Extending Argument Maps To Provide Decision Support For Rulemaking

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Abstract

Argument maps are one possible type of tool for engaging citizens in government policymaking, but they currently lack features to assist with making decisions on specific policies. This paper investigates the question of how argument maps can be enhanced for this purpose. A case study was conducted of public comments submitted in response to a proposed rule regarding health insurance cooperatives. An argument map was created from these sources, and some creation guidelines are suggested. Three decision techniques were evaluated for one issue: multi-attribute utility theory, Franklin's method, and uncertainty analysis. A variant of Franklin's method was selected and combined with the argument map to produce an integrated decision support design. The design represents weights both numerically and visually, allowing the user to dynamically adjust weights relative to those of other arguments. Design walkthroughs provided generally positive reactions to the design.

1. Introduction

Governments are striving to take advantage of the Internet to engage citizens in policy deliberation, termed e-Democracy or e-Participation. The US government's Open Government Initiative [13] provides goals for transparency, participation and collaboration, and has led to efforts to create new systems for public participation (e.g., ExpertNet[1]) and improvements to existing systems (e.g., regulations.gov). Regulations.gov supports the eRulemaking process in which agencies post proposed rules, receive public comment, and post final rules [6]. Public comments are received as free text, such as emails or PDF documents. Agencies are required to process all comments, and are urged to explain how comments affect the crafting of the final rules [8]. This process is used by most Federal agencies and is important in determining how legislation is translated into detailed rules, which affect everything from household appliances to health insurance plans to boating restrictions.

Argument mapping is a technique that has potential as an online environment for e-Participation. Tambouris, et al. surveyed e-Participation experts and policy makers on their reactions to an application of Debategraph [15].[2] The results indicated a generally positive view of the system, while pointing to some initial learning barriers and the need for a moderator. Kourmpanis and Peristeras demonstrated the possibility of using argument maps to structure comments received from the Greek e-government website on a variety of issues [11]. Benn and Macintosh described the ongoing efforts of the European Union IMPACT project (Integrated Method for Policy making using Argument modeling and Computer assisted Text analysis) that seeks to integrate knowledge-based tools, semi-automated data tagging and argument maps [1].

Much of the research on argument mapping itself has focused on the challenge of helping people to represent their thoughts in a formal structure (e.g.,[14]). Argument maps can provide a condensed picture of a topic, including assumptions, supporting evidence and points of disagreement [10]. Some argument mapping tools can support multiple distributed users (e.g., Cohere[3]). However, there is presently little support in argument mapping systems for coming to an actual decision [2], for example, by considering the popularity of positions, weighting of arguments, credibility of statements or uncertainty in predictions. Indeed, the only project known to the authors to incorporate decision features with an argument map was HERMES, which implemented an argument tree on which statements and counter-statements activated or de-activated arguments based on a selectable level of proof [7].

[1] http://expertnet.wikispaces.com

[2] http://debategraph.org

[3] http://cohere.open.ac.uk/

This paper seeks to help fill that gap by presenting a design for integration of a decision analysis technique with the existing argument mapping tool Compendium.[4] This design was based on a case study of the proposed rule *Establishment of Consumer Operated and Oriented Plan (CO–OP) Program*, a part of the 2010 Affordable Care Act (ACA) [5].[5] The design provides cognitive support for the task of deciding whether to implement specific recommendations contained in public comments. The public comments and proposed rules are translated into an argument map, and recommendations are provided for performing that translation.

2. Methodology

This research was designed for the context of a federal agency evaluating public comments, and assumed the following use case scenario: 1) an agency has proposed a rule and collected public comment; 2) a policy analyst[6] at the agency creates an argument map of the rule, the public comments and other pertinent information; and 3) the analyst selects one of the public's recommendations, and uses the decision support feature to weight the arguments and decide whether to accept the recommendation. With this use case in mind, the research was conducted in five stages:

1. **Selection and analysis of a rule and comments.** A small rule (14 pages) with relatively few comments (44 letters) was selected for the case study. A subset of the comments regarding one issue were extracted from the letters, and one specific recommendation was selected as the focal issue. The arguments were assessed for completeness, and additional information was gathered to deepen the presentation.
2. **Translation of comments into an argument map.** The extracted public comments, additional information and proposed rule were translated into an argument map, and guidelines for the process proposed.
3. **Identification of appropriate decision technique.** The characteristics of the debate were examined and evaluated against three decision techniques.
4. **Design of the decision support functionality.** A design was created to integrate Franklin's Method with an argument map.
5. **Design feedback.** Design walkthroughs were held with three people knowledgeable on different aspects of the research topic (decision science, healthcare reform, and argumentation).

3. Argument Map

This section describes the process of constructing an argument map.

3.1 Analysis of the Issue

Section 1322(a) of the ACA directs the Centers for Medicare and Medicaid Services (CMS) to create the CO-OP program. CO-OPs are defined to be private, non-profit health insurers run by their members, similar to other types of cooperatives, primarily serving individuals and small businesses. Organizations apply to CMS in order to become CO-OPs, and, if approved, receive start-up loans from CMS. The program goal is to have one CO-OP operating per state by 2014. CMS published the proposed rule regarding the CO-OP program in July, 2011, which began the 60-day public comment period.

