

Copyright © 2021 Waleed H. Mebane

License is granted to the recipients of this file to distribute it incidentally and without changes with the Allsembly™ Prototype source code provided that all of the terms of the license for the Allsembly™ Prototype software are adhered to. This notice must be reproduced verbatim and legibly in distributed copies. If the Allsembly™ Prototype source code is being distributed for a fee, this file may only be distributed with it if no additional amount is charged. No other permissions are granted. This work or works derived from it may not be published under any other circumstances without the explicit prior written permission of the author.

The text below is a version of my dissertation proposal edited, in a rough way, to streamline it to concerns most informative of Allsembly™ software development.

A Dialectical System for Large-scale Public Deliberation with Computer Support

by Waleed Mebane

“Science may be described as the art of systematic oversimplification—the art of discerning what we may with advantage omit.” --Karl Popper¹

Introduction

The goal of the proposed research is to develop a *dialectical system* for promoting the goals of dialogue for deliberative democracy. A dialectical system is a dialogue between two or more persons that is regulated according to a set of rules (Hamblin, 1970, p. 255; Walton & Krabbe, 1995, p. 66). The dialogue type described by theorists of deliberative democracy is not necessarily the same as what is called deliberation by argumentation theorists. The goal that I am interested in is the justification of policy proposals.

The dialectical system I am proposing to develop is to be to deliberation what academic or exhibition debate (and also other kinds of debates, often called “formal”) are to persuasion. Academic debate is not well suited to informal everyday disputes. It is not a general purpose method of persuasion. Often the issue to be debated is already a popular controversy that has been part of informal discourse for some time. In such cases public debate can be enormously beneficial. While

1 Karl Raimund Popper and William Warren Bartley (ed.), *The Open Universe: an Argument for Indeterminism* (1991), p. 44.

politicians, in their debates, often get away with personal attacks, hyperbole, falsehoods, and egregious bad reasoning, the judges or audiences of exhibition debates generally expect decorum, seriousness, and a general high standard of reasoning from the debaters. Such debates are conducted for the edification of the audience or for sport, as a contest of skill, with edification as a likely by-product. Debaters are often assigned sides in the debate at random and choose the best arguments they can find rather than what suits their partisan preference. Their contest of skill is instrumental to building and exhibiting exemplary good cases on each side of the issue. Likewise, the dialectical system I aim to develop is not intended to be well suited to everyday deliberation, and there will be beneficial informal discourse—perhaps including performance art and satire—that will be left out. So it is better that use of the dialectical system *follows* other kinds of discourse. But in such cases, it should be able to be enormously beneficial.

Background

Deliberative democracy is about the formation of public opinion, prior to voting, through deliberative events that are pervasive in the society, not only in formal institutions such as parliaments (Bachtiger, Dryzek, Mansbridge, & Warren, 2018, pp. 2, 9, 11–13; Estlund & Landemore, 2018, p. 113; Habermas, 1996, p. 171; Habermas, 1994, p. 3; Rehg, 1996, p. ix). Bachtiger, Dryzek, and Mansbridge define deliberation as: “mutual communication that involves weighing and reflecting on preferences, values, and interests regarding matters of common concern (2018, p. 2).” Opinion formation involves not only information exchange but also persuasion (Westwood, 2015).

Charles Hamblin described the features of *dialectical systems* in his book *Fallacies* (1970, pp. 255–260). His dialectical systems were for formal dialogues conducted in a formal language (1970, p. 258). Rules specify what locutions are forbidden and which are obligatory at some time in the dialogue, given the history of the dialogue to that point. And the dialogue progresses by the speakers taking turns (1970, p. 257). The rules could obligate speakers to maintain consistent positions, called *commitments*, and specify which statements a speaker will be considered to be committed to. For this purpose, speakers keep track of their commitments in a *commitment-store* (1970, p. 257). If, by the rules, a speaker would become committed to some statements by the things they say in the current turn, the speaker first checks whether those new statements are consistent with the old statements in their commitment-store. If there is an inconsistency, the speaker must retract the inconsistent statements in

their commitment-store before being allowed to assert the new statements (1970, pp. 262–264, and, e.g., 276–277).

The persuasive part of a deliberation involves using arguments to attack or support some other positions. When two positions conflict, there is a need for a method to decide which of them ought to be accepted. I will propose that there be a measure of confidence in the truth or correctness of statements. Of two inconsistent statements the one we have greater confidence in is the one which ought to prevail. That constrains our choice of confidence measure; we ought not rationally to be able to have high confidence in both of two mutually exclusive inconsistent propositions. In addition, in order for arguments to act as justifications, confidence must be imparted from premises to conclusions through inference rules; and justifications will also need to be evaluated on the basis of how much the confidence in conclusions is in that way increased.

