

Simon Parsons
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Argumentation in Multi-Agent Systems

Second International Workshop, ArgMAS 2005
Utrecht, The Netherlands, July 2005
Revised Selected and Invited Papers



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Preface

This volume is based on the Second Workshop on Argumentation in Multiagent Systems (ArgMAS). The workshop was held in conjunction with the 4th International Conference on Autonomous Agents and Multiagent Systems (AAMAS), at the University of Utrecht in Utrecht, The Netherlands, in July 2005. The workshop itself took place on July 26.

We are happy to report that the second workshop was just as popular and successful as its predecessor, held the previous summer in New York. We received 17 submissions, each of which was reviewed by at least three experts in the field, and ten of these papers were accepted for presentation at the workshop. Once again the workshop was graced by an invited lecture, this time by Frans van Eemeren of the University of Amsterdam, who talked on the subject of pragma-dialectics. The workshop attracted 31 participants, ensuring many questions for the speakers, and a healthy exchange of views during the discussion periods.

Following the practice established with the post-proceedings of the first ArgMAS workshop, we invited the presenters of all the accepted papers to prepare revised versions of their papers for this volume. In addition we approached authors of papers on directly related topics that had been presented in the AAMAS conference, and this gave us an additional seven papers. We further solicited one additional paper (details below) and were lucky enough that Prof. van Eemeren consented to send us a paper that covered the material of his invited talk.

That paper by van Eemeren, written in conjunction with his long-time collaborator Peter Houtlosser and entitled “The Case of Pragma-Dialectics” opens this volume and forms its first part. As its title suggests, the paper provides an overview of the pragma-dialectic view of argumentation — in brief, this is a view that seeks to combine a dialectical view of argumentative reasonableness with a pragmatic view of the verbal moves made in argumentative discourse.

The second part of the book, entitled “Foundations,” contains four papers, all of which deal, in different ways, with some of the very basic issues in computerized models of argumentation. The first, “A Logic of Abstract Argumentation,” by Boella, Hulstijn and van der Torre, picks up the problem of formalizing the kind of reasoning that one can achieve using a system of argumentation. The logic they derive makes it possible to express the properties of such an argumentation system — the system they focus on is the system proposed by Dung [2] and widely studied since — for example, one can express that if arguments a and b attack c , then either a attacks c or b attacks c . “On the Metalogic of Arguments,” by Wooldridge, McBurney and Parsons is concerned with a closely related topic. This paper considers the formalization of argumentation at different levels of abstraction. Just as Boella et al. distinguish between constructing arguments and reasoning about the relationship between arguments, Wooldridge et al. are interested in capturing both this object-level and meta-level reasoning. However,

Wooldridge et al. are interested less in formalizing a specific argumentation system in this way, and interested more in constructing a general framework for this kind of reasoning, making it possible, for instance, to reason about different logics of argumentation (in the sense of Boella et al.).

“Nested Argumentation and Its Application to Decision Making Over Actions” by Modgil then looks at the meta-level reasoning question from yet another angle. Modgil’s work starts from the position of wanting to provide a general solution to the problem of resolving the difference between two arguments that each defeat the other, and he does this by allowing the representation of arguments for and against each of the two arguments being the stronger. These, of course, are meta-level arguments. Modgil further suggests that one can construct arguments about meta-level arguments, in the same kind of way as suggested by Wooldridge et al., and applies his approach to making decisions about actions. Finally in this section, “Testing Formal Dialectic” by Wells and Reed provides a description of Scenario_{GC0}, a framework for implementing computational dialectic systems, which the authors suggest can play the same kind of role in the development of computational dialectics as the fruit fly *Drosophila* plays in biology.

The third part of the book is concerned with negotiation. Negotiation was one of the first topics to be considered by researchers interested in using argumentation in multiagent systems, and, as a result, it is one of the areas of argumentation in multiagent systems in which the most progress has been made. The four papers in this part of the book report a number of new developments that extend the range of what is possible in a negotiation.