The specific issue examined in the case study concerns comments on the rule paragraphs related to the CO-OP Board of Directors. Because CO-OPs are intended to be member-run, there are several rule paragraphs regarding the composition of the Board. One challenge faced by start-up CO-OPs is obtaining individuals with expertise in health insurance. Therefore the rule allows the Board to have seats designated for individuals with special expertise or affiliation to associated organizations. However, the rule prevents those designated seats from being a majority of the board, thus assuring member control.

There were comments from 12 organizations concerning the Board of Directors. Each "comment" is a letter that may contain several (an average of 6) recommendations, each generally pertaining to a separate rule paragraph. All except one of the comments were from interest groups (e.g., trade associations, law firms, companies, and state officials) rather than from individual citizens, which is not unexpected, considering the theory of concentrated benefits and diffused costs [12]. The recommendations from different organizations generally did not overlap, although in one case four physician organizations had similar recommendations.

One recommendation of the New Hampshire Hospital Association (NHHA) was examined for the case

[4] http://projects.kmi.open.ac.uk/compendium/

[5] proposal: http://www.regulations.gov/#!documentDetail;D=HHS-OS-2011-0021-0002 public comments: http://www.regulations.gov/#!docketDetail;dct=PS;rpp=10;po=0;D=HHS-OS-2011-0021

[6] *Policy analyst* is used throughout this paper as a generic term for the person processing public comments.

study. It effectively called for the removal of a paragraph from the proposed rule, 156.515(b)(2)(iv), henceforth called paragraph (iv). The proposed rule and public comments did not contain sufficient information for a balanced presentation, primarily because of a lack of arguments to counter the NHHA recommendation. The proposed rule contained a few sentences of background information for each rule paragraph, but there was little rationale for the existence of the paragraph (e.g., what it intended to encourage or prevent). Therefore, it was difficult to predict what the effect would be of removing paragraph (iv). The Advisory Board testimony[7] provided some information, such as the factors for success for existing insurance cooperatives, however it did not specifically address paragraph (iv). Counter-arguments were also not present in other organizations' public comments. This is due to the fact that in the rulemaking process the public comments are typically written in response to the proposed rule, as opposed to a dialog format where comments are made on other comments.

Besides the lack of counter-arguments, several other factors posed challenges for construction of a balanced presentation. The NHHA recommendation contained two supporting arguments. To be able to fully evaluate those arguments, however, more supporting evidence is needed in order to understand aspects of the arguments such as the likelihood of a given situation occurring, the dynamics between hospitals and insurers, and the number of hospitals operating under certain legal constraints. As these items imply, the issues involved are esoteric, further complicating efforts to create a structured presentation of those issues. Only one comment endorsed paragraph (iv), but even it was stated only in general terms, since the writer was likely unaware of the NHHA's specific arguments. Finally, the proposed rule concerns a complex topic that is unfamiliar to the average person, and is written in legal, abstract language which is difficult to interpret.

3.2 Argument Map Construction

This section describes suggested guidelines for argument map creation, covering the layout, organization of recommendations, and node text. Figure 1 sketches the layout of the overall argument map, while figure 2 provides a detail view of the section concerning the NHHA recommendation. The map was created in Compendium, a freely available tool that allows the creation of argument maps based on the Issue Based Information Systems (IBIS) notation.

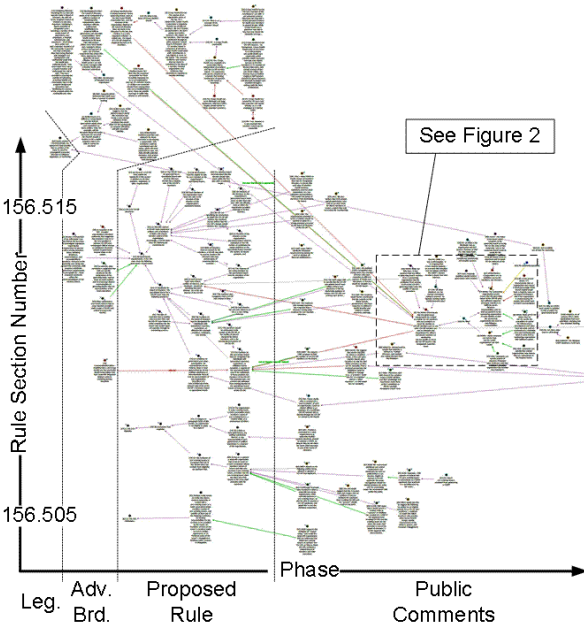

Figure 1. Argument map layout

Due to the large size of the argument map, which greatly exceeds the size of a typical computer screen, the map must be organized in a manner that helps the policy analyst remain well oriented. The argument map consists of four types of information (corresponding to "phases") as shown in figure 1– Legislation, Advisory Board, Proposed Rule, and Public Comments. The organization of the map is largely based on the following emergent guidelines:

- Organize the map to be read from left to right, centered around the proposed rule.
- Define the horizontal axis as the rulemaking phase, arranging nodes roughly in chronological order. This shows the progression of debate over time, but has the tradeoff of sometimes causing long links between nodes.
- Cluster comments together according to the rule paragraph they refer to.

The proposed rule is the backbone that connects the other information together. It inherently has a well defined structure, e.g. 156.515(b)(2)(iv), defined as:

[section] [sub-section][part][paragraph]

This structure is translated in the argument map as a hierarchy, organized on the vertical axis by section number. Within a section, the sub-sections, parts and paragraphs are laid out radially to the right side. The rule is created as a *Reference* node in Compendium to differentiate it from the Compendium *Question*, *Idea*, *Pro* and *Con* nodes that are used for the public com-

[7] http://cciio.cms.gov/resources/co_op/index.html

ments. *Notes* nodes linked to the *Reference* nodes provide background information on the rule.

