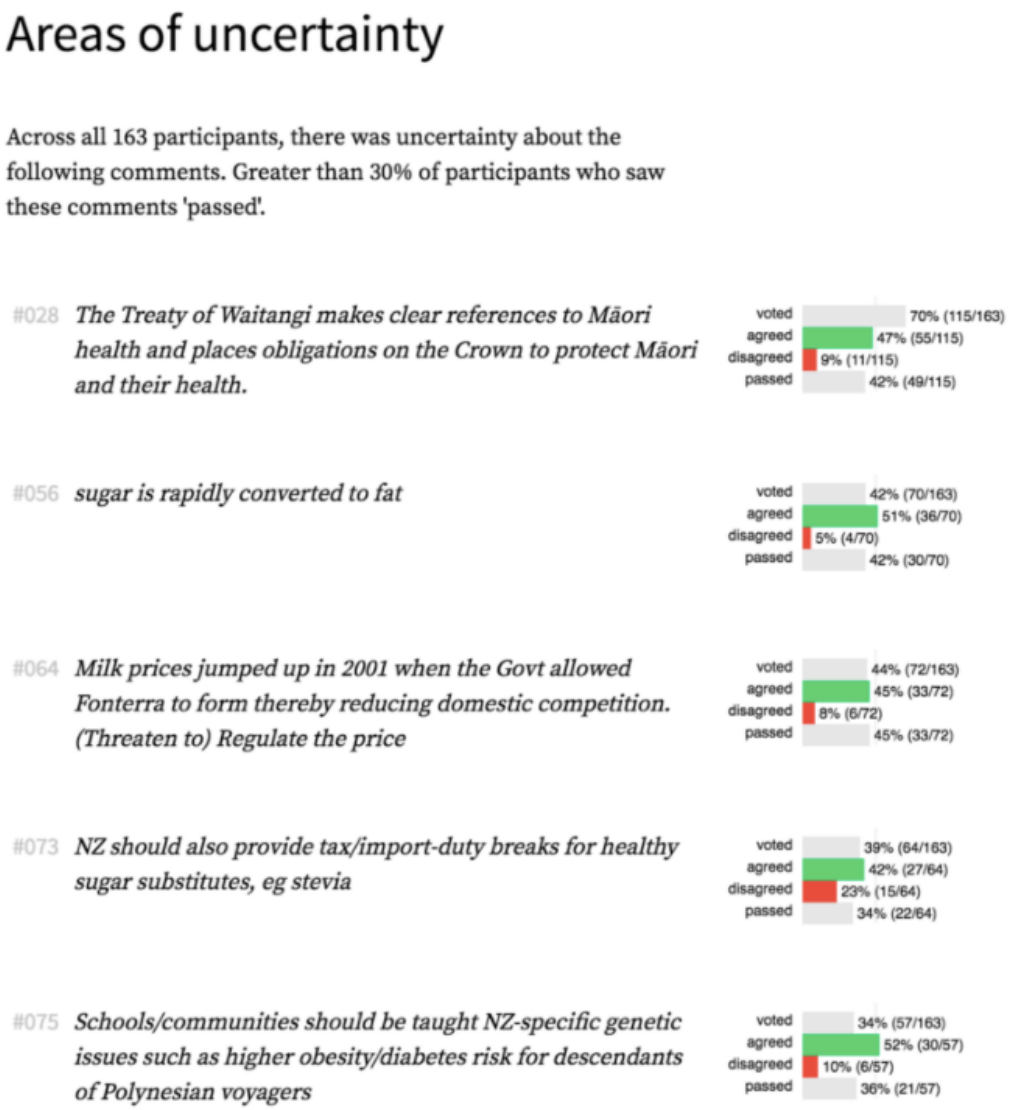
The screenshot below illustrates the visualisation provided by polis of comments and groups.



Conversation interface (Megill 2017)



Representation of opinion groups, highlighting the largest group, group B (Megill 2017)



Metadata on the group, including information on areas of uncertainty (Megil 2017)

Literature and Applications of the Platform

Pol.is has been used in a number of settings, notably in Taiwan, where the project vTaiwan used Pol.is to address particular issues such as liquor sales, crowdfunding, Uber, and Airbnb (Megill 2016, Berman 2017, Barry 2016, Tang 2016). In this case, decision making took the form of four stages. First, Pol.is was distributed through Facebook ads and networks targeting participants. Public meetings were then broadcast where scholars and officials responded to the comments emerging through Pol.is. This was followed by face to face stakeholder meetings broadcast to other participants. In the final stage, Barry (2016) describes how Pol.is was used in a binding way, with the government committing to either transform consensus into national legislature or provide a point by point explanation of why this is not possible.

