

Opinion Gathering Using a Multi-Agent Systems Approach to Policy Selection

(Extended Abstract)

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ABSTRACT

An important aspect of e-democracy is consultation, in which policy proposals are presented and feedback from citizens is received and assimilated so that these proposals can be refined and made more acceptable to the citizens affected by them. We present an innovative web-based application that uses recent developments in multi-agent systems (MAS) to provide intelligent support for opinion gathering, eliciting a structured critique within a highly usable system.

Categories and Subject Descriptors

I.2.11 Multi Agent Systems

General Terms

Experimentation; Human Factors

Keywords

e-Government and e-Democracy; argumentation

1. INTRODUCTION

Current web technologies are both fuelling an increase in the desire of members of the public to participate in democratic debate and decision making, and enabling governments to provide opportunities for them to do so, but many issues arise when one considers how to analyse, evaluate and respond to the volume of data gathered.

From a developer's point of view, a key consideration in designing and building online tools for opinion gathering is the trade-off between the amount of structure provided by the tool and its ease of learning and use. Since the target audience is the general public, participation must be fostered by making the interactive system as straightforward to use as possible. If, however, the responses are to be meaningfully analysed in terms of their content, then considerable structure needs to be imposed on the data.

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Clear separation of distinct issues is one problem with unstructured systems. A second important difficulty concerns how to assess and evaluate competing opinions. Putting the requirement on the user to provide arguments that are sound and coherent yields no guarantee this will be accomplished. Forming coherent and well expressed arguments is a rare skill, and people, including the highly educated, find it hard even to organise their thoughts into premises and a conclusion that follows validly from these premises. If, additionally, the arguments need to conform to, and be annotated with respect to, a structure requiring some minimum knowledge of argumentation theory the difficulties are multiplied.

There is a clear need for online opinion gathering tools to be grounded on some solid semantic foundation whilst retaining their usability. To achieve this, we look to multi-agent systems, and in particular how the reasoning of the agents in a system can be supported by a computational model of argument. In the next section we pinpoint two key developments from this field that can provide the backbone of support for a tool for online opinion gathering.

2. MAS ARGUMENTATION FOR POLICY

Since the publication of Dung's seminal paper [3], computational modelling of argument has become increasingly important as a sub-field of AI in general and MAS in particular. From [3] we take the key notion that evaluating the status of an argument takes place in the context of an argumentation framework, containing many arguments, and the status of an argument is *relative to a set of arguments*, which attack and defend it. Important developments of the initial framework have included methods for distinguishing between successful and unsuccessful attacks. The defeat relation is replaced by an attack relation, and then a preference relation on arguments is used to remove unsuccessful attacks leaving only successful attacks (i.e. defeats), and so inducing a standard AF. Several kinds of preference have been suggested: we use an ordering on the social values promoted or demoted by acceptance of an argument [2], which yields Value-based Argumentation Frameworks (VAFs).

A second important development involves Argumentation Schemes, a notion imported from the study of argument in Informal Logic and Critical Thinking, but now widely used in MAS. Their importance from our perspective is that such schemes provide us with guidance on how to construct,

and how to attack arguments. The argumentation scheme mainly used in this paper is a scheme for justifying the choice of an action as developed in [1]: **PR**: In the current circumstances (R), action ac should be performed, since this will bring about a new set of circumstances (S) in which some goal (g) is realised. Realising g is desirable because it promotes a particular social value (v).

One particular area of study in MAS is the interaction between independent agents and how this interaction can be managed so as ensure that the system as a whole operates in as harmonious and effective manner as possible. One semantical basis for modelling agents and their interactions, used in [1], is a transition system based on joint actions between agents (Action-Based Alternating Transition Structure (AATS)).

We claim that these theoretical developments taken from agent-based studies of computational argumentation can support our opinion gathering task in the following ways:

- *Modelling the Domain.* The need to underpin the enterprise with an AATS determines the components that we need and structures the task of identifying them.
- *Producing Arguments.* Instantiations of the Argumentation Scheme now give us arguments which can justify various actions in the situation as modelled, and various attacks on these arguments.
- *Selecting an Argument.* The arguments can now be organised into an Argumentation Framework (in particular a VAF). Choosing the best argument from those available requires us to make factual and preference assumptions, which can be modelled using agents.
- *Receiving Feedback* The chosen argument, and various possible ways of attacking it, can now be offered to the public as a series of simple questions.
- *Evaluating Feedback* Given the precise attacks which various people wish to make, and the relative numbers who wish to make the different attacks, we can record these in the agent system and so reconsider the factual and value assumptions in the light of what is believed and desired by the citizenry.

We focus especially of receiving feedback about a particular proposal. Having constructed our model, and generated a set of arguments and the objections to them, we evaluate the resulting VAF in accordance with our value preferences, to choose a particular policy and justification. That argument can now be presented to the public for feedback using the web-based tool. We solicit feedback on the model, both disagreements and omissions, the assumptions made, and the ordering of values chosen. After an initial statement of PR1 (if this is the selected argument), participants who disagree are led through a series of screens to identify the particular points at which they disagree, or want further justification.

- *Screen 1* invites the participant to agree or disagree with each proposition in R . If there is disagreement, evidence is presented (e.g accident statistics). If the participant remains unconvinced, the argument supporting the premise can be critiqued.
- *Screen 2* asks questions such as *Do you agree that reducing road deaths promotes life*, to check whether it is agreed that the values will be promoted.

- *Screen 3* Asks whether participants agree with the proposed consequences of the action. Disagreement will lead to a justifying argument and either participants will accept this and return, or be led through a critique of this further argument.
- *Screen 4* offers a range of other actions which participants may think achieve the aims of the policy. Selecting one of these leads to the reason for rejecting it identified from the VAF.
- *Screen 5* asks whether participants endorse the values used, or want other values considered, and gives the opportunity to express their ordering of values.

3. CONCLUSION

We believe that the improvements, both from a functional and a software engineering perspective, resulting from the use of the underlying AATS and the supporting agent system it enables, represent a significant advance on current systems, and represents an innovative and effective use of MAS techniques.

In this paper we have described a web-based application which deploys state of the art of argumentation techniques taken from agent-based research to provide computational support for a particular stage of the policy making process: the production of a White Paper to solicit public feedback on a broadly expressed proposal. Here the effort is shifted from the construction of arguments to justify the proposal, and the understanding of free form responses, to achieving a precise and formal understanding of the problem and its relevant aspects, to provide a model from which arguments can be generated automatically and into which responses can be assimilated. The interactivity offered by the web is exploited by enabling the exact points of objection to be pinpointed so that disagreement becomes specific and hence capable of being addressed specifically: by improved justifications; by modifications to the assumptions and understanding; or even by changes to the policy. The application illustrates how the full potential of the web and agent systems is achieved, not by making available and supporting existing, paper based, procedures, and so perpetuating the flaws in those processes, but rather by rethinking those procedures so that the opportunities offered can be grasped.

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4. REFERENCES

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