There are several candidates for ways of quantifying the weights of claims (see, e.g., Amgoud & Cayrol, 1998; Amgoud & Prade, 2004; Caminada, 2006; Hunter, 2014; Li, Oren, & Norman, 2011). In my opinion, the richest approach is to use probability. Obviously, in an objective sense, we do not know (and probably cannot determine) how probable is the content of a claim like “they are telling the truth”. But each person who is a participant in a dialogue has a belief that it is either a true claim or a false claim or that they ought to suspend judgement. It is the same kind of assessment that a participant (or judge) makes when deciding whether a claim has initial plausibility (see, e.g., Hawthorne, 2020, sec. 2.1, para 6).² Hahn and Oaksford (2006), Godden and Zenker (2018), and others (see Zenker, 2013) have proposed using subjective probability to evaluate the strength of arguments. In addition, computer scientists and philosophers of science have developed theory about the weight of evidence given its probability (see, e.g., Hawthorne, 2020; Jeffrey, 2004; Pearl, 1988).

Constraints on rationality of beliefs emerge from probability theory applied to subjective degrees of belief as probabilities. But these constraints apply to individuals. In order to learn what the rational judgement of the whole group about the weight of evidence ought to be given the judgements of the individuals, we need a way to aggregate those judgements. One way to do that would be to vote. Instead, I will propose to aggregate those judgements using prediction markets, potentially ameliorating some difficulties that can arise with voting (such as those revealed by Arrow’s Impossibility Theorem).

² See Pearl (1988, pp. 14–21, 52–58) for a defense of the usefulness of probability to represent many cases of plausibilistic reasoning.

As far as I know prediction markets have never been proposed to be used for predicting rational confidence in the truth of arbitrary statements (statements other than statements about future events in the world).

Proposal

A possibly counter-intuitive claim that I make is that it is not necessary for participants to address each other or to know anything about each other's identities; they need only *refer* to arguments to which they are responding. This opens up the possibility of *non-interpersonal* and anonymous communication. By "non-interpersonal" I mean that none of the communication is about or involves personalities; instead, it is exclusively about the positions taken in the exchange of arguments and proposals. Among other distractions, abusive *ad hominem* arguments are ruled out. It is not that they are forbidden, but they become pointless to the extent that participants neither address each other or know anything about each other. While it cannot be guaranteed that, even anonymous, participants neither address each other nor share information about one another, it can be made more likely.³

Political theorists have made some claims about good social epistemic practises for making good decisions more likely. Consider the requirement that democratic deliberation be between free and equal persons: they are free to speak their minds and what they say receives consideration equal to that received by the speech of others (see Estlund & Landemore, 2018, p. 122). One way to achieve that is to have (only) virtuous persons: They would never think of hindering another's speech or of retaliating against another for speech they do not like; and they unfailingly restrain themselves from exploiting any excess of power they possess over others. Another way to achieve that is to have a powerful or authoritative third-party, such as a judge or moderator, preside over the proceedings: The third party's job is to restrain unfair behavior and to guide the discussion toward the disclosure of relevant concerns and away from distractions.

I am interested in developing a system that enables large numbers of people to participate together in a deliberation, all contributing proposals and considerations in favour of or against those proposals. The need to find only virtuous participants or to educate or train participants in virtuous behavior would be a severe limitation on the growth of participation. Likewise, the need for trained

3 Note: this does not mean that participants would be restricted from sharing anecdotal evidence. They simply do not present the evidence as their *own* testimony. It would be impossible to authenticate it if it were presented in that way unless the witness's identity could be verified. Therefore, the evidence should be offered outside of the system, such as in a newspaper or blog post, and then referred to. Alternatively, it could be presented as a plausible hypothetical rather than as empirical evidence.

moderators (and possibly small break-out groups) would work against increasing the size of groups, and it has another drawback: The moderators can be accused of bias, and such accusations cannot be definitively refuted. Therefore, I prefer a system that is self-regulating and is without moderators.