These applications have been reported to be successful, for example it is claimed that the issue of online liquor sales had been in deadlock for five or six years, but through vTaiwan and the use of Polis a decision had been reached in three to five months. As of February 2018, 26 cases have been discussed through vTaiwan, 80% have led to decisive action from the government (vTaiwan 2018). Tang (2016) describes how the case concerning Uber and Taxi services resulted in the administration pledging to ratify all Pol.is consensus items into new regulation. As an indication of the success of the process, Taiwan's premier is quoted as saying "all substantial national issues should go through a vTaiwan-like process" (Barry 2016).

Rbutr

Background, Objectives and Design

Rbutr "is a community-driven app which connects webpages together on the basis that one page argues against the other" (Rbutr 2017). It utilises crowdsourcing to identify rebuttals and critical responses to a given web page or article. It was initially developed as a plug-in alerting users to rebuttals of arguments. There is an additional frame option to view rebuttals, and an accompanying website offering further functions. The developers of Rbutr describe its aims as being to promote critical thinking for future generations, tackling the problem of filter bubbles and ensuring that "misinformation is corrected, scams are exposed... and context is provided to a claim that allows readers access to the full story" (Rbutr 2017).

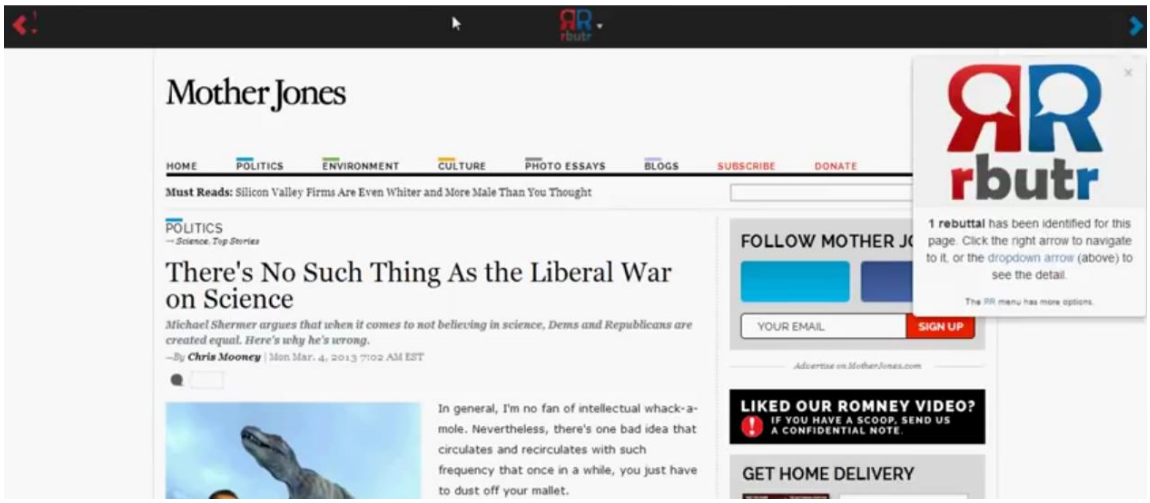
Users of Rbutr can use the plug-in to submit rebuttals. Users are able to link one page to another page that contains a rebuttal of the first. Users are also able to add relevant tags. Rbutr also utilises social media, for example it identifies where an article has been linked to by Twitter users and allows for an automatic response alerting that user to rebuttals of that article. A given article can have a number of rebuttals linked to it, these rebuttals can be ranked by users in the hope that people will be directed to what is considered to be the best example of a rebuttal of a given article.

The Rbutr website states that the project is run by a small team with very little funding. It received seed funding and support from the Start Up Chile Programme, the developers made Rbutr open source and non-profit and are currently engaged in fundraising with educational

organisations, fact checking organisations and publishing platforms as well as looking for volunteers and donors (Rbutr 2017). Rbutr is a good example of an annotation approach to argument representation and online deliberation. It aims to address a specific set of challenges in online deliberation, the filter bubble and polarisation of debate, and aims to foster critical thinking and engagement with alternative viewpoints.

