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A DIALOGUE GAME FOR CRITICAL DISCUSSION

Groundwork in the formalisation and computerisation
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Voor senior

"As soon as we abandon our own reason, and are content to rely upon authority, there is no end to our troubles."

Bertrand Russell, 1943: *An outline of intellectual rubbish: A hilarious catalogue of organized and individual stupidity*

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Preface

Whether it was through direct involvement, or in more indirect ways, several people have contributed to the completion of this dissertation. Without them, I would surely not have been able to finish the research project as I have now.

First and foremost, I want to thank Frans van Eemeren and Francisca Snoeck Henkemans. Not only did they act as my supervisors even before the project officially started, but they were also the ones that encouraged me to stay at the University of Amsterdam to teach after finishing my rMA in Rhetoric, Argumentation theory, and Philosophy. Once it became clear that more supervisory expertise in computational argumentation theory was needed, Bart Verheij from the University of Groningen agreed to become the third supervisor. Without the continuous support and seemingly endless patience of Frans, Francisca and Bart, my PhD project would probably not have come to fruition.

Aside from my supervisors, there are, of course, many others that supported me in finishing my dissertation, in one way or another. For the sake of not turning this preface into an even longer thank-you list, regrettably, I cannot mention everyone by name – which is not to say that the support of those not mentioned is any less appreciated.

Many thanks to Floris Bex, Chris Reed and Bart Garssen for co-authoring the paper that has now become the third chapter of my dissertation. I am also indebted to the participants of the research colloquium of the Argumentation and Rhetoric Group Amsterdam for sharpening my thinking during numerous discussions. The same holds for the organisers and participants of the Argupolis programme (Michael Baumtrog, Marta Zampa, Elena Musi, Chiara Pollaroli and the others).

At the University of Amsterdam, I want to thank Annemiek Hoffer and the rest of the staff of the Department for Dutch Studies for always making me feel welcome, and all members (whether temporary or permanent) of the Department of Speech communication, Argumentation theory, and Rhetoric for being such warm colleagues. Outside of the department, I want to thank Anne Bannink for her support. I am also grateful to the Faculty of Humanities for providing me with funding to work on this research project, and to the Amsterdam Center for Language and Communication for hosting me as a PhD candidate.

Much appreciated are also the intellectual interchanges and the necessary (and enjoyable) distractions provided by my office mates (Bert Meuffels among others) and fellow PhD candidates (Ingeborg van der Geest, Nanon Labrie, Ahmed Omar, Roosmaryn Pilgram, Eugen Popa, Lotte van Poppel, Gudrun Reijnierse and others). Falling into both of the aforementioned categories, Renske Wierda deserves a special mention: she has joined me in attending several conferences, in participating in numerous workshops, and in co-authoring a paper – moreover, she graciously agreed to do the layout and typesetting of my dissertation.

I am grateful to my friends for being so patient with me and for tolerating the recurrent periods of radio silence. I want to mention especially (in no particular order, and without intending to make anyone feel left out) Jolanda, Jip, Lotte, David, Ilir, Jornt, Saskia, Renske, Leon, Nanon, Sorina, Roosmaryn, Pieter and Sandra for having been there; also during difficult times.

Finally, I want to thank my parents for their relentless support all these years.

Bedankt, allen!

Amsterdam & Dundee, Jacky Visser
September, 2016

Acknowledgement

The study is organised in seven chapters. Apart from Chapter 1, "Introduction", and Chapter 7, "Conclusion", all chapters of this dissertation are written as self-contained research papers. Because the papers are, at the time of writing this Acknowledgement, in various stages of publication, I will indicate their status and provide the full reference where relevant. The reference sections of the papers have been compiled at the end of the dissertation, together with those of the introduction and the conclusion chapters.

Chapter 2, "Towards computer support for pragma-dialectical argumentation analysis", is based on a paper accepted for the international conference of the Ontario Society for the Study of Argumentation (OSSA), which takes place from 18 until 22 May 2016 in Windsor (ON). It will be included in the conference proceedings as a long paper with a commentary:

> Visser, J. C. (2016e). Towards computer support for pragma-dialectical argumentation analysis.

Chapter 3, "Formalisation of critical discussion as a bridge to computational models of argumentation", is based on a co-authored paper. The collaboration was initiated by me, followed by Reed and me setting a research objective. The pragma-dialectical sections and the formalisation are written mainly by me, with Garssen in an advisory role (Sections 3.1, 3.2, 3.4.2). The description of the Argument Interchange Format is written mainly by Reed and Bex (Section 3.3). The remaining sections in which the two approaches are combined (Sections 3.4.1, 3.4.3, 3.5) are written by Bex, Reed and me (each contributing equally):

> Visser, J., Bex, F., Reed, C., and Garssen, B. (2011). Correspondence between the pragma-dialectical discussion model and the argument interchange format. *Studies in logic, grammar and rhetoric, 23*(36), 189-224.

Chapter 4, "A basic dialogue game for critical discussion (CRIT_1)", is based on three earlier papers:

> Visser, J. C. (2013). A formal account of complex argumentation in a critical discussion. In: D. Mohammed and M. Lewiński (Eds.), *Virtues of argumentation. Proceedings of the 10th international conference of the Ontario society for the study of argumentation (OSSA), 22-26 May 2013* (pp. 1-14). Windsor, ON: OSSA.
>
> Visser, J. C. (2015a). A formal perspective on the pragma-dialectical discussion model. In A. F. Snoeck Henkemans, B. Garssen, D. Godden & G. Mitchell (Eds.), *Proceedings of the 8th Conference of the International Society for the Study of Argumentation (ISSA), 1-4 July 2014*. Amsterdam: Sic Sat.

Visser, J. C. (2015b). Het formaliseren van kritische discussie ter voorbereiding op geautomatiseerde argumentatieanalyse [The formalisation of critical discussion in preparation of automated argumentation analysis]. *Tijdschrift voor taalbeheersing, 37*(3), 321-349.

A revised version of Chapter 4 is to be submitted to the journal Informal Logic:

Visser, J. C. (2016a). A dialogue game as a formalisation of critical discussion.

Chapter 5, "Speech acts in the dialogue game for critical discussion (CRIT$_2$)", is based on a paper that is under review with the journal Argumentation:

Visser, J. C. (2016d). Speech acts in a dialogue game formalisation of critical discussion. *Argumentation*.

Chapter 6, "Complex argumentation in the dialogue game for critical discussion (CRIT$_3$)", is based on a paper that is to be submitted to the journal Argument & Computation:

Visser, J. C. (2016b). Argumentation structures in a dialogue game for critical discussion.

Chapter 1

Introduction

1.1 Computer support for argumentation theorists

The use of reasoning and other means of persuasion in communicative interactions to convince an interlocutor has been the object of study through the ages. In Antiquity, Greek and Roman philosophers, such as Aristotle (1984) and Cicero (2006), studied and taught various subjects related to argumentation, such as the art of public speaking (oratory), the ways of finding good arguments (topics), and what should be considered bad arguments (fallacies).[1] From then on, the traditions within the study of argumentation mostly diverged along the lines of the rhetorical, the dialectical and the logical perspective. The focus in these perspectives is, respectively, on the process of effective persuasion, reasonable procedures of discussion, and inferential validity of the product of argumentation. In the early twentieth century, the divergence increased. This resulted in the almost complete disparity between the research fields of rhetoric – which survived mainly in the North American communication tradition – and logic – in connection to mathematics – while the dialectical perspective had almost disappeared.

After the publication of Toulmin's (1958) *The uses of argument* and Perelman and Olbrechts-Tyteca's (1958) *La nouvelle rhetorique* – which appeared in an English translation later (Perelman and Olbrechts-Tyteca 1969) – the modern field of argumentation theory started taking shape in the 1960s and the 1970s. The reinvigoration of interest in the study of argumentation gave rise to new approaches, such as the Informal Logic movement (e.g. Johnson and Blair, 1977) and the pragma-dialectical theory (van Eemeren, 1978; van Eemeren and Grootendorst, 1982). Since then, argumentation theory has established itself as a full-blown research field. In the *Handbook of argumentation theory*, the object of study is defined as follows: "Argumentation is a communicative and interactional act complex aimed at resolving a difference of opinion with the addressee by putting forward a constellation of propositions the arguer can be held accountable for to make the standpoint at issue acceptable to a rational judge who judges reasonably" (van Eemeren et al. 2014, p. 7). Over the past twenty years, a new development in argumentation theory has steadily been gaining ground. Following the increasing power and availability of computers, a multi-disciplinary research area has opened up in which argumentation theory and computer science are combined. As it turns out, the study of argumentation between humans provides insights that can be used to solve problems in Artificial Intelligence

1 The focus here is on the Western tradition, even though argumentation is also studied in, for example, Arab and Asian traditions (see Hamblin 1970, pp. 177-189; van Eemeren et al. 2014, pp. 764-778).

(a subfield of computer science in which computational systems are developed with characteristics of intelligence, such as reasoning, decision-making, and communication). Vice versa – and more relevant to the topic of my dissertation – computer tools can be used to support the study of argumentation.

To aid the analysis of argumentative discourse, for example, computer programs such as ArguMed (Verheij 2005), Carneades (Gordon, Prakken and Walton 2007) and Rationale (van Gelder 2007) can be used to visualise the reconstructed argumentation. Several of the programs can also evaluate the reasoning inferences the argumentation relies on. An example of automated evaluation of reconstructed argumentation is shown in Figure 1.1, a screen shot of Verheij's ArguMed software aimed at assisting legal practitioners in their reasoning.[2] In Figure 1.1, the argument in the middle, the witness is unreliable, is accepted (indicated by the exclamation mark); it thereby constitutes an attack on the inferential link between the accepted witness' testimony at the bottom and the conclusion that the suspect shot the victim, at the top. In this example, the acceptability of the conclusion turns out to be undecided (indicated by the question mark).

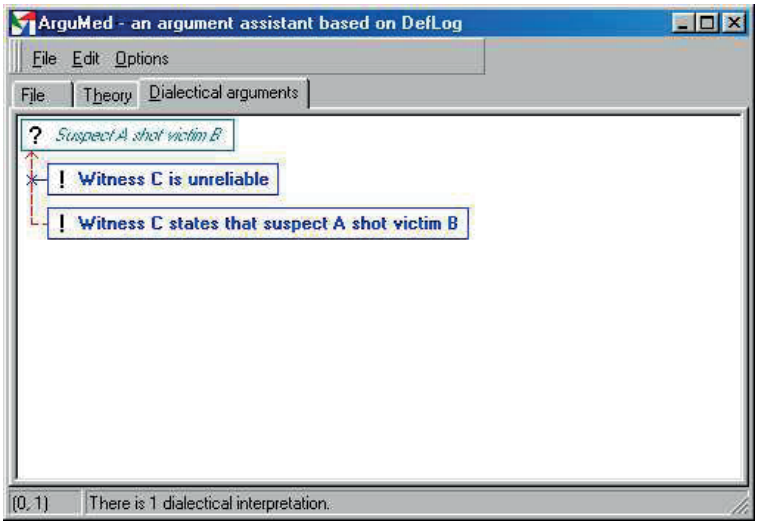

Figure 1.1 *A reconstruction in ArguMed of a legal witness testimony argument*

Another example of a computational tool for argumentation analysis, is the Argument Analysis Wall, constructed by Chris Reed's group at the University of Dundee.[3] This 7,7 square meter touchscreen serves as an interface that allows a group of people to collaboratively work on the reconstruction of a text. In Figure 1.2, such a collaborative reconstruction is undertaken of a BBC Radio 4 debate, while the debate

2 ArguMed is available at: http://www.ai.rug.nl/~verheij/aaa/.

3 See: http://www.arg-tech.org/index.php/projects/argument-analysis-wall/.

is taking place. Such real-time reconstructions of spoken discourse would be impossible for one analyst to keep up with, which is why a multi-user interface is called for.