Suppose we focus not on the persons but on the environment. The most obvious situation in which participants would be free and equal would be when they are members of a completely egalitarian society with robust guarantees of freedom. Consider it a given that no such society exists or may be easily created. Nevertheless we may simulate an environment of freedom in a discussion by guaranteeing anonymity.⁴ No one may retaliate because they are unable to find out whom to retaliate against. We may also simulate equality because markers of status or other inequality are obscured by anonymity and participants in the system have strictly equal powers within the system.⁵

Justification using the system is sketched as follows. Contributions are made using natural language. After some policy proposals have been offered, participants propose evaluation criteria. Evaluation criteria are such as: “a proposal should be preferred over another (or the status quo) if it is less expensive” or “a proposal should be preferred over another if it solves the problem more effectively”. In addition, participants propose how relatively important are each of the evaluation criteria, e.g., 50% cost and 50% effectiveness. In order to be justified, a policy proposal must address the initially agreed upon issue of concern and do so in a way agreed at the start to count as adequate—I call meeting those two conditions “solving” the problem—and it must be better than alternatives, including the status quo, according to the evaluation criteria that are agreed upon during the deliberation; and those evaluation criteria must be in accord with the norms and values of the community. All of these are probabilistic conditions. It is only a prediction that it will solve the

4 An example of a guarantee of anonymity would be a contract binding an organization not to release identity information or a law prohibiting its release. In a setting of weak rule of law, in which organizations’ promises to maintain anonymity cannot be trusted or in a setting in which an intrusive government can uncover identities of speakers, there is cryptographic technology that can enable a person to prove that they are entitled to a service without revealing their identity. (They reveal their identity when signing up but not when logging in.) An extension of that technology is *revocable anonymity*. A secret code that can be used to uncover a person’s identity can be maintained by a judicial panel or by a contractually obligated escrow service operating in another jurisdiction, where rule of law is strong. Anonymity could be revoked if the system is used by a participant for criminal activity or threats of violence.

5 Anonymity has been blamed for lack of civility leading to unproductive deliberative events; however, there is recent empirical evidence that anonymity has been apportioned more than its fair share of the blame. In one study, anonymity does not result in more irresponsible speech when the discussion has a facilitator (moderator) (Strandberg & Berg, 2015). In another study abusive speech is explained by the level of controversy of the topic and not by anonymity (Berg, 2016). Although I do not intend to restrict deliberation to uncontroversial issues and, as I have mentioned, I do not intend to make use of moderators, the evidence suggests a false dichotomy between unaccountable anonymity with irresponsible speech behavior and accountable real identities with responsible speech behavior. Some accountability is possible without knowing real identities since participants can be temporarily banned or their contributions withheld, and responsible speech is not dependent only or primarily on accountability.

problem and do so better than those alternatives that are mutually exclusive and be consistent with community norms and values. It must be more probable than not. And two or more proposals might be considered justified. We can think more in terms of ruling out obviously unjustified proposals than about discovering one best proposal.

Proposals are supported by facts such as that “realizing Proposal x is credibly estimated to cost \$1,000,000.” Evaluation criteria are supported or rebutted by normative considerations such as that “it is wrong for the most vulnerable in society to be harmed most by the negative side-effects of adopting a policy.” Initial evidence for the truth of an alleged fact or the correctness of an alleged normative consideration is that the group has confidence in it, which we learn from an aggregation of their positions on the issue (its market price in a prediction market, to be explained shortly). Facts and normative considerations (subsequently, *positions*) may be supported or rebutted by other facts and normative considerations forming arguments for or against some position. An argument imparts some weight of confidence that participants have in the facts and normative considerations that are its premises to its conclusion; and its conclusion is that the position that it supports is true or (of normative considerations) correct or that the position that it rebuts is false or incorrect. The weight of evidence from the supporting or rebutting argument combined with the initial evidence value is our new evidence for the truth or correctness of the position. As long as the calculations are kept up-to-date, participants can always tell which positions are most in need of support or rebuttal: positions they agree with that are at less than 50% total confidence, positions they oppose that are at greater than 50% total confidence, and any position that is very close to 50% total confidence.

Suppose that, for each claim, participants place bets on whether the evidence will ultimately support that claim. Up until some prearranged time close to the time at which discussion is to end, participants may revise their positions (at a cost). The odds and therefore the price of a position will be adjusted according to how many participants currently favour that position. This is a rough description of a betting market, which is called a prediction market when it is used to forecast events. In such a market, if the odds favour the claim, then betting against the claim is relatively less expensive. A participant who knows an argument that could defeat the claim can make bets at a bargain, and the stronger and more robust against future attacks that defeating argument is, the more likely the bets are to pay off in the long run. Likewise, if a participant knows an argument that would strengthen support for a claim, the claim is possibly currently undervalued. The participant bets at the current price confident that the claim will remain well supported in the end. The same reasoning shows that

participants have an incentive to seek out new information: so as to take advantage of undervalued positions. And the cost associated with endorsing a position also provides an incentive to bet only in accordance with their true assessment. Finally, a participant has an incentive to contribute to making sure a position is clear, as to the meanings of its terms and the conditions of its confirmation or refutation, so as to be assured that the goalpost for a payout will not be moved. In order to be inclusive and to prevent market manipulations, participants will bet with play money that is evenly distributed; however, they could win real money or other prizes according to their betting (prediction) performance in addition to being paid for their labour.