The junction between the proposed rule and public comments is defined by three aspects. First, the portion of a comment making a recommendation about the rule must be extracted into the appropriate type of node. The Compendium node type is chosen as follows (intuitively), depending on whether the recommendation:

- Supports the rule → *Pro* node
- Opposes the rule → *Con* node
- Recommends a change to the rule → *Idea* node
- Requests clarification of the rule → *Question* node

Second, a recommendation is linked to the rule it references. The link has an arrow that points from the recommendation towards the rule. This is consistent with the use of arrows in the typical IBIS argument map structure, in which the arrow points from one node towards the node it responds to.

Third, the portion of a comment other than the actual recommendation (e.g., the rationale or other background) is linked to the recommendation and translated into the map. The linking and translation follow the standard IBIS structure, using *Question*, *Idea*, *Pro* and *Con* nodes as appropriate to build the map outwards and to the right. This consistency in structure facilitates the later process of examining each recommendation and deciding whether to accept or reject the recommendations.

Each node within the map contains 1) a unique ID for easy reference, 2) the source of the comment or the rule paragraph number, and 3) the text of the comment or paragraph. For example, in figure 2, the node in the lower right corner, "[96] AHA: Covenants can specify…" is node 96, and the source of the comment is the AHA (American Hospital Association). Nodes marked with "PA" represent the nodes that would be added by a policy analyst during construction of the argument map.

Condensing text into the space available in a node is a challenge. For rule nodes, it is critical to copy the exact wording from the original rule. For the comments, the text in the node is generally a subset of the important points, which can be continued into the node detail (not shown on the map) if needed.

4. Selecting a Decision Technique

Comments on the NHHA recommendation involved several types of arguments, ranging from fiduciary responsibility, to the definition of a CO-OP, to examples of successful cooperatives. Three decision techniques, Multi-Attribute Utility Theory (MAUT), uncertainty analysis, and Franklin's method were examined to determine which would best suit a decision support design in this case.

MAUT [9] is designed for situations where there are many alternatives and each alternative is to be judged against several established criteria. While the NHHA issue only had two alternatives, accept or reject the recommendation, it did involve many criteria. In order to test the technique, 8 criteria were extracted from the arguments, for example *Ability of CO-OP to obtain necessary capital*. The findings of this exercise were: a) the process of establishing generalized criteria involved more effort than likely would be practical on a large scale, and b) the criteria create a potentially confusing layer of abstraction between the policy analyst and the details of the arguments. Additionally, MAUT requires setting weights on each criterion based on importance, and then assigning a score for the degree of satisfaction to each alternative for each criterion. This requires creating an explicit scale on which to rate the alternatives, which can be difficult when many of the criteria are qualitative.

There are many uncertain factors in the CO-OP issue that affect the outcome of a decision, including the behavior of hospitals, CO-OP applicants and others. An uncertainty analysis based on [3] was performed to obtain insight into how the range in behaviors affects the possible outcomes. The scenarios evaluated were the best, most likely and worst cases, and the outcome predictions were rated on a four-point scale from very good to very bad. The results of this analysis were mixed. On the positive side, the analysis forces the policy analyst to make predictions for these different scenarios, giving the policy analyst a sense of the likelihood of the various outcomes. For the NHHA issue, however, there was very little information on which to base these predictions. Furthermore, this analysis does not take into account the other types of arguments, such as appeals to definitions (e.g., of cooperative governance).

(Benjamin) Franklin's method [17] can be viewed as a simplified version of MAUT. The method involves listing out all of the pros and cons of a decision, then finding those that have equal weights on either side and canceling them out. This process continues until arguments remain on only one side. The relative simplicity of Franklin's method has several advantages for handling the NHHA issue. It is not restricted to a single defined perspective on a decision, such as the predicted outcomes in the case of uncertainty analysis. It is suitable for weighing the many argument types found in public comments, and they can be compared against one another in their original form without the requirement for transformation into the more abstract criteria of MAUT. Finally, Franklin's method may be more intuitive than the other techniques since it is si-

