Using Computational Argumentation to Support E-participation

Dan Cartwright and Katie Atkinson, University of Liverpool

Internet-based tools that encourage public participation in debates concerning policy issues have been recognized as a good way to engage the electorate with political issues. In addition, such systems for e-participation can gather, make available, and analyze the public’s contributions to political debate. In recent years, numerous systems have appeared with the aim of meeting these objectives (see the “Existing Tools” sidebar).

In this article we discuss a system called Parmenides (www.csc.liv.ac.uk/~parmenides), which we designed to exploit technological developments to bring democratic processes into the online world. Parmenides is primarily a forum by which government bodies can present policy proposals to the public so that users can submit their opinions on the justification presented for the particular policy. Within Parmenides, the justification for action is structured to exploit a specific representation of persuasive argument based on the use of argumentation schemes and critical questions, following Douglas Walton.\(^1\) Two earlier publications describe the original version of Parmenides and its extensions.\(^2,3\) In this article we describe the latest version, which includes enhanced analysis facilities, and a larger set of argumentation schemes to allow for richer debates. We also give examples of debates that show how the tool can support decision making in e-government.

The Parmenides System

Parmenides is a system for deliberative democracy that allows the government to present policy proposals to the public and lets the public submit their opinions on the policy and its justification.\(^3\) The system uses two mechanisms for argument representation and evaluation: First, it uses argumentation schemes to structure and relate the opinions gathered. Second, it uses argumentation frameworks\(^4\) to evaluate the arguments of concern to a debate and determine which ones would be most acceptable to the system’s users.

Argumentation schemes represent stereotypical patterns of reasoning, whereby the

---


-democracy is a growing area of interest for governments wishing to engage with citizens through the use of new technologies. As a result, researchers have developed several systems to achieve this in the last decade. Prominent examples of online democratic support systems are the several e-consultation systems developed by Ann Macintosh and her colleagues.1 1

The systems support and encourage young people in Scotland to participate in democratic decision-making, and the systems have been tested in the Scottish Parliament. The first of these systems is Highland Youth Voice (www.hyv.org.uk), a system created to “encourage young people living in the Highland region of Scotland to participate in democratic decision-making and, the systems have been passed on to and what action has been taken.

The second tool described by Macintosh and colleagues is Ur’Say, a youth information portal for young people living in Scotland. Ur’Say was a discussion forum “designed to engage a wide range of young people with contemporary issues and to facilitate constructive discussion on a series of topics.” The Web site allowed discussion of one topic at any particular time. After the debates were closed, human moderators could analyze the discussion and provide a short report to organizations with interest in the findings.

Online petitions are a second example of Web-based tools that support e-participation. In November 2006, the British government introduced a mechanism to allow the public to create, sign, and deliver online petitions to the Prime Minister (http://petitions.number10.gov.uk). These e-petitions are intended to replicate their paper-based counterparts to facilitate signature collection, and to make it easier for the government to use e-mail to answer to the concerns raised in the petitions. However, the quality of engagement provided by the e-petitions is questionable because these electronic versions suffer from the same problems as their paper counterparts: mainly, that they conflate several issues within one stock statement, and the stock responses generated might not appropriately address each signatory’s individual concerns on the issue. It therefore becomes important to recognize that individuals have different reasons for taking a stance on a particular issue, and that this will affect the relevance and subsequent persuasive force of the arguments posed to counter objections to a proposal. Furthermore, if online tools are used to support such debates, they too must provide structure to enhance the quality of engagement while remaining easy to use.

Several available e-democracy tools impose more structure on the information provided and gathered than do the e-petitions. One example is the Zeno argumentation framework,2 described by its authors as a framework “designed to be used in mediation systems, an advanced kind of electronic discussion forum with special support for argumentation, negotiation, and other structured forms of group decision making.” The framework is based upon a formal model of argumentation that provides structure to the issues and their relative merit within a debate. However, by introducing such structure, the system can become difficult to understand and use by laypersons. This problem is often encountered when any such interactive system attempts to decompose and classify arguments.