Figure 1.2 *Collaborative argument reconstruction on the Argument Analysis Wall*

Computer tools for argumentation analysis (as well as for other argumentative tasks, such as the production and evaluation of argumentation) make use of computational implementations of formal models of argumentation. These models serve as the conceptual framework that determines the interpretation given to central notions such as 'argument', 'argumentative defence', 'argumentative attack', and 'argumentation structure'. Because the various theoretical models of argumentation provide different interpretations and explanations of these notions, the computer tools that are based on these models are not theory-neutral and not fully compatible with other theoretical approaches. In the current study, the focus is on computer support based on the pragma-dialectical theory of argumentation (van Eemeren et al. 2014, pp. 517-613). Although the pragma-dialectical method of analysing texts (van Eemeren and Grootendorst 1992) is widely used and theoretically well-founded, no dedicated computational support tools have been developed yet. In this dissertation, the theoretical groundwork for the development of such computer tools is undertaken.

In the remainder of this introductory chapter, I will first describe the rationale and theoretical framework of the study (Section 1.2). Next, I will introduce the aims of the study and the research questions that are to be answered (Section 1.3). Finally, I will outline the organisation of the study (Section 1.4).

1.2 Rationale and theoretical framework

The rationale of the study is that it would be useful to prepare a theoretical foundation for the development of computer tools to support a pragma-dialectical analysis of argumentation. This theoretical foundation consists of a formalisation of the *ideal model of a critical discussion* that is the cornerstone of the pragma-dialectical method of analysis. In Subsection 1.2.1, I will introduce the pragma-dialectical theory and in particular the model of a critical discussion. In Subsection 1.2.2, I will introduce the notion of *dialogue game* that is used in this study to formalise the model of a critical discussion.

1.2.1 The pragma-dialectical ideal model of a critical discussion

The pragma-dialectical theory of argumentation has been developed since the early days of modern argumentation studies by van Eemeren and Grootendorst (1982; van Eemeren, 1978) and their co-authors (see van Eemeren et al. 2014, pp. 517-519). The theory was primarily motivated by the prospect of improving argumentative practice. Within the pragma-dialectical approach, this practical objective is pursued via two routes. First, attempts are made to improve argumentative practice by fine-tuning the design of the communicative situations in which argumentation occurs (van Eemeren, Grootendorst, Jackson and Jacobs 1993; Jackson 2015). Argumentative practice is always guided by the conventions that hold within the particular communicative activity type (van Eemeren 2010, pp. 129-162) in which the argumentation takes place – such as doctor's consultations (Labrie 2013; Pilgram 2015), political interviews (Andone 2013), parliamentary debates (van Eemeren and Garssen 2010) and advertising (Wierda 2015). In order to promote reasonable discussion, suggestions are made to improve the conventional designs regulating the argumentative activity in these argumentative activity types.

The second route by which efforts are made to improve argumentative practice is through the skills of individual arguers. An individual's argumentative skills in general can in the first place be improved through education (van Eemeren, Garssen and Rietstap, 2014). Additionally, didactic efforts are focussed on the specific skills required for argumentative participation in particular (professional) domains, such as the legal field (van Eemeren et al. 2005). Elementary in all cases, is the instruction on the production, the analysis, and the evaluation of argumentation (van Eemeren, Grootendorst and Snoeck Henkemans 2002).

Central in this pragma-dialectical approach to the production, analysis, and evaluation of argumentation is the ideal model of a critical discussion (see van Eemeren and Grootendorst 2004, pp. 42-68). This ideal model is a proposal for a dis-

cussion procedure that is instrumental to the resolution of a difference of opinion in a reasonable way.[4] The model has a dialectical and a pragmatic dimension.[5]

The dialectical dimension refers to the dialectical perspective on argumentation that is taken. Argumentation is interpreted as always involving a (possibly implicit) discussion between two discussants. To do justice to all parts of the text that are argumentatively relevant, the entire discussion has to be taken into account, not just the advancing and criticising of arguments. Within the discussion, four stages are distinguished: the confrontation stage, in which discussants externalise their difference of opinion; the opening stage, in which the material and procedural starting points of the discussion are agreed upon; the argumentation stage, in which arguments and criticisms are voiced; the concluding stage, in which the outcome of the discussion is established. The rights and obligations that discussants have in these discussion stages are regulated in fifteen procedural rules (van Eemeren and Grootendorst 2004, pp. 135-157).

The pragmatic dimension of the ideal model does justice to the fact that argumentation forms part of communicative interactions. In the ideal model, all of the discussion moves are conceived of in terms of speech acts (van Eemeren and Grootendorst, 1984). For all four discussion stages, an inventory is made of the speech acts that contribute to the resolution of the difference of opinion. The Searlean (1969; 1976) speech act perspective on language use is in the pragma-dialectical theory integrated with a Gricean (1975) perspective on verbal interaction. This integration makes it possible to use pragmatic tools from discourse analysis to perform a dialectical reconstruction. Unexpressed or implicit parts of the discussion can be reconstructed on the basis of pragmatic insight by interpreting communicative acts as part of a discussion aimed at resolving a difference of opinion in a reasonable way.

Although the pragma-dialectical model can be used to analyse actual argumentative texts, this does not mean that the model is descriptive.[6] Instead of describing the sometimes imperfect reality of argumentative practice, the ideal model is a proposal for ideal argumentative conduct (see van Eemeren 1986; 1990). The normativity of the model is based on an implementation of a critical conception of reasonableness – as opposed to a geometrical or an anthropological conception (see van Eemeren and Grootendorst, 2004, pp. 123-134). This normativity makes it possi-

4 The guiding principle in the development of the pragma-dialectical discussion model is its instrumental (or problem-solving) validity (see Barth 1972). This orientation is important for the normativity of the model that will be discussed later. As Hamblin (1970, p. 256) rightly observes, a normatively oriented model should retain empirical relevance. For this reason, van Eemeren, Garssen and Meuffels (2009) have performed a series of quantitative studies to test the conventional (or intersubjective) validity of the pragma-dialectical model.

5 In the current study, only the 'standard' pragma-dialectical model is taken into account. In an extension of the model, van Eemeren and Houtlosser (2005; van Eemeren 2010) added a rhetorical dimension to the model, in order to account for the strategic manoeuvring of actual arguers in conventionalised argumentative activity types.

6 Misconceptions about the normative nature of the pragma-dialectical model have been pointed out and rectified at several occasions, for example by van Eemeren and Koning (1979), Garssen (2009), and van Eemeren (2012).

ble to employ the model as a critical tool in the evaluation of argumentation. Because the model takes the full discussion into account, it can be used to identify not only inferential fallacies, but also fallacious discussion moves that impede the reasonable resolution of the difference of opinion in other ways.

1.2.2 Dialogue games as formal models of language use

To formalise the pragma-dialectical ideal model of a critical discussion, the notion of a 'dialogue game' will be used. Dialogue games provide an abstract way of looking at communication as a game, played by the interlocutors to reach an interactional goal. Dialogue games can be seen as an elaboration of the Wittgensteinian (1953) notion of 'language games'. The dialogue game formalism has been used in philosophy to study the dynamics of dialogue and reasoning (e.g. Hamblin 1971; Lorenzen and Lorenz 1978; Walton and Krabbe 1995), in linguistics as a basis for the analysis of language use (e.g. Carlson 1983), and in Artificial Intelligence to computationally model communication (Norman, Carbogim, Krabbe and Walton 2004; Prakken 2009).

Although the literature provides various definitions of the notion, in this dissertation dialogue games are understood in terms of McBurney and Parsons as "rule-governed interactions between two or more players (or agents), where each player 'moves' by making utterances, according to a defined set of rules" (2009, p. 261-262). In the current study, the aforementioned 'defined set of rules', which specifies a particular dialogue game, is subdivided into five categories. This presentational format is used because, on the one hand, it stays close to related formal dialogue games and dialectical systems (e.g. Walton and Krabbe 1995; Krabbe 2012), while on the other hand it offers the flexibility that is required for the formalisation of the pragma-dialectical discussion model. The five categories of rules are based on a common pattern followed in the definition of dialogue games (and formal dialectical systems), with the exception of the category of commencement rules, the addition of which is based on the format proposed by McBurney and Parsons (2009, p. 265).

The commencement rules define the circumstances under which the dialogue game starts. The goal of the game, the number and role of the participants, and other preparatory conditions that have to be met, are all specified as part of this first category of rules. The second category defines the various moves that players can make during the dialogue game. The third category of rules specifies the effect that moves have on the game in terms of players' commitments. The fourth category defines for each move under which circumstances it may be made. The rules determine, for example, for each move which preceding move it may follow up on. In this way, certain sequences of moves are sanctioned in the game, while others are prohibited. Finally, in the fifth rule category the conditions for winning and losing the dialogue game are specified.

Dialogue games can be formal to different degrees. Barth and Krabbe (1982, pp. 14-19; Krabbe 1982) classify these degrees in five senses of the term 'formal'. In the current study, the dialogue game is intended to i) provide rules for the correct assembly of moves and move sequences, ii) implement a procedural regimentation of the interaction, and iii) be normative or *a priori*. These characteristics make the

dialogue game, respectively, $formal_2$, $formal_3$, and $formal_4$ in Barth and Krabbe's classification.[7]

1.3 Aims of the study and research questions

The rationale of formalising the pragma-dialectical ideal model of a critical discussion is given shape by developing a $formal_{2,3,4}$ dialogue game based on the model. The ideal model itself is already $formal_3$ and $formal_4$, as Krabbe and his co-authors (Krabbe and Walton 2011, p. 246; Krabbe 2012, p. 12; van Eemeren et al. 2014, p. 304) have noted. The present study is aimed at formalising the model in the sense of $formal_2$. This means that a rigid definition of the well-formed expressions (moves) and the way in which these can be combined (into move sequences) is incorporated.

This rationale of the study gives rise to two research aims. The first aim is to devise an adequate approach to the formalisation of the ideal model in terms of a dialogue game. The second aim is to realise the formalisation by developing a dialogue game in accordance with this approach. The two aims lead to several research questions, which I will now introduce.

Aim I: Approach to the formalisation of the pragma-dialectical model

The first aim of the study pertains to the way in which the formalisation of the pragma-dialectical ideal model will be developed. The choice for an approach is addressed in Research Question 1.

> **(Research Question 1)** How can formalising the pragma-dialectical ideal model of a critical discussion best be approached?

Because the formalisation is intended to serve as a foundation for the computational application of the pragma-dialectical method of analysis, its adequacy in this regard should be explored. Whether the formalisation indeed helps to bridge the gap between the pragma-dialectical approach and computational argumentation theory is addressed in Research Question 2.

> **(Research Question 2)** Does the proposed way of formalising the pragma-dialectical discussion model indeed facilitate a connection to computational approaches?

Aim II: Development of a dialogue game as a formalisation of the pragma-dialectical model

Once the incremental development of a dialogue game has been decided upon as

7 The first and the fifth sense of 'formal' respectively relate to Platonic forms and to non-material models, both of which are not relevant to the present study. There are other classifications of formality, such as Johnson and Blair's (1991, pp. 134-135), but the one by Barth and Krabbe provides a good point of reference and allows for the distinctions needed in the current study.

an adequate approach to the formalisation of the pragma-dialectical ideal model, the dialogue game for critical discussion can be developed. Because the ideal model is multifaceted, some facets are to be investigated and developed separately. First, the dialectical dimension of critical discussion is to be looked into by answering Research Question 3.

> **(Research Question 3)** How can the dialectical dimension of critical discussion be accounted for in a formalisation of the pragma-dialectical ideal model in terms of a dialogue game?

As explained in Subsection 1.2.1, next to the dialectical, the pragmatic dimension of the ideal model of a critical discussion should be considered. Integral to the pragmatic dimension is the role that speech acts play in the ideal model. This leads to Research Question 4.