There is a potential problem, for democratic decision, of majority domination of minorities. The dialectical system to be developed through the research is a rule-governed system. In that way, it is similar to a debate. Parliamentary rules give minorities the right to be heard but ultimately, the decisions are made when greater than 50% of voting-eligible persons endorse them through a vote. The alternative is to require a supermajority, in which case any sizable enough minority may wield a veto against the majority and not always for good reason. By this I mean that less than 50% of persons may stop a proposal favored by more than 50% of persons from being accepted. A good reason to stop a proposal might be that it infringes on important rights or freedoms, but persons in the minority could just as well have ill-considered reasons of narrow personal preference. So the smaller number of people might arbitrarily frustrate the will of the larger number. I implicate in this problem the lack of any enforceable standard of rationality or even just consistency. For example, the opposition party may claim they want to spend tax money frugally when out of the majority, yet vote to spend profligately at some other time when they are in the majority. And not only the party as a whole, but also individual members, may disregard their previous stated commitments and use the power of their vote in apparently arbitrary ways. Of course, it is not irrational to change one's mind, but it is not always without consequence; a member with a changed mind ought to exhibit it by advocating, and then voting, to repeal previous policies they now consider mistaken, if possible, or otherwise to make amends. The solution I offer to this problem is enforcing commitments. When members of majorities are held to their commitments, minorities have a chance to force enough members to concede a position by arguing using premises endorsed by those members.⁶ Under such conditions, use of reason to arrive at justified policies would have a chance to predominate over use of power to enact arbitrary ones.

6 This is a strategy in the Permissive Persuasion Dialogue by Walton and Krabbe (1995, p. 135).

I propose the following prescriptive ideal practices for participants for optimal progress toward producing a justification of a policy proposal, if one is, in fact, justified.

1. Significance – Participants endorse only statements they believe (or, through observation of evidence, realize that they ought rationally to believe) to be (probably) true or (of hypotheses) best candidates for truth.
2. Information & Relevance – Participants contribute all (and only) the relevant considerations that they know of in favour of or opposed to any position or proposal for action currently under consideration, within the time available and according to the priority order given by (5).
3. Clarity – Participants communicate all causes that they know of for significant lack of understanding of a position or of its conditions for successful confirmation or refutation.
4. Evidence sensitivity and non-evidence insensitivity – Participants are persuaded to *change* their endorsements by and only by the weight of evidence.
5. Fortification –
 - a) Participants contribute their strongest arguments or best proposals first.
 - b) Participants choose those positions to attack or support which will result in their arguments having the most impact on the confidence (weight of evidence) estimate of some proposal for action.
6. Common-good alignment – Participants consider as relevant only those considerations that, in their judgement, bear on a proposal's promotion of or detracting from the common good.

The rule for the dialectical system is that endorsement of a position requires risking something. That comes in the form of making a bet in favour of the position, and a participant's outstanding bets function as their commitment-store. A bet in favour of a position can only be made by a participant when that participant has no outstanding bets opposed to that position or outstanding bets in favour of positions that are the premises in an argument which concludes in opposition to that position. A participant may make such bets after selling betting contracts representing bets in conflict with the bet they wish to make. This rule promotes practice 1. Selling betting contracts or holding on to losing ones might incur losses, so if one does not believe a statement one endorses by betting on it, one should rationally expect to lose "money".

Practices 2 through 5 are also promoted by the market, as explained in the paragraph giving the rough description of the betting market above. Practice 4 is additionally promoted by anonymity

because participants do not have irrelevant personal information of other participants available to them, which might have become non-evidential reasons for endorsement (e.g., by having accepted *ad hominem* arguments made against other participants). The last practice is a moral norm (as opposed to an epistemic or dialectical norm). My sense for practice 6 is that it could be promoted by making the common good an overriding evaluation criterion for all proposals. An additional, separate concern is that, in general, reproducible and verifiable forms of evidence be preferred over other forms of evidence. Epistemic standards expressing that preference could be included as starting assumptions. It is desirable that any starting assumptions (other than the axioms of logic and probability) be able to be overridden by the participants. However, if they are not overridden then they could help to prevent majority beliefs that are based on, for example, those forms of revelation or tradition that are not supposed to be testable but only taken on faith from dominating the discussion to the disadvantage of the arguments of minorities. It is not strictly necessary to prevent such an outcome, and it is not procedurally different from any intractable disagreement over fundamental beliefs (beliefs for which no further reasons are available), but it corresponds fairly well with a requirement of “public reason” expressed by John Rawls for liberal democracy (see Rawls, 1996, Chapter 6). So, such additional assumptions of epistemic standards might be desired in application to deliberative democracy.