There are also tools for argument mapping that show relations between arguments and their contributions within a debate. One example is Argunet (www.argunet.org), which provides a platform for users to create, share, and present argument maps that they construct themselves. Another notable system is QuestMap,3 a tool designed for virtual rather than face-to-face meetings. QuestMap lets debate participants put forward ideas, pros and cons of these ideas, and questions. The tool shows these different types of submissions in a graphical framework linked by arrows. More recent systems employ Web 2.0 technologies. One notable example is the Cohere system (www.cohereweb.net), by Simon Buckingham Shum and colleagues. Its Web site introduces Cohere as a “tool for making meaningful connections between ideas” with “argumentation [being] just one possible application that users may want to pursue.” The tool lets users share and create connections between “ideas,” which can be thought of as positions in a debate context (either supporting or challenging other positions that they are connected to).

Argument-mapping tools are useful for the purpose of debate visualization, but they do not always provide inference and evaluation mechanisms. It is often left to the users to make logical connections between the arguments they put forward in a debate, and this can present validation and usability issues. Crucially, because users are provided with little guidance on how to structure their arguments, it is often difficult to see precisely how different contributions relate to one another. We considered these issues, and those related to the existing tools we’ve described, in developing the Parmenides system.

References

basis for computational tools such as the Parmenides system (as is the case for some of the tools discussed in the “Existing Tools” sidebar).

For example, an early, popular form of argument representation is Stephen Toulmin’s schema, which more effectively enabled reasoning about the defeasible nature of arguments than did prior logic-based schemes. Although innovative in its day, Toulmin’s schema now appears somewhat inflexible in the light of later work on defeasible reasoning and argumentation schemes. The schema doesn’t provide a systematic way of attacking all elements of an argument in the same way that the approach using argumentation schemes and critical questions does. In fact, Toulmin’s schema doesn’t even distinguish between rebuttal and undercut. Furthermore, if we wish to make a clear distinction between reasoning about beliefs and reasoning about actions (our focus is on actions, whereas Toulmin’s was on beliefs), we need an approach that allows a variety of different kinds of argument, each with its own defining characteristics, to be put forward in the course of a debate; the argumentation schemes approach makes this possible.

In addition, because argumentation schemes allow near-natural-language representation of arguments, a system using this approach presents arguments in a form more accessible to laypersons. Furthermore, argumentation schemes can also be formalized to allow computational analysis of arguments. (In our approach, we feed argumentation schemes into argumentation frameworks to enable computational evaluation.) Additionally, researchers have described a wide range of argumentation schemes in the relevant literature; we have drawn upon these schemes in developing our system.

The argumentation scheme we used in the first version of Parmenides was one to represent persuasive argument in practical reasoning. We used this particular scheme because its focus is on carrying out an action, and we intended the system as one for reasoning about what action should be taken in the context of a political debate about a particular policy. This scheme, described by Katie Atkinson, Trevor Bench-Capon, and Peter McBurney, is an extension of Walton’s sufficient condition scheme for practical reasoning. Walton’s original scheme is as follows:

\[ \text{W1: G is a goal for agent a, Doing action A is sufficient for agent a to carry out goal G. Therefore, agent a ought to do action A.} \]

The purpose of Atkinson, Bench-Capon, and McBurney’s extended scheme, which they label AS1, is to differentiate several distinct notions conflated in the “goal” of Walton’s original scheme. AS1 is stated as follows:

\[ \text{AS1: In the current circumstances R, we should perform action A, which will result in new circumstances S, which will realize goal G, which will promote some value V.} \]

Instantiations of AS1 provide justifications of proposals for action (which is the conclusion of the scheme). This scheme makes Walton’s notion of a goal more explicit by separating it into three elements: the state of affairs brought about by the action; the goal (the desired features in that state of affairs); and the value (the reason why those features are desirable). The underlying idea in making this distinction is that an action is performed to move from one state of affairs to another. The new state of affairs may have many differences from the current state of affairs, and it may be that only some of them are significant. The significance of these differences is that they make the new state of affairs better with respect to some good valued by the proposer of the argument.

Additionally, the scheme has associated with it critical questions that can be posed to challenge presumptions in an instantiation of the scheme. Each critical question can be seen as an attack on the argument it is posed against. Walton’s original scheme has associated with it four critical questions; the extended AS1 scheme has expanded the number of critical questions to 16. Examples of such critical questions are, “Are the circumstances as described?” “Does the goal promote the value?” and “Are there alternative actions that need to be considered?” The original description of AS1 includes the full list of critical questions, but only a subset are relevant for use in the Parmenides application.