> **(Research Question 4)** How can the speech act perspective of critical discussion be accommodated in the dialogue game?

The structure of argumentation is of great importance to the evaluation, which is why it is also a crucial part of the analysis. The way argumentation structure relates to the ideal model and how it should be taken into consideration in the dialogue-game-formalisation is therefore the next topic that is to be addressed. In this endeavour, special attention needs to be paid to complex argumentation structures. This leads to Research Question 5.

> **(Research Question 5)** How can complex argumentation be accommodated in the dialogue game for critical discussion?

1.4 Organisation of the study

The study is organised in seven chapters. Apart from Chapter 1, 'Introduction', and Chapter 7, 'Conclusion', all chapters of this dissertation are written as self-contained research papers. The collected papers systematically address the aims and research questions introduced in the previous section. To make sure they are self-contained, some information will be repeated in several of the papers, leading to some, in this respect, unavoidable redundancy in the chapters. For the provenance of the chapters in terms of the papers they are based on, see the Acknowledgement. Because the individual papers are now included in a dissertation, it is sometimes necessary to provide additional clarification about the use of terms, or about the relation of findings to the project as a whole. This clarification is provided in footnotes, indicated by the symbols † and ‡.

The first aim of the study, to find a suitable way of approaching the formalisation of the pragma-dialectical model in preparation of computational application, is related to two research questions. The first of these, "How can formalising the

pragma-dialectical ideal model of a critical discussion best be approached?", is addressed in Chapter 2, 'Towards computer support for pragma-dialectical argumentation analysis'. In this chapter, a selective overview of computational modelling of argumentation from the perspective of argumentation theory is provided, followed by a characterisation of the pragma-dialectical method of analysis and the analytical tasks that may benefit from computational support. Next, an outline is presented of an incremental approach to the development of a formal foundation of computer support for pragma-dialectical argumentation analysis.

The second research question, "Does the proposed way of formalising the pragma-dialectical discussion model indeed facilitate a connection to computational approaches?", is addressed in Chapter 3, 'Formalisation of critical discussion as a link to computational models of argumentation'. In this chapter, the relation is explored between a provisional formalisation of the pragma-dialectical ideal model and the computational Argument Interchange Format (AIF). Via the intermediate formalisation as a dialogue game, central notions from the ideal model are interpreted in terms of the AIF.

The second aim of the study, the synthesis of a dialogue-game-formalisation of the pragma-dialectical model, leads to three further research questions. The incremental approach to developing the dialogue game means that a basis is needed on which the subsequent incremental steps can be built. This basis consists of a simplified case, in which only the dialectical dimension of critical discussion is taken into account. The related third research question, "How can the dialectical dimension of critical discussion be accounted for in a formalisation of the pragma-dialectical ideal model in terms of a dialogue game?", is addressed in Chapter 4, 'A basic dialogue game for critical discussion (CRIT_1)'. First, the scope of the formalisation is limited through a number of simplifying assumptions with respect to the pragma-dialectical discussion model that is formalised. Next, the rules of the dialogue game CRIT_1 are defined.

Research Question 4, "How can the speech act perspective of critical discussion be accommodated in the dialogue game?", is addressed in Chapter 5, 'Speech acts in the dialogue game for critical discussion (CRIT_2)'. First, a characterisation of the speech act perspective of the ideal model is provided. Next, the dialogue game rules from CRIT_1, defined in Chapter 4, are revised to account for the role of speech acts in critical discussion. This results in the definition of the revised dialogue game CRIT_2.

Research Question 5, "How can complex argumentation be accommodated in the dialogue game for critical discussion?", is addressed in Chapter 6, 'Complex argumentation in the dialogue game for critical discussion (CRIT_3)'. In this chapter, first the pragma-dialectical interpretation of complex argumentation is characterised. Subsequently, the rules of CRIT_2 are systematically extended to incorporate the different forms of complex argumentation as they are distinguished in the pragma-dialectical theory. This results in the extended dialogue game CRIT_3.

Chapter 2

Towards computer support for pragma-dialectical argumentation analysis

2.1 Introduction

The prospect of improving argumentative practice has been one of the main catalysts of modern argumentation theory. It was clear to Perelman (Perelman and Olbrechts-Tyteca 1958) and Toulmin (1958) that the formal study of logic did not provide society with the best means to understand and improve reasoning and argumentation in practice – a sentiment shared to some extent by the Informal Logicians (e.g. Johnson and Blair 1977) and the Pragma-Dialecticians (van Eemeren 1978; van Eemeren and Grootendorst 1982) that shaped the modern field of argumentation studies.

By studying how people use language and reason to persuade each other, and by identifying the norms that govern this process, argumentative practice can be improved in at least two ways. On the one hand, people can be educated about reasonable ways of arguing, about fallacies, and about rhetorical strategies to improve their individual skills (e.g., van Eemeren et al. 2005; van Eemeren, Garssen and Rietstap 2014). On the other hand, the various kinds of designs of the institutional contexts in which argumentation occurs can be improved (van Eemeren, Grootendorst, Jackson and Jacobs 1993, pp. 178-183; Jackson 2015). By providing people with advice and instruction or with better tools, their argumentative skills and behaviour may be improved.

Increasingly, the tools and environments that shape argumentative reality are digital, computer-based, and online. For example, any written argumentative discourse on the Internet is implicitly guided and constrained by the opportunities that the particular forum, blog, or social network website offers to its users. The guides and constraints on these online environments may promote or may hamper reasonable argumentation (see Lewinski 2010). Aside from shaping online discourse, digital tools to support argumentation and reasoning are making their way into the workflow of professional experts, such as doctors making diagnoses, lawyers preparing their cases, and marketeers choosing their advertising strategies. The engineering of these kinds of digital tools to support the practice of argumentation and reasoning requires expertise from several fields, most notably from argumentation theory or decision-making theory and computer science. Limiting the scope to argumentative practice, this leads to a multi-disciplinary research field concerned with computa-

tional argumentation theory. In Section 2, I will present a selective overview of this field.

Aside from tools to support professional experts in their argumentative tasks, computer software can also be used to aid argumentation scholars. The use of computer support makes some academic tasks easier, such as the drawing of argumentation structures. Additionally, it opens up previously unavailable research opportunities, such as identifying argumentative elements in large text corpora in a short period of time. An additional advantage of the use of computer support is that it standardises the output of, for example, the analysis of argumentation. The software guides the user through a unified set of analytical steps, towards a uniform output pattern, thereby promoting objectivity in the analysis. The uniformity makes it easier to track the analytical steps that were taken and to compare analyses.

Because computational support tools implement specific models of argumentation, they are not theory-neutral and mostly not compatible with other approaches. So far, no computer support has been built specifically aimed at argumentative tasks (production, analysis, evaluation) based on the pragma-dialectical theory of argumentation. This absence is surprising, because the pragma-dialectical theory is one of the central approaches in the field of argumentation studies. The approach constitutes an elaborate research program with components covering the philosophical, theoretical, analytical, empirical and practical components of argumentation studies (van Eemeren et al. 2014, pp. 517-613). On the basis of a philosophical ideal (a critical conception of reasonableness), a theoretical ideal model of a critical discussion is devised, which is subsequently used as a heuristic in the study of argumentative practice (van Eemeren 2010). Because of the normative basis of the ideal model and the fact that it involves all discussion stages relevant to the resolution of a difference of opinion, the model can be used in the evaluation of (informal) fallacies. Furthermore, the conventional validity of the model (the degree to which ordinary language users agree with the implemented norms) has been tested empirically by van Eemeren, Garssen and Meuffels (2009).

The ideal model forms the basis for the pragma-dialectical method of analysing argumentative texts (van Eemeren and Grootendorst 1992; van Eemeren 2015c). This analytical method is arguably one of the most complete and well-established analytical methods in argumentation theory. It is used (and has been refined) for more than thirty-five years by research groups and argumentation scholars around the world. In Section 3, I will look into the possibilities for computational tools to support the pragma-dialectical analysis of argumentation.

One reason for the current absence of such computational support tools is that the pragma-dialectical model is presented in informal terms, while the field of computer science is inherently formal in its orientation. Furthermore, it is not immediately clear how the pragma-dialectical theory in total is to be approached when looking for formalisation opportunities, which is why the absence of insights from pragma-dialectical theorising in the field of computational argumentation theory is not so surprising. Bridging the conceptual gap between the inherently formal computer science and the informally presented pragma-dialectical theory is a precondition for the development of computational tools to support pragma-dialectical

research or argumentation theory. In Section 4, I will look into an approach to the formalisation of the pragma-dialectical discussion model in preparation of computational application.

2.2 Computer support for argumentative tasks

The development of computational tools to support argumentative practice (of both ordinary language users and argumentation scholars) is part of the multi-disciplinary field of computational argumentation theory. The research in this field combines insights and techniques from argumentation theory with those from computer science. Although the term 'computational argumentation theory' may point at a primarily theoretical focus, it should rather be understood to cover theoretical consideration as well as practical application and engineering. From the perspective of computer science, Simon Parsons (2016), in his keynote address at the first European Conference on Argumentation, emphasised the efficacy of insight about argumentation for solving computational issues. Similarly, from the perspective of argumentation theory, Frans van Eemeren (2015a) reiterated the importance of computerisation in his keynote address opening the eighth conference of the International Society for the Study of Argumentation.

As a result of combining two disciplinary backgrounds, most contributions in computational argumentation theory can be characterised as falling into one of two categories: argumentative means to address computational problems, or computational means to address argumentative problems. I will provide a selective overview of the state of the field from the perspective of argumentation theory. Concise overviews of the different strands of scholarship on the intersection of argumentation theory and computer science, are provided in, for example, the volume *Argumentation in Artificial Intelligence* edited by Rahwan and Simari (2009), and the chapter 'Argumentation and Artificial Intelligence' in the *Handbook of Argumentation Theory* (van Eemeren et al. 2014, pp. 615-675).

2.2.1 Argumentative means for computational tasks

The first category of contributions, those using argumentative insights to solve problems in computer science, can in turn be subdivided into two broad themes (although these two themes are certainly not fully distinct and there is overlap between the two). The first theme concerns the use of argumentation theoretical insights to provide a foundation for the modelling of defeasible reasoning in Artificial Intelligence. Taking place within one (artificial) agent, this form of 'intra-agent' reasoning should be able to deal with incomplete, possibly inconsistent, and dynamic knowledge bases. Argumentation-based defeasible reasoning has been proposed as an alternative to classical, monotonic logic, which turned out to be ill equipped to deal with the vagueness and mutability of an agent's reasoning.

The use of insight into the argumentative relations of justification and refutation between propositions has proven a useful basis for so-called systems for

commonsense reasoning (Prakken and Vreeswijk 2002). Refutatory relations between propositions have become a mainstay in the study of commonsense or defeasible reasoning. In this respect, Pollock's (1987) distinction between undercutting and rebutting defeaters was an important development. A further theoretical foundation for the application of argumentative principles to address computational issues is based on the abstract argumentation frameworks introduced by Dung (1995). Central to abstract argumentation frameworks are the conflict relations between premises, abstracting away from the content of arguments.[8]

To give material substance to the conflict relations and to reintroduce the importance of support relations, the notion of argument schemes has been employed. Argument schemes and their accompanying critical questions that can be used to test the acceptability of the inference have been widely studied in argumentation theory (e.g. Hastings 1963; van Eemeren, Grootendorst and Kruiger 1978, p. 20; van Eemeren and Grootendorst 1992; Kienpointner 1992; Walton 1996; Garssen 2002). Especially Walton's work on argument schemes has found uptake within the argumentation-oriented part of computer science (see also Walton, Reed and Macagno 2008, pp. 393-415).