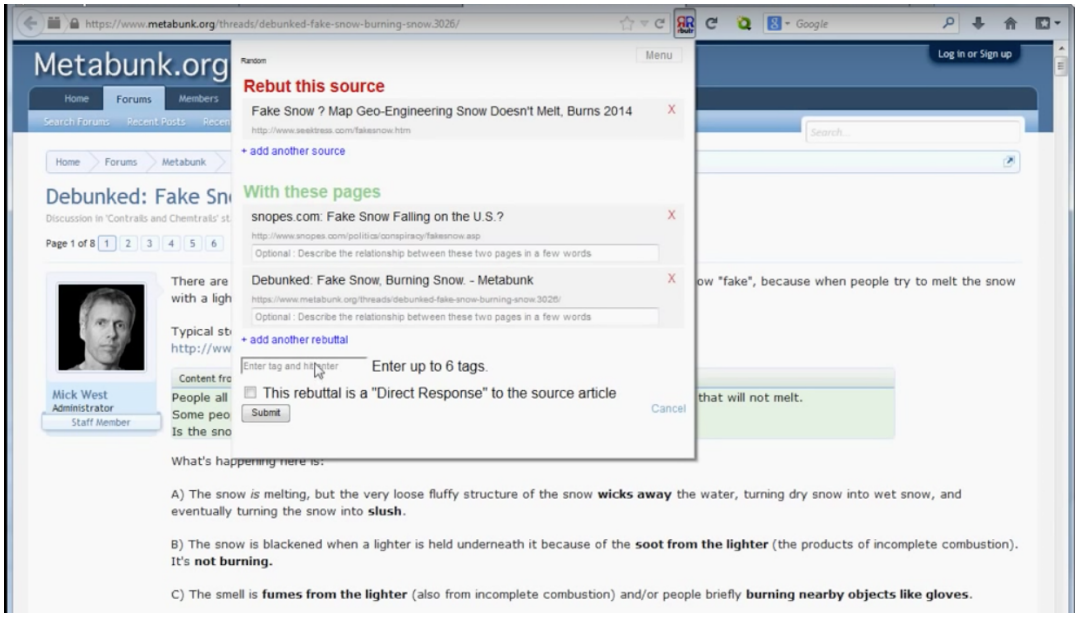
Images and Screenshots of the Platform

The screenshots below illustrate Rbutr's design.

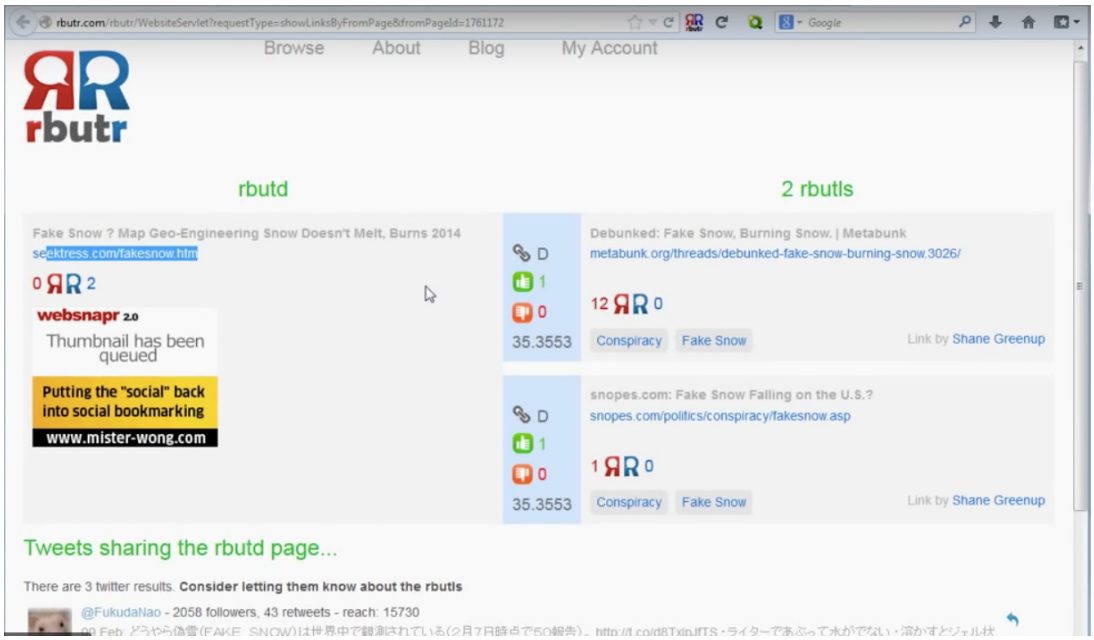


Displaying how Rbutr appears when visiting a website[23]