The Parmenides system uses argumentation schemes in its front-end Web site and argumentation frameworks in its back-end analysis tools. Overall, the Parmenides system consists of three main components:

- **Debate Creator.** The first component is a PHP-based Web interface that lets debate administrators create a new debate by instantiating elements of the relevant argumentation scheme. The system then creates the relevant Web site and database source files.
- **Parmenides interface.** The second component is the Web site mentioned in the previous point, which lets people participate in the debate. The system writes data submitted by users to a back-end database.
- **Analysis tools.** The final component is a set of Java-based analysis tools,
which use argumentation frameworks to analyze the data submitted by users.

Since our earlier publication about Parmenides, we have extended the system with respect to each of these elements. This article includes descriptions of the extensions.

Debate Creator
To create a debate, the system administrator accesses the Debate Creator Web site and enters the details of the debate that he wishes to create. These include both details pertaining to the debate itself and technical details that support the debate operation:

- **Debate title and question posed.** Each debate poses the question of whether an action should be carried out—for example, “Should we install more speed cameras?” or “Should we ban fox hunting?”
- **Initial position of the debate.** The administrator creates the initial position by instantiating the argumentation scheme for practical reasoning (AS1). To instantiate this scheme, the administrator must enter the current circumstances, the action to be carried out in response to these circumstances, the goals of the action, and the social values promoted by achievement of the goals.
- **Technical details.** To ensure correct operation of the Web site and analysis tools, these details include items such as the name of the database that will store user responses and the user name and password needed to access this database.

Once the administrator has created the debate by instantiating all of the required details, the system automatically creates the Web site that lets the public participate in the debate and the database source files where the stored responses reside.

Parmenides Interface
When users wish to participate in the debate, they can access the debate through a Web interface, through which they are presented with the policy proposal for the particular debate. The proposal sets out a justification upholding a particular action for the topic under discussion, with the justification being structured in the form of the AS1 argumentation scheme. The interface then leads users in a structured fashion through a series of Web pages that pose the appropriate critical questions to determine which parts of the justification the users agree or disagree with. On each page, the users express their opinions by giving yes and no answers to the critical questions associated with the argumentation scheme.

Users aren’t aware (and have no need to be aware) of the underlying structure for argument representation, but the system does, nevertheless, impose it on the information they submit. Thus, Parmenides allows collection of information structured in a clear and unambiguous fashion, but users don’t need to gain specialist knowledge before they interact with the system. Additionally, the highly structured nature of users’ interaction with the system minimizes the risk of irrelevant or redundant contributions and reduces spam. This is an important consideration in an e-democracy system, where strong feelings among potential users could lead to attempted abuse of the system.

Figure 1, an example Web page from the Parmenides system, shows the initial position of a debate on the proposed installation of more speed cameras on UK roads. As with all debates in the Parmenides system, the initial position of this debate consists of several circumstances, consequences, and social values instantiated using the practical reasoning argumentation scheme we described earlier.

Parmenides Analysis Tools
The Parmenides Java-based analysis tools take the individual critiques of the policy justification that users have submitted to the database and compute a set of statistics about...
the popularity of individual arguments. The analysis tools use argumentation frameworks\(^4\) through which we represent the constituent parts of the initial position of the debate (as shown in Figure 1), along with the number of respondents who agree and disagree with the respective parts. Phan Minh Dung introduced argumentation frameworks as a method for evaluating sets of arguments with respect to how well they defend themselves against attack and defeat from other arguments; they can be represented as graphs. Arguments put into these frameworks are abstract, in the sense that no concern is given to the arguments’ internal structure or content, merely that attack relations between the arguments exist. However, in our system we derive arguments forming such frameworks from attacks made through responses to critical questions posed through the Parmenides Web site.

Framework A in Figure 2 shows an argumentation framework in which there are two arguments, Arg1 and Arg2, such that Arg2 attacks Arg1. In this example framework, Arg2 is not attacked by any other argument and it attacks and defeats Arg1, which has no defenders. Thus, Arg2 is the only accepted argument. Framework B, an example of how argumentation frameworks are used in the Parmenides system, introduces Arg3, which attacks Arg2.

Figure 2. Argumentation frameworks. In Framework A, Arg2 attacks Arg1. Arg2 is not attacked by any other argument, and it defeats Arg1, which has no defenders. Thus, Arg2 is the only accepted argument. Framework B, an example of how argumentation frameworks are used in the Parmenides system, introduces Arg3, which attacks Arg2.