The second theme I distinguish in the use of argumentative insights to address computational issues, is the use of argumentation theory for ('inter-agent') communication in computational multi-agent systems (computer systems in which several agents interact and solve problems in a distributed way). Insights about human argumentative behaviour are employed to develop communication protocols that allow artificial agents to interact and reach a mutual alignment of beliefs and plans. Mimicking natural persuasion and deliberation, the agents in computational multi-agent systems can be designed to advance arguments in defence of their own point of view or against that of other agents, thereby attempting to come to a joint plan or belief.

The theoretical foundation for these developments is mainly found in the dialectical studies of argumentation (e.g. Hamblin 1970; Rescher 1977; Barth and Krabbe 1982). Most influential in this respect is Walton and Krabbe's (1995) book *Commitment in dialogue*. Their categorisation of dialogue types has led to a series of computational implementations of dialogue protocols for persuasion (Prakken 2009), deliberation (McBurney, Hitchcock and Parsons 2007), and negotiation (Amgoud, Maudet and Parsons 2000), among others. The dialogue protocols offer a set of rules that allows agents to reach some interactive goal through communication – for example to determine a plan of action, to distribute resources, or to accumulate knowledge.

8 This extreme form of abstraction is not necessarily problematic. Rather than serving as a heuristic framework to analyse argumentative discourse, the 'arguments' are employed as mathematical constructs in abstract, automated reasoning.

2.2.2 Computational means for argumentative tasks

The second category of contributions to computational argumentation theory may be characterised as using computational tools to support argumentative tasks. These support tools can be aimed at ordinary language users and professional experts, but also at argumentation scholars. Especially in the latter case, the use of computational methods for studies in the humanities can be considered part of the Digital Humanities (see Schreibman, Siemens and Unsworth 2004). The study of argumentation is generally concerned with three 'argumentative tasks': the production, the analysis, and the evaluation of argumentation. Most of the existing computational support tools can be classified along the lines of these three argumentative tasks, although in some cases the distinction cannot be made so strictly and a tool may be relevant to several tasks.

Computational tools supporting the production of argumentation are mostly focused on the structuring (the classical notion of *dispositio*) of the user's argumentation instead of on the way the argumentation is presented (the classical notion of *elocutio*). Using software to visually layout their case can help users to better understand the relations between standpoints, arguments and counter-arguments (for example by using van Gelder's (2007) software Rationale). The diagramming of argumentation structures is also a main function of computational tools aimed at the analysis of argumentation. Because an overview of the argumentation structure is a crucial outcome of an argumentative analysis, this is not surprising.

There are various computer programs that let users diagram the argumentation structure of reconstructed or analysed texts (for example Araucaria (Reed and Rowe 2004) and its successor OVA).[9] These programs are designed to support human analysts in reconstructing argumentative texts. An additional advantage of using software to diagram the argumentation structure of analysed texts is the possibility to archive it in an online repository (such as the AIFdb (Lawrence, Bex, Reed and Snaith 2012)).

The next step in the development of software for argumentation analysis is the automation of the reconstruction itself. This is the objective of 'argument mining' (e.g., Peldszus and Stede 2013; Budzynska et al. 2014; Lippi and Torroni 2015). On the one hand, the scale at which argumentative elements can be identified in text corpora is greatly enlarged through argument mining techniques, because a computer can do this task much quicker than a human analyst. The quality of the automated reconstruction, on the other hand, is not at the level of that of a trained human analyst – not yet.

On the basis of the analysis of an argumentative text, the argumentation can be evaluated. The evaluative task can be understood as deciding on the reasonableness or fallaciousness of the argumentation or as deciding on the acceptability of an outcome or conclusion of an argumentative process. Most of the computational tools to support the evaluation are focused exclusively on the second interpretation of 'evaluation'. To my knowledge there are no examples of computational tools that

9 OVA is available at: http://ova.arg-tech.org.

cover a wide range of fallacies, in particular none that cover the (so-called) informal fallacies (i.e. the non-inferential fallacies). A reason for this may be the lack of a theory of fallacies (beyond the formal or logical fallacies) that is ready to be implemented in a computational system – another reason to computationally develop the pragma-dialectical theory (see Section 2.3 and 2.4), which offers a concise explanation of fallacies (van Eemeren and Grootendorst 1992, pp. 93-217).

As Walton (2016) recently pointed out, there are several studies on the topic of the computational determining of preferred or acceptable outcomes or conclusions of argumentation or reasoning. Software for diagramming the reasoning that underlies argumentative discourse (or any other reasoning for that matter), and decision-making tools based on, for example, Dung's (1995) abstract argumentation frameworks, often let users evaluate the structure of the reasoning (e.g. TOAST (Snaith and Reed 2012)). By first assigning values to certain parts of the structured reasoning, evaluation software can subsequently calculate the preferred or acceptable conclusion by weighing the accepted arguments for and against it (see Walton 2016).

Some of the computational tools aimed at the support of argumentative practice are designed with a particular practical context of application in mind. The software can then be catered to the specific characteristics of argumentative practice within the institutionalised context at hand (see van Eemeren 2010, pp. 129-162). For example, in the educational domain, computer programs are used to teach argumentative skills (see, e.g., Kirchner, Buckingham Shum and Carr 2003, pp. 25-47). Especially in collaborative online settings, argumentation theoretical insights are used in two ways (see Scheuer, Loll, Pinkwart and McLaren 2010). First, in 'learning to argue', the software supports the students' apprehension of argumentative skills. Second, in 'arguing to learn', the idea is that forcing students to engage in argumentative discussions about certain topics through an online platform, increases their apprehension of the topic. As a case in point, Belvedere (Suthers, Weiner, Connelly and Paolucci 1995) is a computer program that supports students in reasoning about a topic, by visualising their arguments pro and con in a structured diagram.

Another domain, which historically has received a lot of attention from argumentation scholars, is legal communication. To support legal practitioners in preparing their case, systems such as Verheij's (2005) ArguMed and Gordon et al.'s (2007) Carneades can be used to diagram and evaluate argumentation structures. Another example of computer applications for legal argumentation is found in online dispute resolution. By employing knowledge about persuasion dialogue and negotiation, a dispute may be settled before being brought before a judge (e.g., Bellucci, Lodder and Zeleznikow 2004). A final example is the medical domain. To improve the distribution of donor organs among different hospitals with often conflicting interests, argumentation is used as an inspiration for decision-making software (e.g., Tolchinsky, Cortés and Grecu 2008). In health communication, computer systems are designed to help medical experts explain difficult topics that require medical expertise to layman patients (Green, Dwight, Navoraphan and Stadler 2011).

2.3 Pragma-dialectical argumentation analysis and computer support

To illustrate how computational tools can support the analysis of argumentation using the pragma-dialectical method (van Eemeren and Grootendorst 1992), the analytical method will be presented in a procedural manner.[10] This procedural perspective on the analysis is admittedly artificial. That is, the explanation given here should not be taken as a representative description of what analysts do when they analyse a text. More often than not – and this especially applies to experienced analysts – instead of following the clinical procedure presented here, analysts will go back and forth through the text and the analytical steps; sometimes performing several operations at once, sometimes skipping steps, etc. Although this 'organic' approach works for analysts that can rely on their experience and their natural feeling for language and the communicative situation, by decomposing the analytical process into its constitutive steps, it becomes clearer where computer support can be usefully applied.

The pragma-dialectical method of analysis is comprised of two sub-tasks: the reconstruction sub-task and the abstraction sub-task. In the reconstruction subtask, the parts of the original text that are argumentatively relevant are identified by using the ideal model of critical discussion as a heuristic (van Eemeren and Grootendorst 1992, p. 36). In this discussion model an ideal procedure is proposed for the reasonable resolution of differences of opinion (van Eemeren and Grootendorst 2004, pp. 42-68). By using the ideal model as a heuristic, the analyst reconstructs the original text as if it were a discussion aimed at the resolution of a difference of opinion. To arrive at this reconstruction in terms of the ideal model, the analyst applies four transformations – deletion, addition, substitution and permutation (van Eemeren 1986; van Eemeren and Grootendorst 1990; van Eemeren, Grootendorst, Jackson and Jacobs 1993, pp. 61-62) – which bring the original text analytically in line with the ideal model.

Next, as part of the abstraction sub-task of the pragma-dialectical method of analysis, an analytic overview is constructed on the basis of the outcome of the reconstruction sub-task (van Eemeren, Grootendorst and Kruiger 1983, p. 290). The analytic overview contains indications of everything that is analytically relevant in the text from an argumentative perspective: the standpoint(s) at issue, the distribution of the discussion roles, the material and procedural starting points, the argumentation structure and the argument schemes (van Eemeren and Grootendorst 2004, p. 118), as well as the outcome of the discussion (van Eemeren 2010, p. 12). The analytic overview forms the basis for the subsequent argumentative evaluation

10 The procedure presented here characterises the 'standard' pragma-dialectical analysis. This means that the rhetorical dimension of argumentative discourse, which deals with arguers' strategic manoeuvring in a conventionalised communicative context, is not taken into account. For explanations of the extension of the pragma-dialectical analysis focused on these matters, see van Eemeren (2010; 2015c) and van Poppel (2015). An early algorithmic procedure for standard pragma-dialectical analysis is proposed by Skolnik (1996).

of the text (which was alluded to in the previous section, but which is not discussed further in the present paper).

In a more detailed explanation of the two sub-tasks of the pragma-dialectical analytical method (Subsection 3.1 and 3.2), I will indicate where dedicated computational tools would fit in. In the explanation, the short (artificial) dialogue fragment in Example 2.1 will be used as the text that is to be analysed. Intuitively it will be obvious that Paul makes a contentious statement, about which Olga expresses some doubt, which leads to Paul defending his statement with an argument. Example 2.1 is kept simple on purpose to explain the analytical procedure that also produces a theoretically justifiable analysis of texts that are intuitively less clear.

Example 2.1

(1)	Paul:	I think it will start raining soon.
(2)	Olga:	Why do you think so?
(3)	Paul:	Because the clouds keep getting darker.
(4)	Olga:	Ah, I see.

2.3.1 The reconstruction sub-task of a pragma-dialectical analysis

As part of the first sub-task of the analysis, the text (in our present case, Example 2.1) is reconstructed in terms of the ideal model of a critical discussion. Because the ideal model of a critical discussion is more complex than is needed for the current exposition, I will make use of a very simple dialectical model, which I shall call DISC. The DISC model is only introduced to clarify the procedural exposition of the analytical method without getting lost in details. It explicitly does not serve to elucidate, for example, the dynamics of actual argumentative discussions.

Instead of giving a full (formal) definition of DISC, I will introduce it informally. In DISC there are two discussants: the protagonist and the antagonist. A dialogue of DISC is started when the protagonist puts forward a standpoint, and then progresses with the discussants taking turns to make moves. The antagonist has two options after any of the protagonist's moves: to accept it or not to accept it (by casting doubt). After his opening move, the protagonist can only put forward arguments in response to the antagonist's possible doubt. Dialogues of DISC terminate when the antagonist accepts one of the protagonist's moves. The sequential structure of this model can be visualised as the graph in Figure 2.1, in which the players and moves are represented as text boxes (the nodes of the graph) and the possible sequences of moves are indicated by the arrows (the edges of the graph).

Whereas in a pragma-dialectical analysis a text is reconstructed in terms of the ideal model of critical discussion, in the current example the text is reconstructed in terms of DISC. Regardless of the model used, the process is the same (albeit less elaborate in the case of DISC, due to the simplicity of the model). Four analytical transformations (van Eemeren 1986) are used to cast the dialogue of Example 2.1 between Paul and Olga in the mould provided by the DISC model. By applying the analytical transformations of substitution, permutation, addition, and deletion the

example text is reconstructed as if it were a dialogue of DISC. The contributions by Paul and Olga in Example 2.1 are reconstructed as moves in DISC. In texts that are more complex than Example 2.1, a systematic use of the pragma-dialectical interpretative and reconstructive tools is necessary. Among these tools are insights from speech act theory (van Eemeren and Grootendorst 1984, pp. 19-46) integrated with a Gricean (1975) perspective on communication (van Eemeren and Grootendorst 1992, pp. 49-59), insight into the possible function of argumentative indicators (van Eemeren, Houtlosser and Snoeck Henkemans 2007), and the typology of argument schemes (van Eemeren and Grootendorst 1992, pp. 94-102; Garssen 2002)). The dialogue of Example 2.1, on the other hand, is constructed in such a way that the structure of the text and the indicator words used make reconstruction in terms of the DISC model fairly easy.