[23] https://www.youtube.com/watch?v=V9qi3vaLKyU



Interface for adding rebuttals[24]



Displaying Rbutr's website, displaying the rebutted article, 2 rebuttals, and details of tweets sharing the rebutted article[25]

Literature and Applications of the Platform

There is currently no literature on the use of Rbutr, however a study into its use in an educational context is being undertaken currently (Rbutr 2017b). The developer, Shane

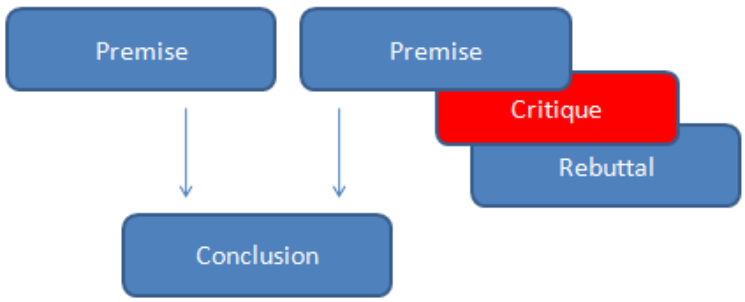
[24] http://www.rbutr.com
[25] http://www.rbutr.com

Greenup, describes how Rbutr has reached a peak of 20,000 users and has been surprisingly robust. It has not experienced any problems with spam and every rebuttal has been appropriate.

Truthmapping

Background, Objectives and Design of the Platform

Truth Mapping is a website that allows people to construct argument maps. The developers describe the design of Truthmapping as an attempt to resolve the problem of "noise", which is associated with forums organised by time. The problem of "noise" is attributed to a number of factors: Digression from the topic, the "soapbox problem" and participants speaking past one another. The "soapbox problem", it is argued, is a result of participants being incentivised to be the last person to talk or the most vocal. It is argued that this is a problem in forums organised by time where a person is most likely to be heard if their comment is listed first or if they make the comment repeatedly. Similarly, when participants digress or speak past one another they produce information that is redundant and detracts from the information more relevant to the discussion (Truthmapping 2017a). Truthmapping is an attempt to resolve these issues through the use of argument visualisation. This approach to argument mapping was created by the developers of Truthmapping and is not grounded in a specific theoretical account of argument. The ontology of the argument maps consists of conclusions supported by premises; these premises can then be critiqued and those critiques rebutted. This is illustrated below.