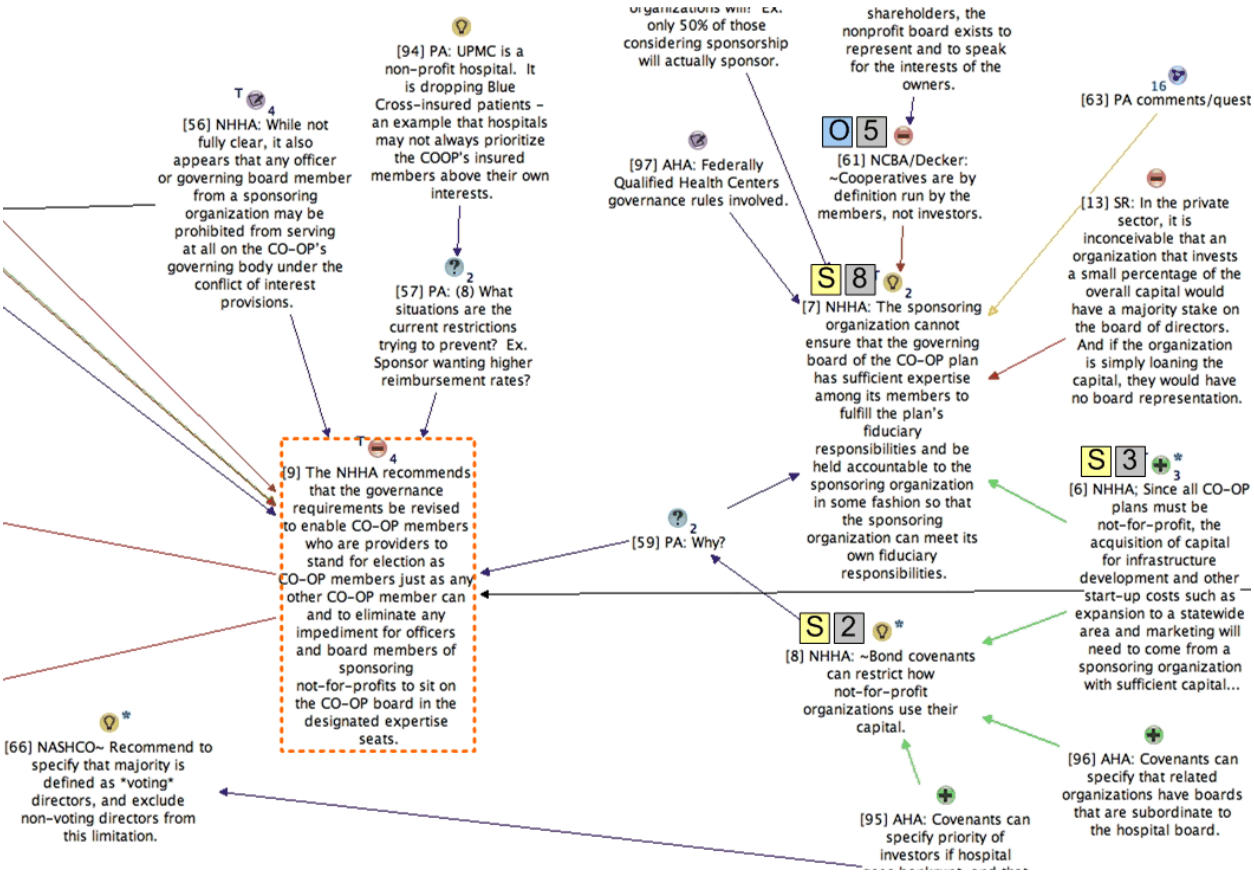

Figure 2. Detail of argument map – NHHA proposition

milar in some ways to human mental models of judgment [4]. The advantage of simplicity has a drawback however: the intended benefits of the other methods are not present. Without the criteria of MAUT there is less transparency into how the different arguments are weighed. Without the need to predict outcomes for each alternative, some implications of a decision may be overlooked. In general, the burden of considering those aspects is shifted towards the policy analyst's own means (and outside of the software tool). Balancing these considerations, Franklins method was chosen for the prototype system reported in this paper.

5. Decision Support Design

The design for integrating Franklin's method with an argument map involves two parts. The first part is modifying the argument map to enable the policy analyst to record his or her rating of the arguments while reading through the argument map. The rating is on a numeric scale of 0-10. The second part is a new Decision View where the policy analyst reviews and can adjust the relative importance of the arguments in a visual representation that is confined to the pros and cons of the chosen proposition.

The design is described below in the order that a policy analyst would encounter the system in the typical use case. It is assumed that the policy analyst has created the argument map from the proposed rule and public comments, according to the guidelines in Section 3.1. The policy analyst then choses one of the public's recommendations to be the focus of debate, calling this the *proposition*, and rates the nodes in relation to that proposition. Next the analyst, possibly together with other decision makers, adjusts the ratings in the Decision View until a clear presentation of the issues at stake in the decision is constructed.

5.1. Argument Map Modifications

Figure 2 shows the features of the argument map. A description of each element is given below:

Proposition – The policy analyst selects a node to be the center of debate, which becomes highlighted with dashed lines (node 9).