In Parmenides, we consider an argument accepted if a greater number of users express agreement with it, than with its attacking statement. In the example just presented, the analysis tool attaches the number of users that agree with the circumstances to Arg3, and the number of users that disagree with the circumstances to Arg2. Arg1 has no numerical data attached to it; this node’s status depends on the status of its attackers (it is only accepted if none of its attackers are accepted). For example, if most users believe that the circumstances are as described, then Arg3 defeats Arg2, and Arg1 is not defeated. If most believe, for example, that the circumstances are not as described, then Arg3 doesn’t defeat Arg2, and therefore Arg2 defeats Arg1, the overall initial position of the debate.

This representation of argumentation frameworks lets the system administrator easily pinpoint which particular element of the policy justification users agree or disagree with most. For example, the analysis will reveal whether the most contentious part of the justification concerned the description of the facts of the situation, the effects of the action proposed, or whether the consequences do indeed promote the social values stated. Such a fine-grained analysis of the arguments gives the policy’s proponent meaningful information that highlights elements of the justification that must be presented more persuasively or better justified, and elements that could be emphasized to increase the argument’s acceptability. Alternatively, citizens’ critiques and suggestions might
influence the government to alter the policy.

Figure 3 shows an analysis tool screenshot. The tools show defeated argument nodes with red outlines, and undefeated nodes with green outlines. This gives the debate administrator an at-a-glance overview of the debate. As an alternative to the graphical representation of the argumentation framework shown in Figure 3, the debate administrator can also view a textual summary of the debate analysis. The textual summary shows percentage agreement and disagreement with each of the critical questions posed, as well as aggregate statistics (for example, the average agreement with all of the circumstances put forward in the argument).
Debate Examples in Parmenides

A notable feature of the Parmenides system is its capacity for use in debates at different levels of granularity—for example on an international, national, or local level. By way of an example, consider a local debate based in a town called Smalltown. The proposed action is to build a supermarket in the town. The initial position of the debate, instantiated using the practical reasoning argumentation scheme, could be as follows:

In the current circumstances, Smalltown does not have adequate shopping facilities. Smalltown has high unemployment, Smalltown has wasteland suitable for building. Therefore we should build a supermarket. This will result in increased shopping facilities, job opportunities, regeneration of wasteland. Increased shopping facilities promotes convenience, job opportunities promotes prosperity, regeneration of wasteland promotes aesthetics.

As one can imagine, there are many possible reasons for disagreeing with the proposed action of building a new supermarket. For example, Mr. A might be a wildlife enthusiast who disagrees with the proposal to build a supermarket because the building work will destroy animal habitats. Mr. B might be a local corner shop owner who opposes the new supermarket because it is likely to result in reduced profits for his business. In a normal petition, these people aren’t given the opportunity to be selective about aspects of agreement and disagreement within petitions presented to them. Some people might hesitate to sign a petition because they agree only with a small part of it. In the example presented here, signers of a petition could state their disagreement with the building of a supermarket, but the petition might not unambiguously pinpoint the exact reasons they disagree with the proposed action. Consequently, the petition results aren’t particularly useful.

However, the Parmenides system would let respondents agree or disagree with each part of the justification presented. In the situation we’ve described, Mr. A would probably disagree with the circumstance, “Smalltown has wasteland suitable for building.” Conversely, Mr. B would probably express no disagreement with this statement, but disagree instead with the statement, “Smalltown does not have adequate shopping facilities.” As more people participate in the debate and express agreement or disagreement with the various parts of the justification, analysis of the resulting data lets us construct a clear picture of which part of the debate the majority of respondents agree or disagree with. Analysis also helps distinguish disagreements based on factual matters (such as the unemployment rate) from disagreements based on subjective values (such as whether wildlife preservation is a social value of highest importance). Additionally, the dynamic nature of Web-based submissions means that the debate can be modified as it progresses. Parmenides lets users suggest elements of the initial position that they feel are missing, and the debate administrators can consider these suggestions and add them to the debate if they feel this is appropriate, thus letting future participants view and critique the updated debate.

As briefly discussed earlier, debate administrators can use the analysis tools in Parmenides to change or target their campaign. For example, in the Smalltown supermarket example, analysis might show that the majority of respondents disagree with the circumstance statement, “Smalltown has wasteland suitable for building.” In this case, the administrators could, for example, provide a list of the waste plots deemed to be suitable for building.