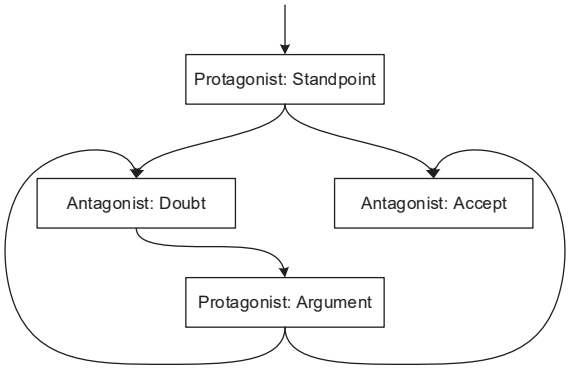

Figure 2.1 *The sequential structure of DISC*

There are only four possible moves in DISC onto which the contributions to the dialogue of Example 2.1 can be mapped. On the basis of Paul's use of the indicator of standpoints "I think that" (see van Eemeren, Houtlosser and Snoeck Henkemans 2007, p. 29), his first move is reconstructed as an instance of 'Standpoint' in DISC. Olga's use of the indicator "Why" (van Eemeren, Houtlosser and Snoeck Henkemans 2007, p. 48) in her response is reconstructed as an expression of 'Doubt' in DISC. Paul's subsequent reason, indicated by "Because" (van Eemeren, Houtlosser and Snoeck Henkemans 2007, p. 166), is reconstructed as an 'Argument' in DISC. Lastly, Olga's admission of acceptance of the standpoint, indicated by "I see" (van Eemeren, Houtlosser and Snoeck Henkemans 2007, p. 230), is reconstructed as an 'Accept'-move in DISC.

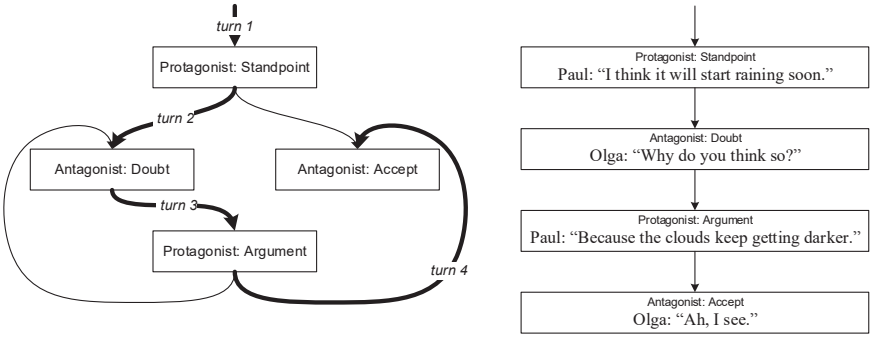

Figure 2.2 *Example dialogue reconstructed in terms of DISC*

This sequence of moves is one of the possible routes through the profile of DISC as shown on the left side of Figure 2.2. The arrows are labelled with the turn in which that move is selected. The sequence of DISC moves instantiated with the results of the very basic reconstruction of the example dialogue is shown on the right side of Figure 2.2. Especially when texts are longer, it would be useful if a computer program highlighted the (groups of) words that can be indicative of argumentative moves. Not all such indicators are actually reliable, so the analyst should consider the automated highlighting of indicators as one of several interacting reconstructive tools.

2.3.2 The abstraction sub-task of a pragma-dialectical analysis

Following the reconstruction in terms of the ideal model – DISC in the example, critical discussion in a real pragma-dialectical analysis – the results are collected in the analytic overview. Each of the elements of the analytic overview corresponds to a particular move in the discussion model. In Figure 2.3, I have indicated how the moves in DISC correspond to three of the elements of the analytic overview.[11] Based on these correspondences, the analytic overview can be abstracted from the reconstructed discussion. Because the content of the analytic overview is fully determined by the reconstruction in terms of the ideal model, the step from reconstruction to analytic overview seems to be very suitable for automation.

Due to the correspondence between the first move as reconstructed in terms of DISC, and the element 'standpoint at issue' in the analytic overview, after the analysis it turns out that the standpoint in Example 2.1 is 'it will start raining soon'. Likewise, the outcome that both discussants accept the standpoint is clear from the reconstructed last move of the discussion.

11 The analytic overview of the dialogue of Example 2.1 is only partial, because it is reconstructed in terms of DISC, which is much more restrictive than the ideal model of a critical discussion.

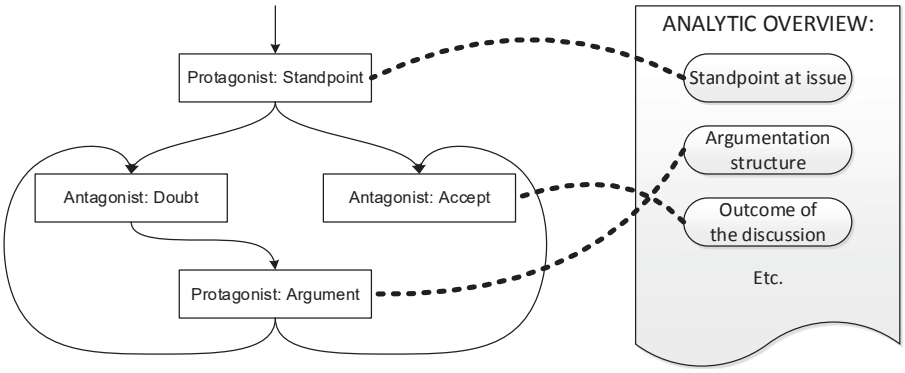

Figure 2.3 *The relation between the discussion model and analytical notions*

The structure of the argumentation depends on the move "Protagonist: Argument". This move is used once in turn 3 of the example. If the move were made more than once, the argumentation structure would be subordinatively compound, with every subsequent argument defending the previous. Since only one argument was presented, the argumentation structure is single, as shown in Figure 2.4.[12]

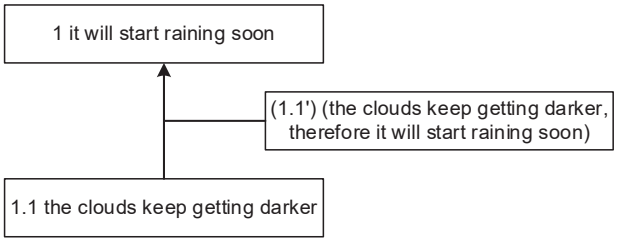

Figure 2.4 *The argumentation structure of Example 2.1*

In section 2, I already mentioned some examples of software that can be used to visualise argumentation structures. However, these programs are not based on a pragma-dialectical interpretation and are therefore lacking in functionality from the perspective of the pragma-dialectical analysis and subsequent evaluation. For example, the treatment of coordinatively compound argumentation is particular to the pragma-dialectical approach (van Eemeren and Grootendorst 1992, pp. 76-82) and not treated in the same way in existing computer systems (e.g., Walton 2016). An additional feature that would be useful is the possibility to translate between the diagrammatic visualisation of the argumentation structure such as in Figure 2.4, and the traditional pragma-dialectical 'list notation' of the same structure:

12 The brackets are used to indicate that this premise of the argumentation was unexpressed in the original text, but was reconstructed (van Eemeren and Grootendorst 1992, pp. 60-72)

1 it will start raining soon
1.1 the clouds keep getting darker
(1.1') (the clouds keep getting darker, therefore it will start raining soon)†

For educational purposes, it would be useful if software could be used to compare two argumentation structures in an automated way – much like some word processing software can compare two text files. Because the software enforces a standardised layout, it could compare a student's reconstructed argumentation structure in an assignment to the one given in the answer guidelines for grading.

After a text is reconstructed and an analytic overview is abstracted, it would be very useful if the analysis were available to others. A good way of archiving and disseminating the analysed texts with the resulting analyses is by using a web-based service (such as the AIFdb mentioned in section 2). Over the past 35 years a lot of pragma-dialectical analyses have been produced, but most of these did not leave the office or computer of the analyst, with the exception of the fragments that were published in articles or books. With a computer tool that allows the archival of pragma-dialectical analyses, these can be made available for educational purposes (to train argumentative or analytical skills) or for academic purposes (for example, to easily test inter-coder reliability).

Both Example 2.1 and the DISC discussion model were intentionally kept very simple. Therefore, the analytic overview that resulted from the analysis in two sub-tasks is not surprising. The point is that when using a more complex model as a heuristic instrument during the reconstruction sub-task, a method like the one presented here can also be applied to much more complicated texts, leading to overviews that were not immediately available on the basis of intuition alone. The computational tools that were mentioned during the explanation of the analytical method could make it easier to follow the procedure. Especially since the reconstruction of more complex texts, with a more complex model such as the ideal model of a critical discussion, soon leads to a complicated analytical process in which many things need to be kept track of.

The ultimate computational tool would be one that automates the complete analysis. Progress into this direction is made in terms of the aforementioned argument mining, but these computational techniques do not yet deliver analyses

† In this dissertation, linking premises (1.1') are often formulated as 'argument therefore standpoint'. This formulation expresses the justificatory force of the argumentation with respect to the standpoint; as this is part of the felicity conditions of the speech act complex (van Eemeren and Grootendorst 1992, p. 31). The formulation with 'therefore' is chosen to substantiate this condition as neutrally as possible – by merely stating that the argument is supposed to support the standpoint through some unspecified form of reasoning. Conventionally, a formulation with 'if argument, then standpoint' is used for the logical minimum (van Eemeren and Grootendorst 1992, p. 64). Formulating the linking premise as an if-then-statement is based on a modus ponens reasoning pattern. This pattern is very useful as a starting point for the reconstruction of the pragmatic optimum of the unexpressed linking premise (van Eemeren and Grootendorst 1992, pp. 60-72). However, since the logical or pragmatic nature of the reasoning principle underpinning the argumentation is disregarded in this dissertation, an even more neutral formulation with 'therefore' is used..

that are comparable in quality to those made by human analysts. In order to build a computer system that fully automates the pragma-dialectical analytical method, computational representations of the text under analysis, of the ideal model, and of the analytic overview are required. In addition, computational implementation of the procedures for the reconstruction sub-task and for the abstraction sub-task of the analysis would be needed. Several technical and theoretical problems still stand in the way of such computerisation of the pragma-dialectical analytical method. One obvious obstacle is natural language processing: engineering computers to understand the meaning of texts in natural language, which is still an open problem in Artificial Intelligence. A second obstacle is the absence, I just mentioned, of the computational representations of the ideal model, of the analytic overview, and of the analytical sub-tasks, which is what I will turn to in the next section.

2.4 An outline of the development of pragma-dialectical computer support

2.4.1 From philosophical ideal to software implementation

Computer software for argumentative tasks, as described in Section 2, is always based on a specific argumentative framework or model. The model gives meaning to the argumentative notions that are used in the software. This is done by applying a computational implementation of the model, which makes it accessible to the computer software. In turn, the computational model implements some formal model of argumentation. The formal model is based on a theoretical model. And, finally, this theoretical model is based on a philosophical ideal. This retrospective path, tracking the heritage of the argumentative notions in dedicated support software, can be used to indicate the steps that still need to be taken in the development of support software for the pragma-dialectical analysis of argumentation.