One of the main purposes of using argumentation in a negotiation is to introduce a measure of “persuasion” (which, of course, can be considered an entirely separate kind of argumentation) into a negotiation. One way that this persuasion can be achieved is through the use of threats and rewards — one agent can offer a reward in return for another agent accepting its proposal (a kind of side-payment in game theory terms), or can offer a negative reward for not accepting the proposal, a threat. “Formal Handling of Threats and Rewards in a Negotiation Dialogue” by Amgoud and Prade provides a model for dealing with these issues, showing how they can be seamlessly incorporated into the argumentation process.

When engaging in negotiation, an agent can aim to persuade using arguments that are based on logical force — arguments where the correctness of what is being said is paramount. Agents can also persuade by making use of arguments that are based on societal roles — arguments where who makes the argument is important as well. “Argument-Based Negotiation in a Social Context” by Karunatillake, Jennings, Rahwan and Norman is concerned with this social form of argumentation. In particular, they develop a representation of social influence, and show how it can be used to derive arguments that are then used in a negotiation.

Another important aspect of employing argument in practical situations is knowing how best to argue — in other words how to use different patterns of

locutions to best advance one's interests. This matter is addressed in "Practical Strategic Reasoning and Adpatation in Rational Argument-Based Negotiation" by Rovatsos, Rahwan, Fischer and Weiss. This paper describes a model that enables agents to learn how best to argue and shows that agent performance improves over time when this model is used. This demonstration of performance improvement is notable because, unlike much work on argumentation in multi-agent systems, it is empirical and so involves a implementation of a dialogue system.

Finally, in "A Protocol for Arguing About Rejections in Negotiation," van Veenen and Prakken consider how agents might deal with proposals that are rejected. As they argue, rejected proposals are very informative — knowing why a proposal was rejected makes it possible to avoid making new proposals that are rejected for the same reason. Van Veenen and Prakken provide a protocol which allows rejected proposals to be questioned, and show how it can lead to shorter negotiations.

The fourth section, "Protocols," contains four papers on this topic, one that is currently of great interest within the computational dialectics community. The first paper in this section, "New Types of Inter-agent Dialogues" by Cogan, Parsons and McBurney, starts from the classification of dialogue types introduced by Walton and Krabbe [3], and concentrates on the pre-conditions that study identifies for the different types of dialogue that it examines. Cogan et al. show that considering different pre-conditions leads to a range of new types of dialogue with somewhat different aims from those examined by Walton and Krabbe. The paper enumerates some of these new kinds of dialogue, and suggests simple protocols that can achieve them, with the overarching idea that the point of identifying these new kinds of dialogue is to be able to combine them, together and along with existing kinds of dialogue, to create new forms of interaction between agents. Of course, in order to assemble new kinds of dialogue as novel combinations of existing dialogue types, one needs a mechanism for combining dialogues. This is exactly what is provided by Dimopoulos, Kakas and Moraitis in "Argumentation-Based Modelling of Embedded Agent Dialogues" — in their framework dialogues are combined by embedding one dialogue inside another. While such combinations have been suggested before, indeed they are suggested in [3], this is the first paper to seriously make an effort to formalize the process of combination in a way that considers the nature of the dialectical shift taken at such transitions. The result is a general framework for analyzing embedded dialogues, a framework in which one can identify whether certain embeddings are legal.

The idea of combining a number of different types of "atomic" dialogue into more complex dialogues is one way to develop a powerful theory of dialogues in which one constructs complex interactions from simple and well-understood components. Another way to permit complex interactions is to develop more complex protocols, protocols that can be instantiated in many different ways. This latter approach is the subject of the final two papers in this section of the book. In "Liberalizing Protocols for Argumentation in Multiagent Systems,"

Vreeswijk suggests one way to approach this objective, by proposing a framework for inquiry dialogue that is considerably more flexible than many existing protocols (though, of course, it pays for its flexibility in the sense that it is not possible to ensure that dialogues will terminate). Even more ambitious is “Protocol Synthesis with Dialogue Structure Theory” by McGinnins, Robertson and Walton. In this paper, the authors propose a language for defining protocols, and then use this to define a process by which protocols can be synthesized. Characterizing this process as a set of declarative transformation rules, as the authors do, makes it possible to equip agents with this set of rules and to have the agents define their own protocols for interaction.

