

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; Theory.

Keywords

e-Government and e-Democracy; argumentation.

1. INTRODUCTION

Current web technologies are fuelling an increase in the desire of members of the public to participate in democratic debate and decision making and are also 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.

Clear separation of distinct issues is one problem with unstructured systems. A second important difficulty concerns how to assess and evaluate competing opinions. Putting

Appears in: *Proceedings of the 11th International Conference on Autonomous Agents and Multiagent Systems – Innovative Applications Track (AAMAS 2012)*, Conitzer, Winikoff, Padgham, and van der Hoek (eds.), 4-8 June 2012, Valencia, Spain. Copyright © 2012, International Foundation for Autonomous Agents and Multiagent Systems (www.ifaamas.org). All rights reserved.

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.

Thus, 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 three key developments from this field that can provide the backbone of support for a tool for online opinion gathering.

2. MAS ARGUMENTATION FOR POLICY

The first important development is computational modelling of argument [2], which has become increasingly important as a sub-field of AI in general and MAS in particular. From [2] we take the key notion that evaluating the status of an argument takes place in the context of an argumentation framework (AF), containing arguments in an attack relation, and where the status of an argument is *relative to a set of arguments* that either attack or defend it. Subsequent research on AFs 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), 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 which yields Value-based Argumentation Frameworks (VAFs) that use [2].

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 to attack arguments. The argumentation scheme mainly used in our tool for opinion gathering is the *Practical Reasoning* (PR) 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 a goal (g) is realised. Realising g is desirable because it promotes a social value (v).

The third development is the study of the interaction between independent agents and how this interaction can be managed so that the system as a whole operates in as harmonious and effective a 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 that 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 simple questions in a web-based survey tool.
- *Evaluating Feedback* Given the precise attacks that 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 on critiques about a particular proposal. Having constructed our AATS 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 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 the proposed the circumstances. If there is disagreement, supporting evidence is presented. If the participant remains unconvinced, the argument for the circumstance can be critiqued.
- *Screen 2* offers the participant the selected policy action, which can be accepted or critiqued. Alternative actions can be selected by the participant. Selecting an alternative action leads to arguments against it.
- *Screen 3* asks whether participants agree or disagree with the proposed consequences of the action. Disagreement will lead to a justifying argument, and participants will either accept this and continue or be led through a critique of this further argument.

- *Screen 4* inquires whether the user agrees that the policy action promotes or demotes the value as specified in the original argument, e.g. raising taxes promotes equality. If the user disagrees, a justification is given.

3. DISCUSSION

Our opinion gathering tool brings improvements from functional and a software engineering perspectives. The improvements are the result of using the underlying AATS and the supporting agent system it enables. The tool is a significant advance on current systems [3] and an innovative and effective use of MAS techniques.

We have outlined a web-based application that deploys state of the art 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. We shift the effort from the construction of arguments to justify the proposal and the analysis of free form responses to a precise and formal understanding of the problem and its relevant aspects as well as the creation of 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 can be specifically addressed by improved justifications, by modifications to the assumptions, or even by changes to the policy. The application illustrates how the full potential of the web and agent systems is achieved, not by 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.

Acknowledgements

This work was partially supported by the FP7-ICT-2009-4 Programme, IMPACT Project, Grant Agreement No 247228. The views expressed are those of the authors and are not necessarily representative of the project.

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