The pragma-dialectical ideal model of a critical discussion, which is at the basis of the analytical method, is a theoretical model. It is based on a philosophical ideal, implementing a conception of reasonableness that is inspired by critical rationalism (see van Eemeren and Grootendorst 2004, pp. 123-134; Albert 1975). The next step, in the list I presented above, towards software applications is the transition to a formal model. This is necessary because of the inherently formal nature of computer science, where everything has to be defined strictly and unambiguously in the programming language used. For computer programs to function, the systems developed with these programming languages need to adhere to specific preconditions: e.g., there may be no exceptions that are not covered, nor holes or loops, or room for unexpected errors. Therefore, a certain degree of formality is required of argumentation models that are to be used as the basis for computer programs.

2.4.2 The formal approximation of the pragma-dialectical discussion model

A model can be called 'formal' in different senses.[13] The five different senses of 'formal' distinguished by Barth and Krabbe (1982, pp. 14-19; Krabbe 1982) form a good starting point for a discussion of the intended sense of formal, when I speak of a formal version of the pragma-dialectical ideal model.[14] The first and last senses Barth and Krabbe distinguish – relating to Platonic forms and non-material systems, respectively – are not the intended senses of 'formal' in this regard. The three remaining senses are all relevant. The formal model should contain a rigid definition of the well-formed linguistic expressions and the way in which these can be combined (formal$_2$ in Barth and Krabbe's taxonomy), should be procedurally regimented (formal$_3$), and *a priori* or normative (formal$_4$). Krabbe and his co-authors (Krabbe and Walton 2011, p. 246; Krabbe 2012, p. 12; van Eemeren et al. 2014, p. 304) have pointed out that the existing pragma-dialectical ideal model is already formal$_3$ and formal$_4$. The objective in the *formal approximation* of the ideal model has then become to make the model formal$_2$ as well.[15]

The term 'formal approximation' is used to express three considerations.[†] Firstly, the result of a *formal approximation* can be contrasted to the result of a *strict formalisation*. Formalisation in the strict sense can give rise to the impression that the original model is being replaced by the formalised model. This is not the intention with the formal approximation, which is meant to exist next to the original ideal model.

Secondly, the notion 'formal approximation' expresses the expectation that not all properties and aspects of the original model can be preserved. In this sense the *approximation* is comparable to the conventionalised argumentative activity types as *empirical* approximations of critical discussion developed by van Eemeren and Houtlosser (2005; van Eemeren 2010, pp. 129-162). Empirical approximations are used in the extended pragma-dialectical theory (van Eemeren 2010) to characterise the conventions of argumentative practice in reality. Unsurprisingly, ordinary arguers turn out not to behave exactly in accordance with the ideal model of a critical discussion. Analogously, a formal approximation can diverge from the original ideal model. Such a divergence could be an indication of an imperfection or obscurity in the original model, while it could also be the result of the streamlining inherent in the formalisation of informal models. A reason for the divergence could be found in the expressiveness of formalisms, which is (usually) more restricted than that of natural language. Formal models have to be fully explicit and free of ambiguity to define

13 This subsection is based in part on an earlier conference paper (Visser 2016c).

14 There are other classifications of formality. An example is Johnson and Blair's (1991, pp. 134-135), which is partly based on the classification by Barth and Krabbe.

15 Krabbe (2012; 2013a; 2013b) has proposed a system CD with the same objective: making the system *formal$_2$*, see Chapter 4 (Section 4.2), Chapter 5 (Section 5.4), Chapter 6 (Section 6.6).

† Although the term 'formal approximation' as introduced here is preferred to 'formalisation' (for the reasons that are discussed in the current section), in the rest of the dissertation, 'formalisation' is used. This is because the use of 'formal approximation' makes the text quite laborious, and 'formalisation' is the widely used and accepted term.

what falls within the model and what is excluded. This restricted expressiveness will mean that the formal approximation is stricter than the original ideal model.

Thirdly, the term 'formal approximation' is used because of the approach to developing the formal model. Instead of defining a formal model based on the pragma-dialectical ideal model in one time in its entirety, the formal approximation is developed in increments. Starting from a simplified basis, additional, complex features are gradually added in extensions.[16] In this way the scope of the formal approximation is brought ever closer to the full extent of the ideal model. This systematic approach has the practical advantage of decomposing a large task into several smaller constitutive tasks, such that these smaller tasks can be carried out in stages, at different times and by different people. Another kind of advantage is of a theoretical nature: by gradually increasing the complexity of the dialogue game, the properties of the model can be studied in isolation (without other features of the model complicating the investigation). In the incremental approach proposed here, formal approximation has become a gradual concept. A model can approximate the ideal closer or less closely, which is why the term 'formal approximation' is more applicable than 'formalisation'.

In the incremental development of the formal approximation, the pragma-dialectical ideal model is interpreted as a blueprint for a dialogue game. Dialogue games are a way to describe a communicative activity in abstract, formal terms. The formalism has been employed by philosophers of language to study small portions of everyday linguistic activity in isolated and simplified form (following Wittgenstein's (1953) use of 'language games' in his *Philosophical investigations*), by linguists to study discourse (Carlson 1983), and by logicians (Hintikka 1968; Lorenzen and Lorenz 1978), among others. The perspective on language use as intentional, action-driven interaction has since been recognised by computer scientists as a natural way to use existing computational means to model communication in multi-agent systems. There are different definitions of the notion available in the literature. I will subscribe to McBurney and Parsons' (2009, p. 261-262) characterisation of dialogue games as "rule-governed interactions between two or more players (or agents), where each player 'moves' by making utterances, according to a defined set of rules."

The aforementioned defined set of rules can be categorised into five categories. First, the commencement rules define the initial state of the game (i.e. the set-up of the board and shuffling of the cards before the game starts). Second, the move rules define the types of moves that players can make during the game. Third, the commitment rules define for each move what effect it will have on the players' commitments (i.e. the propositions they can be held committed to). Fourth, the sequence rules define for each move under which circumstances it can be made (e.g. in response to which preceding moves). Fifth, the termination rules define when the game stops and what the winning conditions are.

16 This incremental approach is similar to that of Walton and Krabbe (1995) in their definition of 0-versions of dialogue systems, allowing further rule modifications in 1-, 2-, and subsequent versions.

2.5 Conclusion

My objective in this paper was to explore the way in which a formal approximation of the ideal model of a critical discussion can be developed as a preparation for computer tools to support the pragma-dialectical analysis of argumentation. To this avail, I first presented a selective overview of the integration of insights from argumentation theory and methods from computer science. Next, I characterised the pragma-dialectical method of analysis procedurally as consisting of a reconstruction sub-task and an abstraction sub-task. In addition to indicating some points at which computer tools would be of use, the procedural interpretation showed that the ideal model of a critical discussion fulfils a crucial role. Lastly, an incremental approach to the formal approximation of the ideal model was outlined in order to prepare the model for the computational implementation that would be necessary in the development of computer support for pragma-dialectical analysis.

The outline of the approach that I presented brings us one step further in the direction of the development of computational tools to support argumentative tasks based on the pragma-dialectical theory. Although I have not focussed on this in the current paper, the formal approximation of the pragma-dialectical discussion model can also be of benefit to computationally oriented argumentation studies. For example, the formal approximation of the ideal model may serve as a starting point in the definition of dialogue protocols for multi-agent systems. On the one hand, the ideal model is normative (implementing a critical conception of reasonableness and an instrumentally valid procedure), which makes it a good starting point to exclude fallacies from protocols. On the other hand, the ideal model is empirically tested for its conventional validity (van Eemeren, Garssen and Meuffels 2009), which makes it a good starting point for multi-agent systems in which human agents participate. In this endeavour, conventionality and experienced naturalness are important factors to take into account.

Chapter 3

Formalisation of critical discussion as a link to computational models of argumentation†

3.1 Introduction‡

In the last forty years the pragma-dialectical approach to argumentative discourse has been developed into a full-blown argumentation theory and normative discussion model (van Eemeren and Grootendorst 1984; 2004; van Eemeren et al. 2014, pp. 517-613). The theory takes any argumentative exchange as an instantiation of the ideal model of a critical discussion. This allows the discourse to be analysed, reconstructed and evaluated with respect to a normative model. Starting out as a theory based on speech acts as the functional building blocks of linguistic communicative activity ("pragma", short for pragmatics, the field within linguistics in which meaning is regarded as inherently usage-dependent) and a procedure for reasonably resolving a difference of opinion (taking the "dialectical" perspective), it has since been extended to also incorporate rhetorical aims of effectiveness and institutional contexts among others (van Eemeren 2010). The conventional validity – whether the rules of the normative model are (implicitly) accepted by actual arguers – has also been put to the test in a series of empirical studies (van Eemeren, Garssen and Meuffels 2009).

In the past few decades, AI has developed its own sub-field devoted to computational argumentation theory, in which significant theoretical and practical advances are being made. This fecundity, unfortunately, has a negative consequence: with many researchers focusing on different aspects of argumentation, it is increasingly difficult to reintegrate results into a coherent whole. To tackle this problem, the AI community has initiated an effort aimed at building a common ontology for computational argument, which will support interchange between research projects and applications in the area: the Argument Interchange Format (AIF) (Chesñevar et al. 2007).

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† This chapter is based on a paper, "Correspondence between the pragma-dialectical discussion model and the argument interchange format", by Visser, Bex, Reed and Garssen (2011) – see the Acknowledgement.

‡ This section was originally entitled: "Argumentation and theory".

Thus far there has been notably little interaction between computational argumentation theory and the pragma-dialectical approach. In the present paper we will focus on the disciplinary intersection by presenting a preliminary account of the correspondence between the standard pragma-dialectical model of a critical discussion and notions within the AIF.[17] The rules for a critical discussion within the context of the ideal pragma-dialectical discussion model can be taken as constituting the foundations for a dialogue protocol. A justification for the possibility of '*protocolisation*' of the rules can be found in their instrumentality towards the goal of the discussion – i.e. reasonably resolving the difference of opinion. Any move in violation of the rules would obstruct the resolution and would therefore be fallacious. By following such a protocol agents can play a dialectical game in which they decide on the acceptability of a certain proposition in a reasonable manner.

Developing the protocol gives us the opportunity to further investigate the rules for critical discussion in regard of the coherence and consistency of the procedure proposed. As such, we can investigate the problem-validity of the rules by testing whether all of the rules are actually aimed at the goal of resolving the difference of opinion and whether there are no additional rules necessary to ideally avoid moves that distract from reaching the overall goal.[18] Because of the AIF's links to more formal systems, translating the protocol into the language of the AIF opens up the possibility of actually implementing the dialectical game of a critical discussion in established computational applications and algorithms at a later moment. These can range from tools to visualise argumentation to automated decision-making systems, and from other dialogue games to logical systems that decide on the validity of arguments. From a computational point of view taking pragma-dialectical insights into account can provide a normative foundation to some applications and answer questions such as those raised by McBurney and Parsons about the design and assessment of dialogue protocols:

> "How many locutions should there be? What types of locutions should be included, e.g., assertions, questions, etc.? What are the appropriate rules for the combination of locutions? When should behavior be forbidden, e.g., repeated utterance of one locution? Under what conditions should dialogues be made to terminate?" (2009, p. 275)

Being a normative discussion model the pragma-dialectical theory provides a procedure, which regiments moves in deliberative or persuasive dialogues in multi-agent systems. It also presents us with a fully developed overview of admissible locutions and argumentative moves, a speech act based approach that allows for complex, composite speech acts, a notion of discussion stages, of fallacious moves, etc.

17 The *standard* pragma-dialectical model (van Eemeren and Grootendorst 2004) refers to the theory before its rhetorical extension in terms of strategic manoeuvring (van Eemeren 2010).

18 This is not to say that any problems found would actually be problems to the theory because the specific issue might be addressed in another part of the theory. It could point us towards aspects of the rules that are less well-developed from a formal perspective.