The next section of the book focuses on deliberation and coalition formation. Amgoud’s “An Argumentation-Based Model for Reasoning About Coalition Structures” exploits the structure of argumentation to handle coalitions. Argumentation frameworks provide a mechanism for resolving conflicting arguments, they identify which arguments are not attacked, or are only attacked by arguments that are themselves defeated. There is a similar requirement in coalition formation — it is necessary to determine which coalitions do not conflict with any other coalitions (in the sense of including the same agents) and which only conflict with coalitions that are ruled out by other conflicts. Amgoud, spotting this similarity, has devised a system which uses the machinery of argumentation to identify a conflict-free set of coalitions. The other paper in this section is “Argumentation-Based Multiagent Dialogues for Deliberation” by Tang and Parsons. This integrates a simple planning procedure with an argumentation-based dialogue that distributes plan construction across all the agents in the dialogue.

The final section of the book is concerned with consensus formation. Now, to some extent “all” work on argumentation is concerned with consensus formation, but in this section we find papers that are explicitly focussed on this topic. The process of establishing the kind of justified truth computed by argumentation systems — where we reach a consensus that something is true provided all attacks on it are defeated — is precisely the process that scientists go through when assessing the status of theories. The formalization of this process of scientific argumentation is the topic of Hunter’s “Presentation of Arguments and Counterarguments for Tentative Scientific Knowledge,” the paper we solicited that was not presented at an AAMAS event. In this paper Hunter shows how the system of argumentation he and Besnard have developed [1] can be used to capture conflicting pieces of scientific knowledge, and the relative strengths of those pieces of knowledge. This is followed by “Towards a Formal Framework for the Search of a Consensus Between Autonomous Agents” by Amgoud, Belabbès and Prade. This paper suggests a model that has much in common with the kinds of negotiation modes commonly used in multiagent systems. In a group setting one agent makes a proposal, and this is then discussed by the group until either it is accepted by all, or one agent rejects it. If the proposal is rejected, then another suggestion may be made and discussed in turn.

This use of argumentation in a dialogue, to allow the views of different agents to be integrated by having them put arguments for and against options, is the classical way to make use of the ability to argue. The same kind of process is used in the system described by “Argumentation-Supported Information Distribution in a Multiagent System for Knowledge Management” by Brena, Chesñevar and Aguirre. Brena et al. describe how they integrated argumentation into the JTIK system to control the distribution of information to users of the system. The dissemination process invokes argumentation to decide whether a specific piece of information should be delivered to a given user, and this is done if the information distribution agent and the personal agent for that user reach a consensus that the user wants to (or should) be a recipient of the information. The final paper in the book is “How Agents Alter Their Beliefs After an Argumentation-Based Dialogue” by Parsons and Sklar. This paper, as the name suggests, addresses the problem of how agents should revise their beliefs after they have completed a dialogue. The paper identifies a number of different aspects of this revision procedure, before showing that adopting the one that seems most promising will lead to agents that reach ever greater consensus the longer they continue to engage in dialogue.

We conclude this preface by extending our gratitude to the members of the Steering Committee, members of the Program Committee, and the auxiliary reviewers, who together helped make the ArgMAS workshop a success. We also thank the authors for their enthusiasm to submit papers to the workshop, and for revising their papers on time for inclusion in this book.

April 2006

Simon Parsons
Nicolas Maudet
Pavlos Moraitis
Iyad Rahwan

Program Chairs
ArgMAS 2005

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The Case of Pragma-Dialectics*

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Abstract. The pragma-dialectical approach to argumentation aims to provide a sound integration of both dialectics — the study of critical exchanges — and pragmatics — the study of language use in actual communication. Pragma dialectics thus combines a dialectical view of argumentative reasonableness with a pragmatic view of the verbal moves made in argumentative discourse. This paper provides an overview of the current state of the pragma-dialectical approach, insofar as this can be done adequately in a single paper, and provides many pointers to the full range of work in this area.