The novel dialectical system I have sketched is meant to contribute to the practice of deliberative democracy, and I am developing it by applying argumentation theory. It is not meant to displace professional public policy analysis, which analyzes policy in depth. The breadth and depth of analysis likely to be achieved in a system such as described would be driven by participant concerns and interests. And that is appropriate because engaging a large diverse group of community members in evaluating policy has as its a differentiating quality that it should enable the norms and values of the community beyond experts and professionals to come to be embodied in recommendations. Professional policy analyses and expert opinion should be an important part of the information gathered by participants to provide evidence for or against various positions that emerge in the dialogues, and it may also be evaluated critically as part of the process.

Works cited

- Amgoud, L., & Cayrol, C. (1998). On acceptability of arguments in preference-based argumentation. In *Proceedings of the Fourteenth Conference on Uncertainty in Artificial Intelligence (UAI1998)* (pp. 1–6).
- Amgoud, L., & Prade, H. (2004). Using arguments for making decisions: a possibilistic logic approach. In *Proceedings of the twentieth conference on uncertainty in artificial intelligence (UAI2004)* (pp. 10–15).
- Bachtiger, A., Dryzek, J. S., Mansbridge, J., & Warren, M. (2018). Deliberative Democracy: An Introduction. In A. Bachtiger, J. S. Dryzek, J. Mansbridge, & M. Warren, *The Oxford Handbook of Deliberative Democracy* (pp. 1–32). Oxford: Oxford University Press.
- Berg, J. (2016). The impact of anonymity and issue controversiality on the quality of online discussion. *Journal of Information Technology and Politics*, 13(1), 37–51.
- Caminada, M. (2006). On the issue of reinstatement in argumentation. In M. Fisher, W. van der Hoek, B. Konev, & A. Lisitsa (Eds.), *Logics in Artificial Intelligence* (pp. 111–123). Liverpool, U.K.: Springer.
- Estlund, D., & Landmore, H. (2018). The Epistemic Value of Democratic Deliberation. In A. Bachtiger, J. S. Dryzek, J. Mansbridge, & M. Warren, *The Oxford Handbook of Deliberative Democracy*. Oxford: Oxford University Press.
- Godden, D., & Zenker, F. (2018). A probabilistic analysis of argument cogency. *Synthese*, 195(4), 1715–1740. <https://doi.org/10.1007/s11299-016-1299-2>
- Gutmann, A., & Thompson, D. (2004). *Why deliberative democracy?* Princeton and Oxford: Princeton University Press.
- Habermas, Jürgen. (1994). Three normative models of democracy. *Constellations*, 1(1), 1–10.
- Habermas, Jürgen. (1996). *Between facts and norms : contributions to a discourse theory of law and democracy*. Cambridge, Mass.: MIT Press.

- Hahn, U., & Oaksford, M. (2006). A Normative Theory of Argument Strength. *Informal Logic*, 26(1), 1–24.
- Hamblin, C. L. (1970). *Fallacies*. London: Methuen.
- Hawthorne, J. (2020). Inductive Logic. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Fall 2020). Retrieved from <https://plato.stanford.edu/archives/fall2020/entries/logic-inductive/>
- Hunter, A. (2014). Probabilistic qualification of attack in abstract argumentation. *International Journal of Approximate Reasoning*, 55, 607–638.
- Jeffrey, R. (2004). *Subjective probability the real thing*. Cambridge; New York: Cambridge University Press.
- Landemore, H. (2017). Beyond the Fact of Disagreement? The Epistemic Turn in Deliberative Democracy. *Social Epistemology*, 31(3), 277–295.
<https://doi.org/10.1080/02691728.2017.1317868>
- Li, H., Oren, N., & Norman, T. J. (2011). Probabilistic argumentation frameworks. In S. Modgil, N. Oren, & F. Toni (Eds.), *Theory and Applications of Formal Argumentation* (pp. 1–16). Barcelona, Spain: Springer.
- Pearl, J. (1988). *Probabilistic Reasoning in Intelligent Systems*. San Mateo, California: Morgan Kaufmann.
- Rawls, J. (1996). *Political Liberalism*. New York: Columbia University Press.
- Rehg, W. (1996). Translator's Introduction. In Habermas, Jürgen, *Between facts and norms : contributions to a discourse theory of law and democracy*. Cambridge, Mass.: MIT Press.
- Strandberg, K., & Berg, J. (2015). Impact of Temporality and Identifiability in Online Deliberations on Discussion Quality: An Experimental Study. *Javnost - The Public*, 22(2), 164–180.
- Walton, D., & Krabbe, E. (1995). *Commitment in dialogue*. Albany: State University of New York Press.
- Westwood, S. J. (2015). The Role of Persuasion in Deliberative Opinion Change. *Political Communication*, 32(4), 509–528.