The current paper investigates the groundwork of an addition of the pragma-dialectical theory of argumentative discourse to the AIF arsenal as a natural language discussion module. For now we start with a very basic instantiation, creating the opportunity to expand on it in the future. Besides simplifying the theory at certain points (by, for example, only focussing on single non-mixed differences of opinion – more on which later), we currently steer clear of the rhetorical extension with strategic manoeuvring, the institutional embedding with argumentative activity types (van Eemeren 2010) and the analysis of argumentative discourse through the use of linguistic indicators and dialectical profiles (van Eemeren, Houtlosser and Snoeck Henkemans 2007). The notion of dialectical profiles interestingly enough appears to be closely linked to what we present in this paper if we regard a dialectical profile or route within the discussion as an instantiation of the possible moves outlined in a critical discussion dialogue protocol and the flow-chart in which our present example has been presented (see Figure 3.5). A continuation of the study should take note of these facets of the pragma-dialectical theory and refine the crude correspondences arrived at in what follows.

We will first introduce the most relevant aspects of the pragma-dialectical theory and of the AIF in Section 3.2 and Section 3.3, respectively. Then we will present a preliminary correspondence between the two in Section 3.4. Section 3.5 will conclude this paper with an outline of our endeavours so far and of the opportunities it opens up for future research.

3.2 The pragma-dialectical theory of argumentation

3.2.1 The ideal model of a critical discussion

In the pragma-dialectical approach argumentative discourse is analysed relative to the ideal model of a critical discussion. This fully developed discussion model is *normative*, as opposed to an empirically distinguished dialogue type; takes into account all *stages* of a discussion instead of merely the inference-drawing stage; and pertains primarily to *natural language* discourse in contrast to just arguments expressed in an artificial language devoid of any basis for their relation to actual discourse.

According to the pragma-dialectical ideal of reasonableness a critical discussion is aimed at resolving the difference of opinion based on the merits of the respective points of view. In the discussion the parties take on the roles of protagonist and antagonist, respectively arguing for the standpoint or criticising its tenability. Thus they engage in a social interaction aimed at achieving mutual agreement about the (un)acceptability of the proposition expressed in the standpoint.[19] To this avail the discussants perform speech acts and pass through the four stages of a discussion all systematically fulfilling a necessary function in the process of reasonably resolving the difference of opinion. The discussants start off from a set of externalised ma-

19 Internal deliberation or monologue on this take would be reconstructed as a dialectical process in which both discussion parties are fulfilled by the same individual anticipating on counter moves.

terial and procedural points of agreement, indicating what common ground there is. The dialectical rules ensure a methodical resolution-oriented discussion procedure based on these conceded premises – *ex concessis* – by prescribing dialectical obligations and rights to the discussants. The subsections that follow will explain the stages (3.2.2), the speech act distribution (3.2.3) and the fifteen rules (3.2.4) of a critical discussion.

3.2.2 The stages of a critical discussion

Discussion parties can only resolve their difference of opinion in a reasonable manner if they go about it in a well-regimented and systematic manner. In the *confrontation stage* the parties recognise their difference of opinion and externalise it. In a single, non-mixed difference of opinion one of the parties will have committed himself to one particular standpoint, which the other party does not agree with. This lack of agreement is expressed by casting doubt on the standpoint. The non-agreeing party can also not merely doubt the standpoint but actually hold an opposite point of view. This would result in a mixed difference of opinion where both discussants have the obligation to defend their own standpoint if they are prompted to do so. There can also be non-agreement about several separate but related standpoints at the same time. In such cases, the difference of opinion becomes multiple. For the remainder of this paper we will focus on single, non-mixed differences of opinion as the elementary case from which more elaborate and complex forms could be composed.

The discussion parties will in the *opening stage* agree on a set of mutually accepted premises and procedures, and commit themselves to engage in a critical discussion. At this time they also distribute the roles they will each play in the next stage of the discussion. One of the parties will defend the standpoint at issue as protagonist by putting forward argumentation in support of it.[20] The other party will cast doubt on the standpoint and, as antagonist, will critically challenge the argumentation.[21]

Once these mutual commitments have been made, the *argumentation stage* commences. In this stage the protagonist tries to defend the standpoint by arguing for it, i.e. by performing the complex speech act of argumentation in defence of his standpoint. The antagonist in turn can ask for further clarification, question the acceptability or justificatory force of the argumentation – as such soliciting further defence by the protagonist – or he can accept (part of) the protagonist's argumentation.

Finally the discussion will enter the *concluding stage* where the current difference of opinion gets resolved by either a retraction of the initial standpoint due to the protagonist's inability to conclusively defend it, or the mutual acceptance of the

20 In most instances it will be the advancer of the standpoint who takes on the role of protagonist and the doubter who takes on the role of antagonist, but the parties are free to decide otherwise as this would suit their particular situation.

21 In the sections involving the pragma-dialectical theory, the term "an argumentation" will be used in a rather specific, technical sense in line with Pragma-Dialectical literature and with its natural meaning in most Roman and Germanic languages. It is taken to denote the constellation of arguments advanced in support of (but not including) a standpoint. It is the term that names the speech act complex consisting of the assertives performed in discourse in support of the standpoint.

standpoint due to a defence that was conclusive. Of course if the protagonist has to retract his standpoint this does not mean that the contradiction of the propositional content of it has been constructively argued for.[22] Such would take another critical discussion.

3.2.3 The distribution of speech acts in a critical discussion

The discussants go through the stages of the discussion by performing speech acts. The model of a critical discussion specifies which types of speech acts have to or may be performed by each party at each stage. In an analysis, the speech acts that are geared towards the resolution of the difference of opinion constitute the argumentatively relevant utterances that need to be reconstructed (van Eemeren, Grootendorst, Jackson and Jacobs 1993). Assertives are performed to express the initial standpoint and to compose the complex speech act of argumentation in defence of the standpoint. Such a complex speech act is made up of the individual assertions and is at a textual level intrinsically connected to the assertion by which the contested standpoint is advanced. Through commissives the parties accept standpoints and argumentation, and agree on mutual commitments towards common starting points, procedures or the outcome of intersubjective procedures and (sub)discussions. Directives are used to prompt the other party to defend his standpoint and argue for it. Discussants can always ask for clarification by performing a directive or provide clarification themselves with a usage declarative.[23]

3.2.4 The procedural rules of a critical discussion

The discussion moves discussants may make through performing speech acts while going through the stages of a critical discussion are regimented by fifteen rules that ensure a reasonable dialectical procedure. These rules are problem-valid in that obeying them is a necessary condition for reaching the intended outcome of critically testing the standpoint at issue and resolving the difference of opinion in a reasonable manner. Any violation of the rules for a critical discussion results in a frustration of the resolution procedure and can therefore be called fallacious.[24]

We will briefly go through the rules proposed by van Eemeren and Grootendorst (2004, pp. 135-157) and reproduce some that are of particular interest to our current project. The first of the fifteen rules specifies the unconditional right of discussants to advance or cast doubt on any standpoint regarding any proposition regardless of topic or (speaker's) status. The second rule allows the discussant doubting

22 Testifying to the critical rationalist principles of the theory (van Eemeren and Grootendorst 2004, pp. 187-190).

23 Van Eemeren and his co-authors (van Eemeren and Grootendorst 1984, p. 105; van Eemeren, Houtlosser and Snoeck Henkemans 2007, p. 16) have collected the speech acts relevant to critical discussion and their distribution over the discussion stages and between the discussion parties in tables.

24 The theory of fallacies as violations of the rules of a critical discussion is presented in detail by van Eemeren and Grootendorst (1992, pp. 93-217).

a standpoint to prompt the discussant that advanced the standpoint to actually defend it. Advancing a standpoint in principle commits the discussant to defend it if he is challenged; the burden of proof rests with him who advances a standpoint. There is no such commitment to challenging the standpoint on behalf of the discussant who casted doubt. One provision here is the principle of *non bis in idem*: the proponent of a standpoint is never obligated to defend a particular standpoint if it has already been successfully defended before under the same discussion rules, and premises, against the same opponent. Furthermore a discussion cannot proceed without the discussion parties first agreeing on certain basic rules and premises.

> RULE 3:
> *The discussant who is challenged by the other discussant to defend the standpoint that he has put forward in the confrontation stage is always obligated to accept this challenge, unless the other discussant is not prepared to accept any shared premises and discussion rules; the discussant remains obliged to defend the standpoint as long as he does not retract it and as long as he has not successfully defended it against the other discussant on the basis of the agreed premises and discussion rules* (van Eemeren and Grootendorst 2004, p. 139).

During the discussion the parties play the roles of protagonist, defending the standpoint, and antagonist, criticising it. That the discussants need to commit themselves to these roles for the remainder of the current critical discussion is laid out in rule 4. After deciding on the discussion rules, discussants should not digress from them or call them into question during the current discussion. If a discussant wants to discuss the status of one of the agreed upon rules this happens outside of the current discussion, giving rise to a meta-discussion.[25]

> RULE 5:
> *The discussants who will fulfil the roles of protagonist and antagonist in the argumentation stage agree before the start of the argumentation stage on the rules for the following: how the protagonist is to defend the initial standpoint and how the antagonist is to attack it, and in which case the protagonist has successfully defended the standpoint and in which case the antagonist has successfully attacked it. These rules apply throughout the duration of the discussion, and may not be called into question during the discussion itself by either of the parties* (van Eemeren and Grootendorst 2004, p. 143).

In the argumentation stage discussants can perform three types of speech acts to critically assess the tenability of the standpoint. First of all the protagonist can perform the complex speech act of argumentation through a constellation of assertives according to rule 6a. This defence of the standpoint is provisional until the antagonist performs a commissive confirming the acceptability of the argumentation. If the antagonist does not accept the argumentation he will perform the illocutionary

25 Which should not be confused with a sub-discussion. We will encounter the latter in the argumentation stage, while the meta-discussion (or meta-dialogue (Krabbe 2003)) is used to determine the common commitments of the discussants in the opening stage.

negation of the commissive and a directive to request new argumentation on the basis of the unacceptability of the propositional content or the justificatory force of the argumentation to the standpoint (rule 6b).

In case the argumentation is attacked on its propositional content, rule 7 states that the protagonist and antagonist will employ the *intersubjective identification procedure* by checking whether the proposition is part of the set of material starting points which were mutually agreed on in the opening stage. If they agree that it is not part of the starting points they can either use a method they specified in the procedural starting points to check the acceptability of the proposition – for example looking it up in an encyclopaedia – or they can engage in a sub-discussion with the contested proposition as sub-standpoint.

If the argumentation is attacked on its justificatory (or refutatory) force, rule 8 determines that in the case that the reasoning in the argumentation is fully externalised and is dependent on logical validity, the discussants can proof the validity through the *intersubjective inference procedure* making use of the system of logic agreed upon as a procedural starting point in the opening stage. Should the argumentation not be dependent on logical validity or fail to be fully externalised it is not logically valid and will make use of an argument scheme. Ordinarily such an argument scheme will not be explicitly stated and need to be reconstructed. This reconstruction will be carried out by following the *intersubjective explicitisation procedure*, which will determine the particular argument scheme employed. Once this has been done, the discussants will have to decide whether the scheme is admissible and has been applied properly. They do this by using the *intersubjective testing procedure*. The admissibility is tested by checking whether this argument scheme and its accompanying critical questions are part of the procedural starting points agreed upon in the opening stage. The application of the scheme is tested by posing the critical questions associated with it and judging whether it can withstand such challenges.