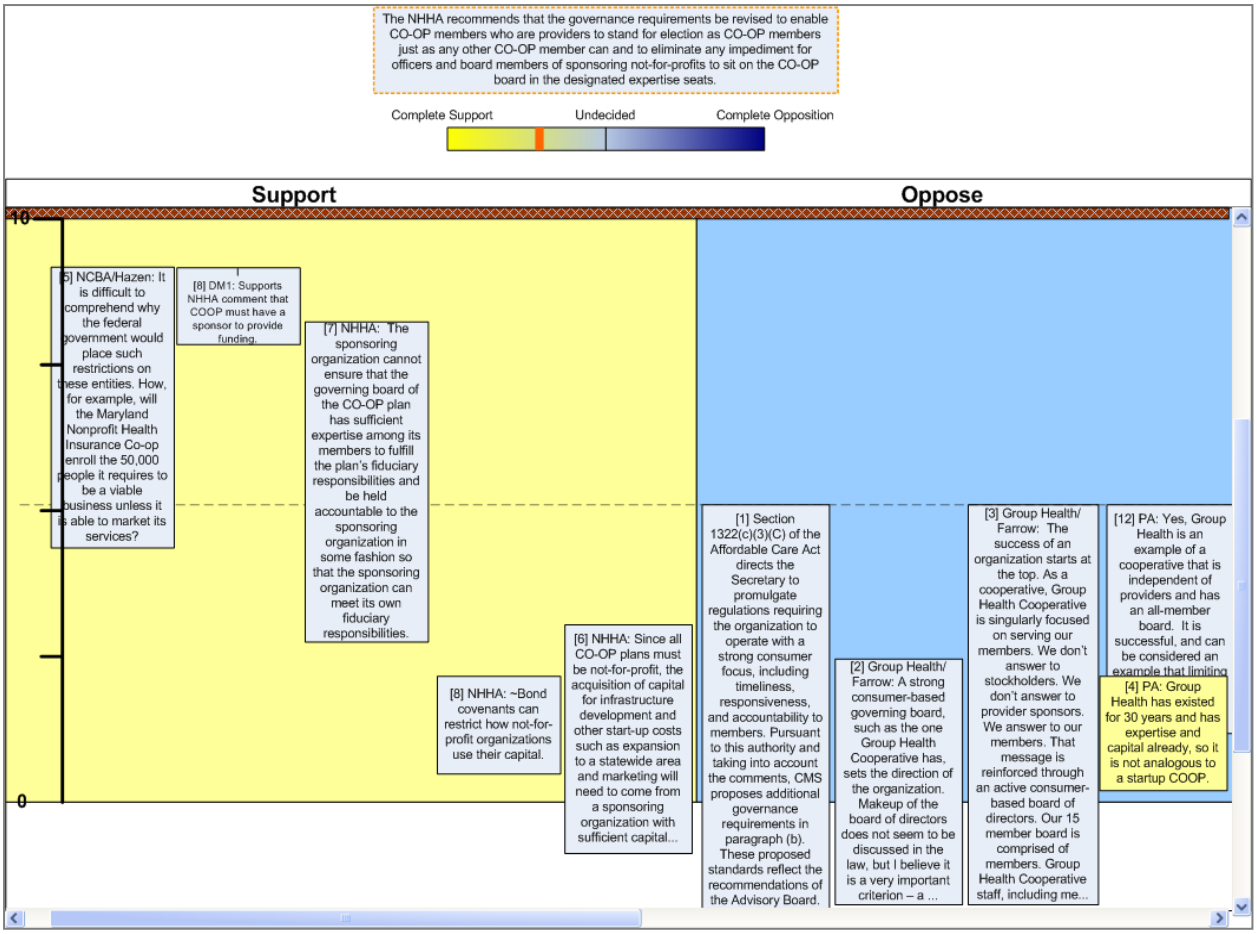

Figure 3. Decision view

Rating – The policy analyst rates comments, as in node 7, selecting S or O depending on whether the node Supports or Opposes the proposition, respectively. The policy analyst also assigns a weight on a 0 to 10 scale, where 0 indicates no importance and 10 is the maximum importance. For example, node 7 is a supporting argument with weight 8. The rating represents the judgment of the policy analyst as to the relative weight (importance to the decision) of each comment.

Nodes can be rated, or selected as the proposition, regardless of node type or location in the map.

5.2. Decision View

Once a policy analyst has rated all of the relevant nodes, he or she can switch to the Decision View (figure 3) in order to see a consolidated view of the rated nodes. There he or she can use visual gestures to make adjustments to the ratings until able to come to a decision. The elements are as follows:

Proposition – Displayed at the top of the screen for reference.

Support/Oppose scatterplot – The nodes that have a rating are automatically displayed on their respective sides (S = Support, O = Oppose) and vertical positions. The vertical position represents the rating of the comment, as set earlier in the argument map. The rating is read from the top of the comment box (e.g., node 1 has a weight of 5). The weight can be adjusted by dragging the box up or down. Any adjustment in the Decision View is reflected in the node display in the argument map.

Decision Indicator – Located just below the proposition, this displays the mathematical balance of the weights, where the aggregate recommendation indicated by the internal bar is determined as the sum of the Opposing comment ratings divided by the sum of all ratings. The thin line in the middle marks the midpoint between the two sides. The indicator is updated in real time whenever the rating of a node is changed,