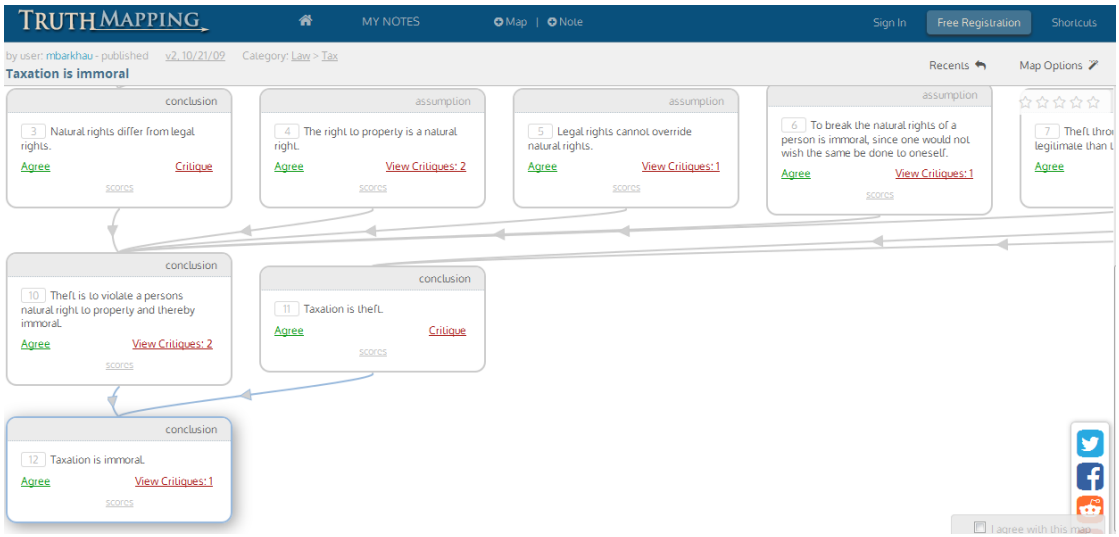


Truthmapping 2017

Only one rebuttal can be added to a critique. These elements can be edited; the final draft being visible to users, while the previous drafts are archived. This process is intended to ensure that the best examples of the critiques and rebuttals are preserved. It is claimed this mechanism removes the incentive of the "soapbox problem" and discourages digression (Truthmapping 2017a). Truthmapping is a good example of argument mapping techniques being used for general public discussion and political debate, the attempt to limit rebuttals through an editing process also represents an interesting approach to the issue of information management that is not found in most other argument mapping tools.

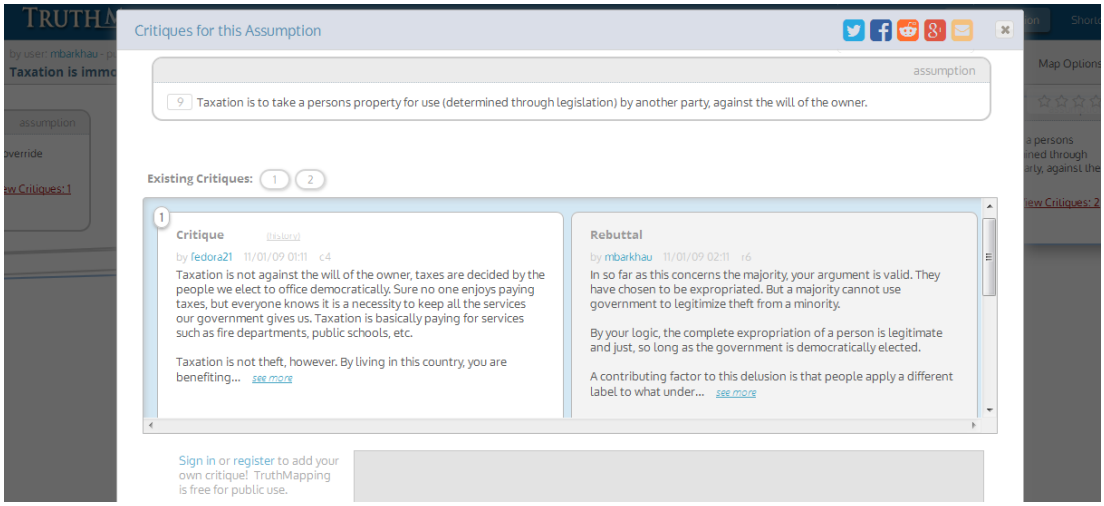
Images and Screenshots of the Platform

The screenshots below illustrate the design and aesthetics of Truthmapping.



Displaying general view of argument map[26]

[26] https://www.truthmapping.com/map/806/#s5361



Displaying a user clicking on individual arguments within the map to view further details[27]

Literature and Applications of the Platform

A literature search found no details on applications or studies of Truthmapping, beyond the material available on the Truthmapping site. There is a publicly available version of Truthmapping which limits the number of maps one can publish, in addition there are subscription plans for small groups and larger groups aimed at non-profit and educational organisations with additional features (Truthmapping 2017b). The publicly available version of Truthmapping has been running for over 10 years and continues to have regular visitors and published maps. To date the most popular categories of topic concern Philosophy (89 maps), Politics (73 maps) and Social Issues (59 maps).

Conclusion

What is clear from this review is that there is a diversity of novel designs for the representation of ideas and arguments and the promotion of elements of deliberation online. The close analysis of twelve of the most well respected designs currently in operation gives us a sense of the breadth of the field and the diversity of approaches to supporting aspects of deliberation. However, it is hard to capture the full range of activity because of methodological challenges in defining the population and its characteristics. We are also victims of the speed of change in the field: new designs emerge rapidly to improve the

[27] https://www.truthmapping.com/map/806/#t5363-c5484

interface, aesthetics and argument representation. Practice is moving faster than our capacity to conceptualise and compare.

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