1 The Pragma-Dialectical Approach to Argumentation

In the pragma-dialectical approach to argumentation the term argumentation is used to refer to a process (“I am still in the middle of my argumentation”) as well as to its result (“Let’s examine what her argumentation amounts to”). Characteristically, argumentation is then studied from a communicative perspective. This communication, which can be oral or written, will generally take place by verbal means, but non-verbal elements (such as gestures and images) may also play a part. In pragma-dialectics, argumentation is viewed as aimed at resolving a difference of opinion by critically testing the acceptability of the standpoints at issue. Thus perceived, the study of argumentation does not only have a descriptive dimension that pertains to the way in which argumentation is conducted in communicative practice but also a normative dimension pertaining to the norms of reasonableness that are employed when argumentation is judged for its quality and possible flaws are detected.

Logicians, whether they are in favor of a formal or an informal approach, tend to concentrate on the problems involved in the regimentation of reasoning. Social scientists and linguists, particularly discourse and conversation analysts, generally focus on empirical observation of argumentative discourse and its effects.¹ In the pragma-dialectical view, however, these two approaches must be closely interwoven. Both the limitations of non-empirical regimentation and those of non-critical observation need to be systematically transcended. Pragma-dialecticians make it their business to clarify how the gap between normative and descriptive insight can be methodically bridged. This objective can only be achieved with the help of a coherent research program in which a systematic connection — *a trait d’union* — is created between well-considered regimentation and careful observation.

* This article, which gives an overview of the pragma-dialectical approach, is for a large part based on [15] and [21]. A textbook version is in preparation.

¹ For protagonists of a purely normative or a purely descriptive approach, see [4] and [58, 59], respectively.

Following a classical tradition, the study of the regimentation of critical exchanges is called *dialectics*. The study of language use in actual communication, which belonged in the past largely to the domain of rhetoric, is nowadays generally called *pragmatics*. Hence the choice of the name *pragma-dialectics* for the approach to argumentation that aims for a sound integration of insight from these two studies. Pragma-dialectics combines a dialectical view of argumentative reasonableness with a pragmatic view of the verbal moves made in argumentative discourse.²

2 The Five Components of the Pragma-Dialectical Research Program

Because the pragma-dialectical research program is designed to achieve a well-considered integration of normative and descriptive insight, it is on the one hand aimed at developing a philosophical ideal of critical reasonableness and, grounded in this ideal, a theoretical model for acceptable argumentative discourse in a critical discussion. On the other hand, argumentative reality is investigated empirically to acquire an accurate description of the actual processes of argumentative discourse and the factors influencing their outcome. Starting from the results achieved in these two enterprises, the conceptual tools are developed to analyze argumentative reality in light of the critical ideal of reasonableness. Then the individual and the procedural problems of the practical analysis, evaluation and production of argumentative discourse — the alpha and omega of the study of argumentation — can be tackled methodically. The research program thus includes a philosophical, a theoretical, an empirical, an analytical, and a practical component.³

The fundamental question in the philosophical component is what it means to be reasonable in argumentation. As it happens, the conceptions of reasonableness entertained by argumentation scholars diverge from the outset, leading to quite different outlooks on what acceptable arguments are considered to be. Dialecticians maintain a critical outlook. For them, reasonableness does not solely depend on inter-subjective agreement on the norms, as many rhetoricians think, but also on whether these norms are conducive to the goal of resolving a difference of opinion by way of a critical discussion. Because the ideal of reasonableness is linked to the methodic conduct of a critical discussion, the dialectical philosophy of reasonableness is *critical-rationalist*.

In the theoretical component the philosophical ideal of reasonableness is given a shape by designing a model of what is involved in acting reasonably in argumentative discourse.

² The dialectical conception of reasonableness is inspired by critical rationalists and analytic philosophers, such as Popper [49, 50], Albert [1], and Naess [45], and by formal dialecticians and logicians, such as Hamblin [29], Lorenzen and Lorenz [44], and Barth and Krabbe [3]. The pragmatic conception of argumentative discourse as consisting of making regulated communicative moves is rooted in Austin [2] and Searle's [51, 52] ordinary language philosophy, Grice's [27] theory of rationality in discourse, and other studies of communication by discourse and conversation analysts. It is in the first place the combination of dialectical and pragmatic insight that distinguishes pragma-dialectics from 'formal dialectic' as developed by Barth and Krabbe [3] that incorporates dialectical insight in a formal (logical) approach.

³ For a more elaborate explanation of the research program, see [15, ch. 2].