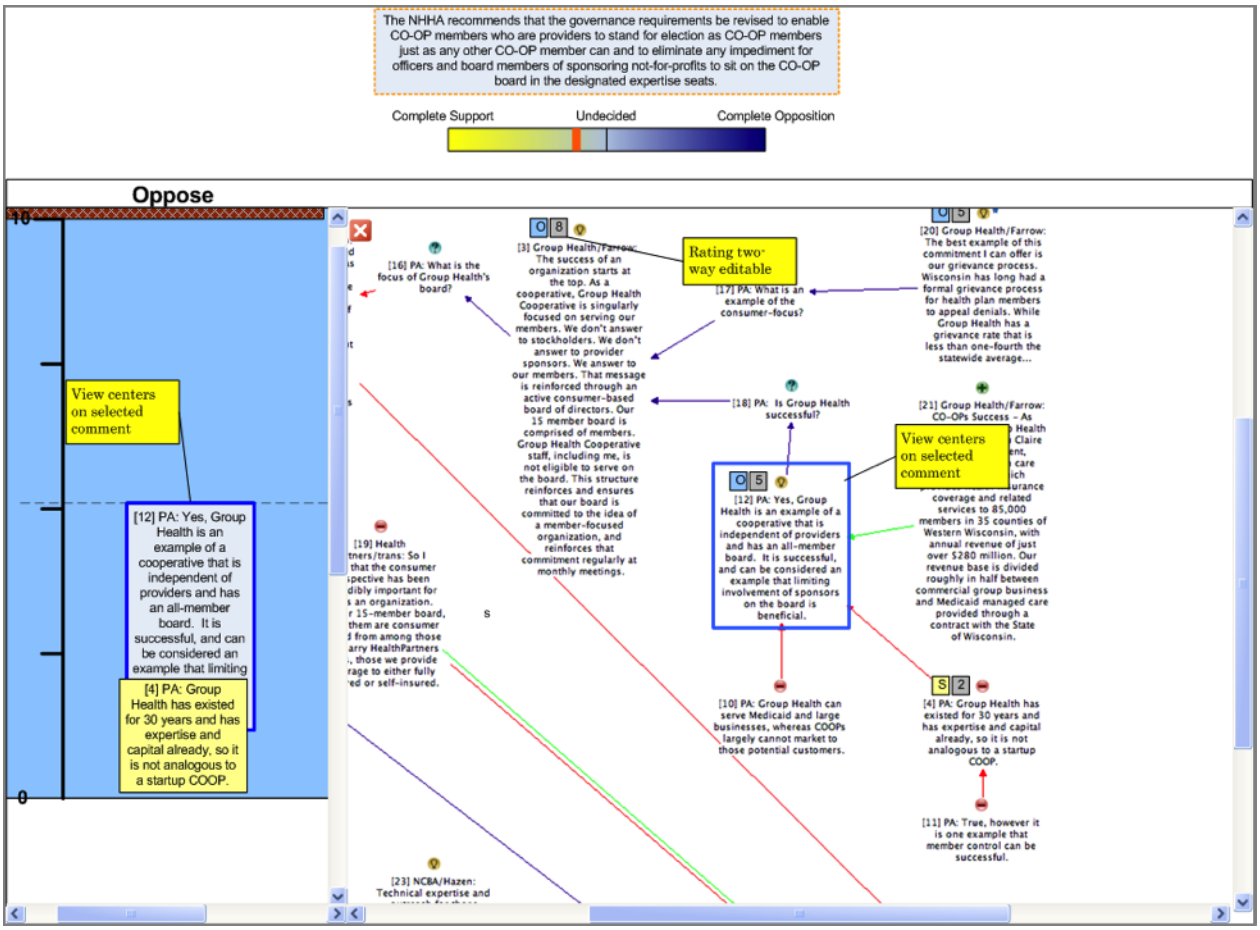

Figure 4. Split screen

thereby allowing the policy analyst to see the effect of changing a weight on the overall balance of arguments.

Figure 4 demonstrates the split screen mode, which displays a node both in the Decision View and in the argument map, enabling the policy analyst to recall the context of the node (i.e., where it fits into the overall debate).

Direct counter-argument – In figure 4, the comments on the left show how direct counter-arguments are automatically treated as a special case for display in the Decision View. In the argument map, node 4 at the bottom right is directly contradicting the selected node 12. Although it is rated as an S node, it is displayed in the Oppose column of the Decision View, but on top of the node that it contradicts. This display retains the direct connection between the two comments, and makes clear the situation that one contradicts the other.

Figure 5 shows two additional features: grouping and decision constraints:

Grouping – The node on the left is an example of grouping nodes. Node 8 on top was originally to the right of node 5 (figure 3). If a policy analyst determines that one node is similar to another node, the analyst can manually drag that node on top of the other. Once combined, the nodes are considered as a single node for the purpose of the Decision Indicator calculations, with the weight set to that of the underlying node.

Decision constraint – In some cases a single argument may determine the decision, rather than simply providing weight for a given side. For example, if a section of the ACA is found to give specific direction to CMS, then the law in this case trumps any other arguments. In such cases, the node can be dragged up to the red bar above the 10 weight, as in the case of node 1. This causes the node to turn orange, indicating that it is constraining the decision, and the Decision Indicator moves to Complete Support or Complete Opposition.