The Smalltown supermarket debate is an example of a debate constructed on a local scale, intended only for a relatively small and targeted audience. Now let’s consider a debate on an international level. The Iraq War debate, which we constructed to reflect the controversy over the 2003 invasion of Iraq, has been implemented in the Parmenides system. We instantiated the initial position as follows:

In the current circumstances, Saddam Hussein has WMD, Saddam is running an oppressive regime. Therefore we should invade Iraq. This will result in removal of the WMD, restoration of democracy to Iraq. Removal of the WMD promotes world security, restoring democracy to Iraq promotes human rights.

(The wording in this instantiation of the practical reasoning argumentation scheme reflects how the information is presented on the Parmenides Web site, with argumentation scheme...
The Iraq War debate differs from the Smalltown supermarket example in terms of the target audience; the former is intended for a large international audience whereas the latter is intended for a selective, local audience. It also differs in its purpose; the former is more likely to be used to gather public opinion, whereas the latter might actually influence a decision. Despite these differences, the Parmenides system makes both levels of debate easy to represent and analyze. In scenarios involving decision making, there are few restrictions on the type of debate that the system can represent. However, the system captures the context-dependent nature of such debates through the underlying structure of the argumentation scheme and the associated critical questions.

To date, we have tested the Parmenides system with a number of political debates, including the justification for the 2003 war in Iraq, the UK debate over the legality of fox hunting, and a debate concerning the use of speed cameras on UK roads (briefly described earlier in this section). Again, these debates differ in their intended audience, and also, perhaps, in the way the collected data will be used.

**Supporting Arguments in Parmenides**

Since the last major publication of our progress on the Parmenides system, we have implemented and tested three additional argumentation schemes, with more to follow soon. The currently available schemes for providing evidence, again taken from Walton, are as follows:

- **Argument from expert opinion.** This scheme can be used to provide evidence from the written or spoken word of an expert source.
- **Argument from position to know.** This scheme can be used to provide evidence from the written or spoken word of a source who is in a position to know some fact.
- **Argument from correlation to cause.** This scheme can be used to state that because of a positive correlation between two events A and B, then A causes B.

For example, in the Smalltown supermarket scenario, the circumstance statement, “Smalltown has high unemployment,” might itself be supported with another statement from the town mayor. The town mayor would probably be considered as a source who is in a position to know this fact, rather than an expert in employment rates. Thus, the administrator could use the argument from position to know argumentation scheme, stated as follows:

**Person A is in a position to know whether Fact F. Person A assert(s) that Fact F. Therefore, Fact F.**

The debate administrator must provide elements Person A and Fact F to instantiate this scheme, and the Debate Creator tool provides prompts for the user to enter the relevant details. Once instantiated, the argument for our example could be as follows:

**The mayor of Smalltown is in a position to know whether unemployment in Smalltown is high. The mayor of Smalltown assert(s) that unemployment in Smalltown is high. Therefore, unemployment in Smalltown is high.**

This argumentation scheme has its own associated set of characteristic critical questions. One example is, “Is Person A an honest (trustworthy, reliable) source?” By providing a response to such a critical question, we can again determine which parts of the evidence a user agrees or disagrees with, thus helping to identify exact points of disagreement within the debate.

Alternatively, the user could employ the argument from correlation to cause argumentation scheme, stated as follows:

**There is a positive correlation between A and B. Therefore, A causes B.**

This argumentation scheme could be used to give evidence related to the change in unemployment rate after a supermarket was built elsewhere, for example, as follows:

**There is a positive correlation between opening new businesses and employment rate rise. Therefore, opening new businesses causes employment rate rise.**

Again, the system poses the critical questions associated with this argumentation scheme to determine which part (if any) of this underlying evidence the user agrees or disagrees with. For example, there might not be enough cases of new businesses opening and causing employment rate rise for this to be seen as strong supporting evidence.

The system presents the evidence supporting the statement, instantiated using whichever argumentation scheme.
the debate administrator deems appropriate, to any users who, when completing their critique on the Parmenides Web site, express disagreement with the fact that there is a high unemployment rate in the town. Parmenides gives users the opportunity to critique the evidence by responding to the critical questions associated with the argumentation scheme used to instantiate the evidence. Thus, we can now not only see that a user disagrees with a particular statement put forward as part of an argument, but also, when presented with a piece of evidence supporting the statement, which parts of this underlying evidence he or she disagrees with. This could help debate administrators further refine policy proposals and their choice of supporting statements (for example, when creating promotional materials for the public). It could even prompt a change to the policy proposal itself.