Zenker, F. (Ed.). (2013). *Bayesian argumentation: The practical side of probability*. Dordrecht: Springer.

Additional reading (by topic)

Deliberative Democracy

Bohman, J., & Rehg, W. (Eds.). (1997). *Deliberative democracy: Essays on reason and politics*. Cambridge, MA; London: MIT Press.

Estlund, D. (2008). *Democratic Authority: a philosophical framework*. Cambridge: Cambridge University Press.

Freeman, S. (2001). Deliberative Democracy: A Sympathetic Comment. *Philosophy and Public Affairs*, 29(4), 371–418.

Moore, A. (2018). Anonymity, Pseudonymity, and Deliberation: Why Not Everything Should Be Connected. *The Journal of Political Philosophy*, 26(2), 169–192.

Parkinson, J., & Mansbridge, J. (2012). *Deliberative systems: Deliberative democracy at the large scale*. Cambridge: Cambridge University Press.

Paul, Ellen Frankel, Miller, Fred D., Jr., & Paul, Jeffrey. (2000). *Democracy*. Cambridge; New York: Cambridge University Press.

Post, Robert. (2011). Participatory democracy and free speech. *Virginia Law Review*, 97(3), 477–490.

Roussopoulos, Dimitrios I., & Benello, C. George (Eds.). (2017). *Participatory democracy : prospects for democratizing democracy*. Montreal: Black Rose Books.

Dialogue Theory and Dialogue Models

Atkinson, K. (2005). *What Should We do? Computational Representation of Persuasive Argument in Practical Reasoning* (PhD Thesis). University of Liverpool, Liverpool.

- Atkinson, K., Bench-Capon, T. J. M., & McBurney, P. (2004). Justifying Practical Reasoning. In F. Grasso, C. Reed, & G. Carenini (Eds.), *Proceedings of the Fourth International Workshop on Computational Models of Natural Argument (CMNA 2004)* (pp. 87–90). Valencia, Spain.
- Atkinson, K., Bench-Capon, T. J. M., & McBurney, P. (2005a). A Dialogue Game Protocol for Multi-Agent Argument over Proposals for Action. *Autonomous Agents and Multi-Agent Systems*, 11(2), 153–171.
- Atkinson, K., Bench-Capon, T. J. M., & McBurney, P. (2005b). Persuasive Political Argument. In F. Grasso, C. Reed, & R. Kibble (Eds.), *Proceedings of the Fifth International Workshop on Computational Models of Natural Argument (CMNA 2005)* (pp. 44–51). Edinburgh.
- Atkinson, K., Bench-Capon, T. J. M., & McBurney, P. (2006). Computational Representation of Practical Argument. *Synthese*, 152(2), 157–206.
- Atkinson, K., Bench-Capon, T., & McBurney, P. (2005c). Arguing About Cases as Practical Reasoning. In G. Sartor (Ed.), *Proceedings of the 10th International Conference on Artificial Intelligence and Law* (pp. 35–44). New York: ACM Press.
- Atkinson, K., Bench-Capon, T., & Walton, D. (2013). Distinctive Features of Persuasion and Deliberation Dialogues. *Argument and Computation*, 4(2), 105–127.
- Bench-Capon, T. J. M., & Atkinson, K. (2009). Abstract Argumentation and Values. In *Argumentation and Artificial Intelligence* (pp. 45–64). Berlin: Springer.
- Kok, E. M., Meyer, J.-J. C., Prakken, H., & Vreeswijk, G. A. W. (2011). A Formal Argumentation Framework for Deliberation Dialogues. In P. McBurney, I. Rahwan, & S. Parsons (Eds.), *Argumentation in Multi-Agent Systems* (pp. 31–48). Berlin, Heidelberg: Springer Berlin Heidelberg.
- Lewinski, M. (2014). Argumentative Polylogues: Beyond Dialectical Understanding of Fallacies. *Studies in Logic, Grammar and Rhetoric*, 36(1), 193–218.
- Lewinski, M., & Blair, J. A. (2011). Monologue, dialogue or polylogue: Which model for public deliberation? In *OSSA Conference Archive* 52.