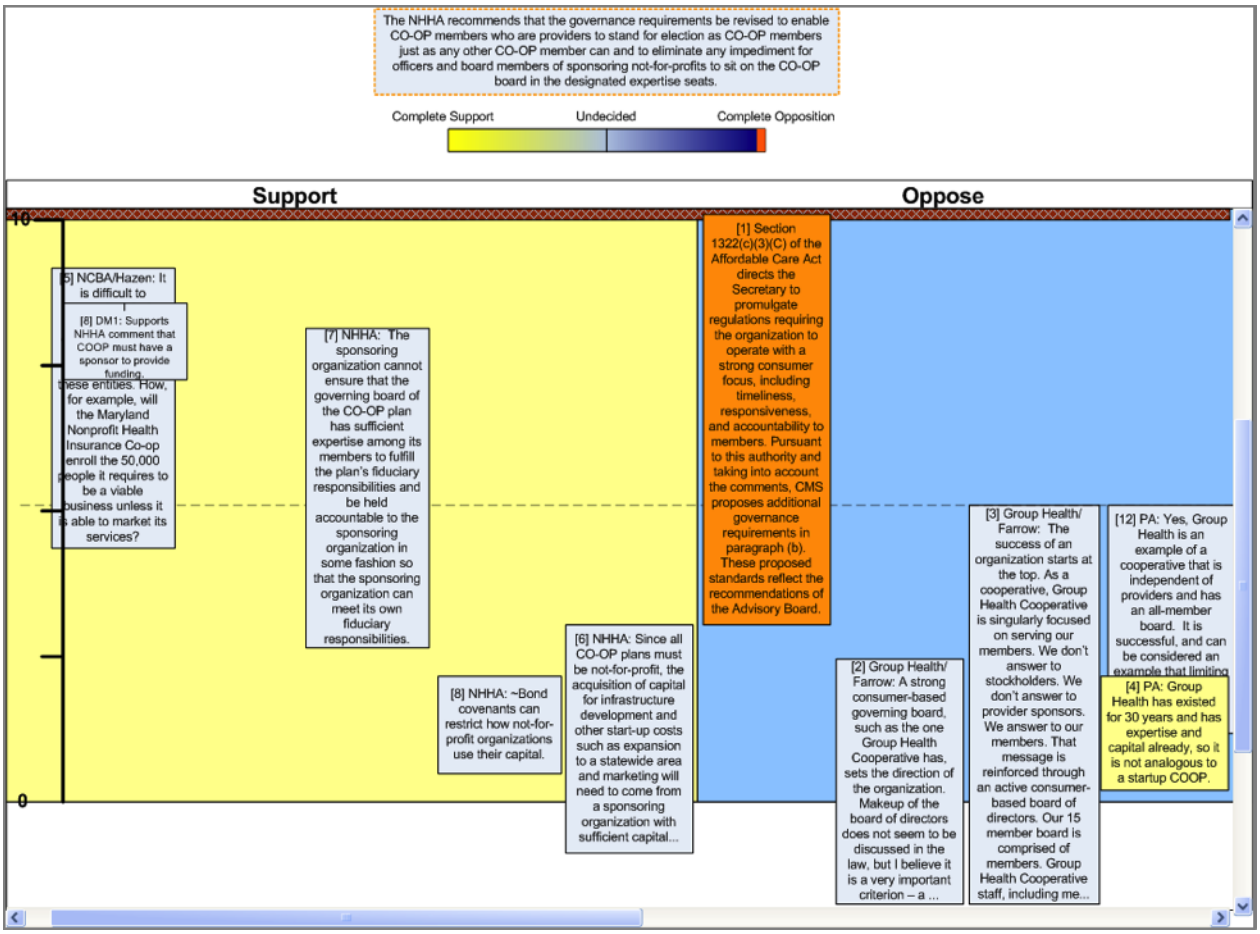

Figure 5. Decision constraint

6. Design Walkthrough

In order to determine the potential for decision support from coupling an argument map with the Decision View, individual design walkthroughs were conducted with three informants by the first author of this paper. Each walkthrough was an audiotaped, semi-structured interview that was designed to elicit feedback on the design. Each began with an overview of the argument map presented in Compendium, followed by an examination of roughly 12 rated arguments, viewed in a design mockup of a static argument map augmented with that capability. These arguments were then viewed in a dynamic mockup of the Decision View, and the informant was asked to judge whether the design would aid their decision process, such as clarifying the arguments and taking more factors into account. Due to the nature of the mock-up, it was not possible to have informants perform actual decisions using the tool.

Informant 1 was an Industrial Engineering graduate preparing for medical school. Informant 2 was a Business School and Information School professor knowledgeable in decision science and argumentation. Informant 3 was a physician and Public Policy professor with expertise in the ACA.

Overall, the informants reacted positively to the Decision View. Informant 1 said that it seems like a logical way to extend argument maps for making decisions. Informant 2 believed that it provides a quick way to understand the shape of a debate (e.g., the number and strength of arguments and counter-arguments) and to see points of disagreement. Informant 3 felt that both quantitative and intuitive thinkers could find benefit in the tool, due to the combination of numeric rating of arguments in the argument map and graphical features for changing weights in the Decision View. He believed that experienced decision makers would accept the Decision View as a "discussion tool" that aids in performing what-if scenarios and in remembering important factors.

Several recommendations were made for improvements. In the Decision View, all informants recommended that the top edge of each comment should be visually distinguished in a way that makes it clear that it is the top (and not, for example, the middle) of the

box that represents the current weight. Informant 2 recommended that all comment boxes be the same size to avoid any potential for misinterpretation of size differences. Informant 1 felt that a guide for the rating scale should be provided to explain, for example, what a rating of 2 means in contrast to a rating of 7.

All of the informants saw potential in the design for group decision making. Informant 1 expressed the idea of having people individually rate the arguments, and then displaying those ratings as a combined rating next to each comment box. Alternatively, Informant 3 thought the Decision View could be used during group meetings where the weights could be set collaboratively. This might be implemented in a graphically appealing way as an iPad application, taking advantage of the touchscreen for seamlessly adjusting weights. Informant 2 envisioned an organizational process in which individuals would utilize the tool to make a decision, and the argument ratings would be exported as justification for the decision.

On the question of whether an agency might use a tool based on Decision View for processing public comments, both Informants 2 and 3 believed it could provide benefits. Informant 3 thought such a tool could be used for internal deliberations within the agency, but that the ratings themselves might be too politically sensitive to release to the public, especially considering the large volume of rules being created in the case of the ACA. Informant 2 believed that the tool could help the agency write responses to the public comments by allowing the writers to see the strength of the various arguments and counter-arguments. Going one step further, it might be possible to automate the generation of some draft responses directly from the ratings. Such a feature would help to offset the additional work of creating an argument map to begin with, although of course draft responses would need to be professionally reviewed.