In addition to representing arguments about evidence used to support the constituent parts of the practical reasoning scheme, we have also extended the Parmenides analysis tools to allow evaluation of the data arising from argumentation scheme interactions in Parmenides. Within the tool, administrators can now view the argumentation framework showing the evidence used to support specific statements within the debate, and they can see how many users agreed or disagreed with each critical question attacking the evidence. This enhanced framework lets the debate administrator easily pinpoint the elements of the argument that cause most conflict when presented to the public, as well as giving an overall view of the debate and how the various elements fit together. Figure 4 shows an example of part of the Java-based analysis framework.

Because the analysis tools now contain far more data, making it difficult to view and understand the whole argument at once, we have made it possible to pan around the argumentation frameworks, as well as to zoom in and out to view parts of the framework in more detail. A user can expand a node to view its supporting evidence (if present) by clicking the node itself. Hovering the mouse over a particular node in the framework shows a pop-up box that provides information about that node. For example, it could contain the full statement if space does not permit it to be written inside the node itself (as in Figure 4), or critique statistics for that node (what percentage of users agree and disagree with the conclusion of the argument represented by the node).

The use of a range of argumentation schemes within the system, each able to provide supporting evidence to any element of the initial argument put forward in favor of the proposed action, gives us further insight into the reasons why particular arguments are used in particular debates. For example, we might find that most people disagree with subjective elements of an argument (such as statements promoting particular social values). Conversely, we might find that most people agree with elements of the argument that are more objective (statements of a more factual nature). Discovering exactly which arguments in a debate are generally disagreed with could help not only administrators of the respective debates to refine their position, but also help government bodies to prevent such disputes from arising in future. Additionally, the use of other argumentation schemes allows debates to be more expressive, as users can make use of different types of argument.

As is the case with any system intended for use by the general public, testing and evaluation of Parmenides is an important consideration. To date, we have tested Parmenides on a relatively small scale, with large-scale, rigorous testing to be planned and carried out in the near future. The small case study involved a student from the University of Brescia who was researching argumentation systems. We allowed the student to create a debate in Parmenides, following which he asked a small sample of students from the university to participate in the debate. We also asked the research student, as well as the students who participated in the debate, to complete a short questionnaire about their experiences with the system. Because we only have a small repository of results, we include here a sample of the questions posed to the debate creator and to the users of the system, including some of the responses obtained:

- “Were you able to understand the difference between the elements of the justification (circumstances, goals, social values)?”—“Yes.”
- “Did you have any problems deciding on goals/values to use in the debate?”—“There was a little problem for the decision of the values...
but I think that was a problem owing to the argument itself.”

- “Do you have any suggestions or comments for improving the debate creator?”—“In my opinion this is a good e-democracy system. In the future a sort of a language pack can ‘internationalise’ the system.”

The feedback received was largely positive, indicating that many students found the system useful and easy to use. A full account of the research student’s experiences with the system are written up (in Italian) in his thesis, of which we are in the process of obtaining an English translation.

In the short term, future work on Parmenides will focus on implementing more argumentation schemes and further extending the analysis tools to allow evaluation of the resulting data. We hope to create a general model of argumentation scheme interaction that will allow schemes to be more quickly and easily implemented in the system. Our long-term goals are to improve the interactivity of Parmenides. The system currently allows users to submit their opinions on a topic of debate, in terms of a critique
of the initial position of the debate, and it includes limited support for users to provide their own suggestions of alternative actions to carry out. However, the system does not allow users to interact with each other. Rather, the debate is moderated in full by the debate administrator. We would like to implement extensions to Parmenides that would allow users to view and critique the ideas of other users, thus providing a fully democratic debate critique system.

As we mentioned earlier, evaluation of Parmenides is an important consideration. We hope to carry out an evaluation with larger-scale testing in the near future and have considered a number of domains for this. One of the most promising domains is the University of Liverpool’s Guild of Students, which already has a Web site (www.lgos.org) through which students can use simple polls to submit their opinions on issues affecting them.

Acknowledgments

We thank the anonymous reviewers for their helpful comments and suggestions. We are also grateful to Trevor Bench-Capon for his input to discussions on the topic of this article.

References