- McBurney, P., Hitchcock, D., & Parsons, S. (2007). The Eightfold Way of Deliberation Dialogue. *International Journal of Intelligent Systems*, 22, 95–132. <https://doi.org/10.1002/int.20191>
- Medellin-Gasque, R., Atkinson, K., McBurney, P., & Bench-Capon, T. J. M. (2011). Arguments over Cooperative Plans. In *Theory and Applications of Formal Argumentation*. Berlin: Springer.
- Prakken, H. (2006). Formal Systems for Persuasion Dialogue. *The Knowledge Engineering Review*, 21(2), 163–188.
- Prakken, H. (2009). Models of Persuasion Dialogue. In I. Rahwan & G. R. Simari (Eds.), *Argumentation in Artificial Intelligence* (pp. 281–300). Dordrecht: Springer.
- Walton, D. (1984). *Logical dialogue-games and fallacies*. Lanham, MD.: University Press of America, Inc.
- Walton, D., & Toniolo, A. (2016). Deliberation, Practical Reasoning and Problem-solving. In P. Bondy & L. Benacquista (Eds.), *Proceedings of the 11th International Conference of the Ontario Society for the Study of Argumentation*. Windsor, Ontario. Retrieved from <https://scholar.uwindsor.ca/ossaarchive/OSSA11/papersandcommentaries/108/>
- Walton, D., Toniolo, A., & Norman, T. J. (2014). Missing Phases of Deliberation Dialogue for Real Applications. In *Proceedings of the 11th International Workshop on Argumentation in Multi-Agent Systems*. Retrieved from <http://scholar.uwindsor.ca/cgi/viewcontent.cgi?article=1030&context=crrarpub>
- Walton, D., Toniolo, A., & Norman, T. J. (2016). Towards a richer model of deliberation dialogue: Closure problem and change of circumstances. *Argument and Computation*, 7, 155–173. <https://doi.org/10.3233/AAC-160009>

Informal Logic and Defeasible Logic

- Goldman, A. (1999). *Knowledge in a Social World*. Oxford: Clarendon Press.
- Pollock, J. L. (1987). Defeasible Reasoning. *Cognitive Science*, 11, 481–518.

- Prakken, H., & Sartor, G. (2006). Presumptions and Burdens of Proof. In T. M. van Engers (Ed.), *Legal Knowledge and Information Systems: JURIX 2006: The Nineteenth Annual Conference* (pp. 21–30). Amsterdam: IOS Press.
- Prakken, H., & Sartor, G. (2009). A Logical Analysis of Burdens of Proof. In H. Kaptein, H. Prakken, & B. Verheij (Eds.), *Legal Evidence and Proof: Statistics, Stories, Logic* (pp. 223–253). Farnham: Ashgate.
- Toulmin, S. E. (2003). *The Uses of Argument, Updated Edition*. Cambridge: Cambridge University Press.
- Walton, D. (1996). *Argumentation Schemes for Presumptive Reasoning*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Walton, D. (2004). *Relevance in argumentation*. Mahwah, NJ: Lawrence Erlbaum Publishers.
- Walton, D. (2011). An Argumentation Model of Deliberative Decision-Making. In J. Yearwood, A. Stranieri, & P. Hershey (Eds.), *Technologies for Supporting Reasoning Communities and Collaborative Decision Making: Cooperative Approaches* (pp. 1–17). IGI Global.

Probabilistic Logic, Probabilistic Argumentation, and Bayesianism

- Hahn, U., & Oaksford, M. (2006). A Bayesian approach to informal reasoning fallacies. *Synthese*, 152, 207–236. <https://doi.org/10.1007/s11229-005-5233-2>
- Hunter, A. (2014). Probabilistic qualification of attack in abstract argumentation. *International Journal of Approximate Reasoning*, 55, 607–638.
- Korb, K. (2004). Bayesian informal logic and fallacy, 24, 41–70.
- Oaksford, M., & Charter, N. (2007). *Bayesian rationality: The probabilistic approach to human reasoning*. New York: Oxford University Press.
- Smith, J. Q. (2010). *Bayesian decision analysis principles and practice*. Cambridge; New York: Cambridge University Press.

Prediction Markets

- Anand Venkateswaran, Paul J. Bolster, & Timm Sprenger. (2007). CONDITIONAL PREDICTION MARKETS AS CORPORATE DECISION SUPPORT SYSTEMS – AN EXPERIMENTAL COMPARISON WITH GROUP DELIBERATIONS. *Journal of Prediction Markets*, 1(3), 189–208.
- Bragues, G. (2009). Prediction markets: The practical and normative possibilities for the social production of knowledge. *Episteme*, 6(1), 91–106.
- Joyce E. Berg, & Thomas A. Rietz. (2003). Prediction Markets as Decision Support Systems. *Information Systems Frontiers*, 5(1), 79–93.