7. Conclusions and Future Work

In this paper we have demonstrated one way in which an interactive decision support system that incorporates argument maps could be created. A case study of the health insurance CO-OP rule was used to guide the design of a decision support feature. First, an argument map was created from the proposed rule and a sample of public comments, which led to several guidelines for map creation. Next, the arguments were evaluated with three decision techniques: multi-attribute utility theory, Franklin's method, and uncertainty analysis. A variant of Franklin's method was selected because it accommodated the range of argument types present. The method was combined with an argument map to produce an integrated decision support design. The design allows a policy analyst to rate comments in the argument map, and then to visually adjust the relative ratings until they are satisfied with the decision. Finally, three individuals provided feedback during design walkthroughs. These informants provided a few suggestions for improvements, but the predominant response indicated good potential for the design to be useful in keeping track of arguments and in seeing the shape of a debate, as well as for group decision making.

By making the basis for reasoning more explicit, argument maps have some potential for helping to improve the transparency of an agency's decision process. Of course, internal pre-decisional deliberations deserve protection in the interest of full and open internal communication during the decision process, so in some settings these contributions to transparency are more likely to take the form of explaining decisions rather than reconstructing them. This might be accomplished either directly (e.g., by making the tool available) or indirectly (e.g., by using the tool to help craft explanations for specific choices).

The application of argument maps for decision making presented here also illuminates areas that are ripe for further research across multiple disciplines. Argument maps might be improved in several ways, for example: How might the natural language of public comments be automatically translated into the notation of argument maps? How can the layout of argument maps be made more readable? What kinds of dynamic arrangement tools would be useful? Regarding the rating of comments: Can argumentation schemes (e.g., [16]) augment decision techniques, or otherwise assist in structuring argument maps? Another idea, perhaps a bit further out, would be to explore how public comments might be submitted directly into an argument map, thus reducing the effort currently expended in reading and processing public comments. Perhaps even further out, we might even offer our argument maps as a tool for agencies to use when considering whether to adopt argument maps.

While much remains to be done, we see promise in the intersection of argument maps, decision support systems, and online support for participatory democracy that we have explored in this paper.

8. References

[1] N. Benn, and A. Macintosh, "Argument Visualization for eParticipation: Towards a Research Agenda and Prototype Tool," Proceedings of the Third IFIP WG 8.5 international conference on Electronic participation, LNCS 6487, 2011, pp. 60-73.

[2] J. Conklin, Dialogue Mapping: Building Shared Understanding of Wicked Problems, John Wiley & Sons, Ltd., West Sussex, England, 2006.

[3] P. K. Davis, and J. P. Kahan, Theory and methods for supporting high level military decisionmaking, RAND, Santa Monica, CA, 2007.

[4] R. M. Dawes and B. Corrigan, "Linear models in decision making," Psychological Bulletin, 1974, v. 81, pp. 95-106.

[5] Department of Health and Human Services, Establishment of the Consumer Operated and Oriented Plan Program, Docket ID HHS-OS-2011-0021, 2011.

[6] eRulemaking Program Management Office, Improving Electronic Dockets on Regulations.gov and the Federal Docket Management System – Best Practices for Federal Agencies, eRulemaking Program, Washington, DC, 2010. Retrieved from http://www.regulations.gov/exchange/sites/default/files/doc_files/20101130_eRule_Best_Practices_Document_rev.pdf on October 10, 2011.

[7] N. Karacapilidis, and C. Pappis, "Computer-supported collaborative argumentation and fuzzy similarity measures in multiple criteria decision making," Computers and Operations Research, 2000, v. 27, pp. 653-671.

[8] C. M. Kerwin, Rulemaking: How Government Agencies Write Law and Make Policy, CQ Press, Washington, D.C., 2003.

[9] C. W. Kirkwood, Strategic Decision Making: Multiobjective Decision Analysis with Spreadsheets, Duxbury Press, Belmont, CA, 1997.

[10] P. Kirschner, S. Buckingham Shum, and C. Carr, Visualizing Argumentation: Software Tools for Collaborative and Educational Sense-Making, Chapter 5, Springer, London, 2003.

[11] V. Kourmpanis, and V. Peristeras, "E-Consultation: Processing and Summarizing Contributions with Arguments Maps," ICEGOV, 2010, pp. 357-358.

[12] M. Olson, The Logic of Collective Action: Public Goods and the Theory of Groups, Harvard University Press, Cambridge, MA, 1971.

[13] P. Orszag, Open Government Directive, Office of Management and Budget, Washington, D.C., 2009.

[14] F. M. Shipman, and C. C. Marshall, "Formality considered harmful: Experiences, emerging themes, and directions on the use of formal representations in Interactive systems," Computer Supported Cooperative Work, 1999, v. 8(4), 333-352.

[15] E. Tambouris, E. Dlakiouridou, E. Panopoulou, and K. Tarabanis, "Evaluation of an Argument Visualisation Platform by Experts and Policy Makers", Proceedings of the Third IFIP WG 8.5 international conference on Electronic participation, LNCS 6847, 2011, pp. 74-86.

[16] D. N. Walton, Argumentation Schemes for Presumptive Reasoning, Routledge, New York, 2009.

[17] K. P. Yoon, and C. Hwang, Multiple Attribute Decision Making: An Introduction, Sage Publications, Thousand Oaks, CA, 1995.