Policy Analysis

- Fischer, Frank, & Gottweis, Herbert. (2012). *The argumentative turn revisited public policy as communicative practice*. Durham: Duke University Press.
- Hajer, Maarten A., & Wagenaar, H. (2003). *Deliberative policy analysis: understanding governance in the network society*. Cambridge: Cambridge University Press.
- Hansson, S. O., & Hadorn, G. H. (Eds.). (2016). *The argumentative turn in policy analysis: Reasoning about uncertainty*. Switzerland: Springer.

Decision Theory

- Bradley, R. (2014, March 9). Decision Theory: A Formal Philosophical Introduction. Retrieved from [https://personal.lse.ac.uk/bradleyr/pdf/Handbook%20-%20Decision%20theory%20\(revised\).pdf](https://personal.lse.ac.uk/bradleyr/pdf/Handbook%20-%20Decision%20theory%20(revised).pdf)
- Hansson, S. O. (2005, August 23). Decision Theory: A Brief Introduction. Retrieved from <https://people.kth.se/~soh/decisiontheory.pdf>
- Steele, K., & Stefánsson, H. O. (2020). Decision Theory. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Winter 2020). Retrieved from <https://plato.stanford.edu/archives/win2020/entries/decision-theory/>

Computer-supported Collaborative Work, Social Computing, and Collective Intelligence

- Aitamurto, T., & Chen, K. (2017). The Value of Crowdsourcing in Public Policymaking: Epistemic, Democratic and Economic Value. *The Theory and Practice of Legislation*, 5(1), 55–72.

- Aitamurto, T., & Landemore, H. (2016). Crowdsourced Deliberation: The Case of the Law on Off-Road Traffic in Finland. *Policy and Internet*, 8(2), 174–196.
- Aitamurto, T., & Saldivar, J. (2017). Examining the Quality of Crowdsourced Deliberation: Respect, Reciprocity and Lack of Common-Good Orientation (pp. 2314–2321). Presented at the CHI 2017, Denver, Colorado, USA: Association for Computing Machinery.
<http://dx.doi.org/10.1145/3027063.305324>
- Aitamurto, T., & Saldivar, J. (n.d.). Motivating Participation in Crowdsourced Policymaking: The Interplay of Epistemic and Interactive Aspects. In *Proceedings of ACM on Human-Computer Interaction* (Vol. 1 (2), p. Article 18).
- Chen, K., & Aitamurto, T. (2017). Barriers for Crowd’s Impact in Crowdsourced Policymaking: Civic Data Overload and Filter Hierarchy. *International Public Management Journal*, 22(1), 99–126.
- Klein, M. (2017). Towards Crowd-Scale Deliberation. MIT Center for Collective Intelligence.
 Retrieved from https://www.researchgate.net/publication/317613473_Towards_Crowd-Scale_Deliberation
- Klein, M. (n.d.). How to Harvest Collective Wisdom for Complex Problems: An Introduction to the MIT Deliberatorium. MIT Working Paper. Retrieved from
https://www.researchgate.net/publication/316659681_How_to_Harvest_Collective_Wisdom_for_Complex_Problems_An_Introduction_to_the_MIT_Deliberatorium
- Klein, M., & Iandoli, L. (2008). Supporting Collaborative Deliberation Using a Large-Scale Argumentation System: The MIT Collaboratorium. Presented at the Directions and Implications of Advanced Computing; Conference on Online Deliberation, University of California, Berkeley. Retrieved from
https://www.researchgate.net/publication/228139786_Supporting_Collaborative_Deliberation_Using_a_Large-Scale_Argumentation_System_The_MIT_Collaboratorium
- Lee, D., Goel, A., Aitamurto, T., & Landemore, H. (2014). Crowdsourcing for Participatory Democracies: Efficient Elicitation of Social Choice Functions. Presented at the The Association

for the Advancement of Artificial Intelligence conference on Human Computation and Crowdsourcing (HCOMP '14).

Scheuer, O., Loll, F., Pinkwart, N., & McLaren, B. M. (2010). Computer-supported argumentation: A review of the state of the art. *International Journal of Computer-Supported Collaborative Learning*, 5(1), 43–102.

Spada, P., Iandoli, L., Quinto, I., Calabretta, R., & Klein, M. (2017). Argumentation vs Ideation in online political debate: evidence from an experiment of collective deliberation. *New Media & Society*.