> RULE 8:
>
> *a. The protagonist has successfully defended a complex speech act of argumentation against an attack by the antagonist with regard to its justificatory (or refutatory) force if the application of the intersubjective inference procedure or (after application of the intersubjective explicitisation procedure) of the intersubjective testing procedure, yields a positive result.*
>
> *b. The antagonist has successfully attacked the justificatory (or refutatory) force of the argumentation if the application of the intersubjective inference procedure or (after application of the intersubjective explicitisation procedure) of the intersubjective testing procedure yields a negative result* (van Eemeren and Grootendorst 2004, p. 150).[26]

Rule 9 pertains to the conditions of the conclusive attack or defence of a standpoint. The standpoint has been defended conclusively if the antagonist did not

26 Because of the disjunctive form in part *b*, this rule forces the choice we make later in our dialogue protocol when it comes to not regarding argumentation that failed the intersubjective inference procedure as still salvageable by subsequently employing the intersubjective explicitisation procedure and then checking its acceptability through the testing procedure.

manage to successfully attack the propositional content or the justificatory (or refutatory) force of the argumentation in support of this standpoint. The standpoint has been conclusively attacked if the antagonist did manage to successfully attack the content or force of every complex speech act of argumentation performed by the protagonist in direct support of this standpoint.

Although the aim of the critical discussion is to critically test the tenability of a standpoint, the antagonist is under no obligation to attack the argumentation in support of a standpoint in all possible ways. The critical stance of the antagonist can be short-lived if he feels compelled to accept the first attempt the protagonist makes at defending the standpoint. The antagonist does retain the right to critically challenge the argumentation throughout the discussion, though, as long as he is not repeating himself after a successful defence or an act of retraction with regards to the standpoint or argumentation for it by the protagonist.

Because the protagonist should defend the standpoint, he has to support it by means of advancing argumentation. Quite similar to the antagonist's right expressed in rule 10, the protagonist retains the right to defend his argumentation throughout the discussion. Should an argumentation be attacked on both its propositional content and its justificatory force, then the protagonist has to defend it against both. Aside from the right to defend a proposed argumentation against attacks, rule 12 allows the protagonist to retract the commitment to an argumentation he advanced earlier in order to support the standpoint in a different way.

The rules so far allow for the discussants to frustrate the resolution of their difference of opinion by allowing them to repeat performing the same speech acts over and over again. The orderly conduct of a critical discussion is regulated through rule 13 by posing a restriction on the repetition and mixing of speech act performances and by having the discussants take alternating turns.

In order to end the particular instance of a critical discussion, rule 14 states the pre-conditions for the speech acts discussants may perform in the concluding stage of the discussion. The discussants will decide on the outcome of the discussion leading the protagonist to have to retract his standpoint if it has not been conclusively argued for or leading to the antagonist having to retract his doubt regarding the standpoint if it has. Although rule 14 allows for an outcome of the discussion in which neither of the discussants has to change their commitment to the standpoint, such a termination cannot be regarded an instance of a reasonably resolved difference of opinion.

Because of the nature of the dialectical procedure (i.e. being based on externalised commitments) it is very important that the discussion parties optimally formulate and interpret their utterances. The utterances should further the resolution process, not obstruct it. To this end, discussants may always perform a usage declarative themselves or ask their dialectical opponent to do so, in which case the other is obligated to comply.

This concludes the normative fifteen rules of a critical discussion as well as our present introduction of the pragma-dialectical theory. In Section 3.4 we will establish some basic correspondences between the pragma-dialectical theory and the Argument Interchange Format, which will be introduced in Section 3.3.

3.3 The Argument Interchange Format

Argumentation theory is a large and diverse field stretching from analytical philosophy to communication science and social psychology. The computational investigation of the subject has multiplied that spectrum by a diversity of its own in semantics, logics and inferential systems. One of the problems associated with the diversity and productivity of the field, however, is fragmentation: with many researchers from various backgrounds focusing on different aspects of argumentation, it is increasingly difficult to reintegrate results into a coherent whole. This in turn makes it difficult for new research to build upon old. To tackle this problem, the computational argument community has initiated an effort aimed at building a common ontology for argument which will support interchange between different research projects and applications in the area: the Argument Interchange Format (AIF).

Owing to its roots in computational argumentation, a main aspiration of the AIF is to facilitate data interchange among various tools and methods for argument analysis, manipulation and visualization.[27] Whilst the ideal of a single format might not be feasible in such a diverse field, a common consensus on the standards and technologies employed is desirable. Furthermore, the AIF project aims to develop a commonly agreed-upon *core ontology* that specifies the basic concepts used to express argumentative information and relations. The purpose of this ontology is not to replace other languages for expressing argument but rather to serve as an abstract *interlingua* that acts as the centrepiece to multiple individual languages for argumentation. These argument languages can be, for example, logical languages (e.g. ASPIC's defeasible logic (Prakken 2010)), visual languages (e.g. Araucaria's AML format for diagrams (Reed and Rowe 2004)) or natural language (e.g. as used in the pragma-dialectical approach (van Eemeren and Grootendorst 2004)).

A common abstract ontology for argumentation is interesting from a practical perspective because it drastically reduces the number of translation functions that are needed for the different argumentation languages to engage with each other; only translation functions to the core AIF ontology have to be defined (i.e., n instead of $n2$ functions for n argumentation languages). In this way, data interchange is facilitated and methods that use different languages can be applied to the same argument resources expressed in the AIF. With the AIF as an interlingua we can, for example, use a diagramming tool such as Araucaria to visualise arguments that were interpreted from a natural language text using pragma-dialectical methods. From a more theoretical perspective a common ontology is interesting because it provides a conceptual anchoring point for the various different argumentation languages.

27 Even though the AIF has a clear computational objective, such tools and methods need not necessarily be implemented as computer programs: a pragma-dialectical analysis, for instance, is a method that is not implemented as a program.

3.3.1 The ontology†

The AIF is constructed as an 'ontology', which in the context of computer science, and knowledge representation in particular, is a way of defining the key concepts of a domain and the relationships between them. In the AIF ontology, arguments and their mutual relations are described by conceiving of them as an *argument graph*. The ontology falls into two natural halves: the Upper Ontology and the Forms Ontology. The Upper Ontology, introduced by Chesñevar et al. (2007), describes the graphical language of different types of nodes and edges with which argument graphs can be built (i.e. the "syntax" for the abstract language of the AIF ontology). The Forms Ontology, introduced by Rahwan, Zablith and Reed (2007), allows for the conceptual definition of the elements of the graphs, that is, it describes the argumentative concepts instantiated by the elements in a graph (i.e. the "semantics" for our abstract language).

The Upper Ontology places at its core a distinction between *information*, such as propositions and sentences, and *schemes*, general patterns of reasoning such as inference or conflict, which are used to relate pieces of information to each other. Accordingly, there are two types of nodes for building argument graphs: information nodes (*I-nodes*) and scheme nodes (*S-nodes*). I-nodes can only be connected to other I-nodes via S-nodes. That is, there must be a scheme that expresses the rationale behind the relation between I-nodes. In the basic AIF ontology, scheme nodes can be rule application nodes (*RA-nodes*), which denote specific inference relations, conflict application nodes (*CA-nodes*), which denote specific conflict relations, and preference application nodes (*PA-nodes*), which denote specific preference relations.

The Forms Ontology is important in that it contains the argumentative concepts instantiated by the graph. The Forms Ontology is essentially based on *schemes*, general patterns of reasoning, that is, inference schemes, conflict schemes or preference schemes. Informally, inference schemes are rules of inference, conflict schemes are criteria (declarative specifications) defining conflict (which may be logical or non-logical) and preference schemes express (possibly abstract) criteria of preference. These main scheme types can be further classified. For example, inference schemes can be deductive or defeasible. Defeasible inference schemes can be further subdivided into more specific argument schemes, such as the schemes for Causal Argument or for Argument from Sign by Walton, Reed and Macagno (2008) or the pragma-dialectical argument schemes based on analogy, sign or cause (see van Eemeren and Grootendorst 1992).[28] There are various ways to represent the schemes in the Forms Ontology. Rahwan, Zablith and Reed (2007), for example, define them as graphs of so-called form-nodes (F-nodes) whilst Rahwan et al. (2011) define schemes as combinations of classes of statements in Description Logic. In this paper, we will represent individual schemes as a list of features, as in Table 3.1.

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† This subsection was originally entitled: "The AIF ontology".

28 It is important to note that the AIF ontology does not (and should not) legislate as to which schemes or forms are the correct ones; different schemes are each plausible according to particular theoretical assumptions.

Scheme name	**Analogy**	**Modus Ponens**
Scheme type	defeasible inference scheme	deductive inference scheme
Premises	*A* is true (false) for *C1* *C1* is similar to *C2*	ϕ $\phi \Rightarrow \psi$
Conclusion	*A* is true (false) for *C2*	ψ
Presumption	The similarity between C1 and C2 is relevant to the comparison	none
Exception	*A* is false (true) for another *C3* similar to *C1*	none

Table 3.1: *Two possible inference schemes in the Forms Ontology*

Note that the critical questions for a scheme are implicitly modelled; some of them point to an implicit presumption ('Is the similarity sufficiently relevant?'), others correspond to the exception ('Is there some other *C3* that is also similar to *C1*, but in which *A* is false?') or they may ask after one of the premises ('Is *A* true for *C1*?').

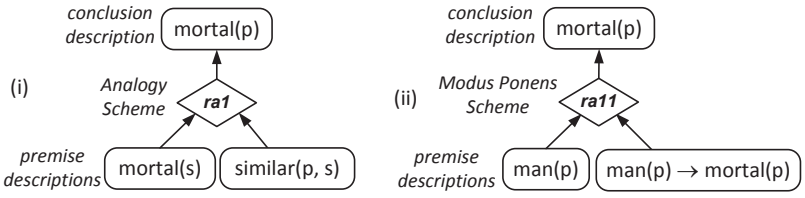

Figure 3.1 *Argument graphs in the language of the AIF ontology*

The Forms Ontology and the Upper Ontology are intimately connected because specific applications of schemes (denoted by RA-, CA- and PA-nodes) are instantiations of general (inference-, conflict- and preference-) schemes; in other words, the S-nodes *fulfil* the schemes expressed in the Forms Ontology. As an example of argument graphs that fulfil schemes consider Figure 3.1, in which two arguments for Plato's (p) mortality are given, one based on Socrates' (s) mortality and the fact that Plato and Socrates are similar (e.g. they are both men) and another based on the fact that Plato is a man (and therefore mortal). Rectangular nodes are I-nodes and ellipses are S-nodes; the concepts from the Forms Ontology that are fulfilled by the nodes (see the two schemes for analogy and Modus Ponens above) are rendered next to the nodes.

3.3.2 Dialogue representation†

The basic AIF ontology, as described by Chesñevar et al. (2007) and Rahwan, Zablith and Reed (2007), does not include ways of representing argument$_2$, that is, dialogical argument.[29] One reason for this is that as Prakken (2005) remarks, while there are a number of well-defined systems for dialogue games, for many of these systems the underlying design principles are mostly implicit. Despite this, Reed et al. (2008; 2010) have recently made some tentative steps in the way of including dialogical argument$_2$ in the AIF ontology. The extended ontology, dubbed AIF+, extends the base ontology to support representation of dialogue protocols (i.e. specifications of how dialogues are to proceed), to support representation of dialogue histories (i.e. records of how given dialogues did proceed) and to support representation of the connection between dialogic argument$_2$ and argument$_1$. One underlying premise of this work is that any extensions to the basic AIF should include a minimal amount of extra representational machinery. Below, we briefly summarize the work on the AIF+ ontology.

In the context of the AIF+ ontology, it is proposed that locutions are modelled as a subclass of I-nodes called L-nodes. This approach is followed primarily because statements about locution events are propositions that could be used in arguments. So for example, the proposition *Plato says, 'Socrates is mortal'* could be referring to part of a dialogue (and later we shall see how we might therefore wish to reason about its propositional content, *Socrates is mortal*) but it might also play a role in a structure of the form argument$_1$ (say, as a premise in an argument from expert opinion or of an argument about Plato's communicative abilities).

A dialogue is more than a mere sequence of unconnected locutions: there is a functional relationship between different locutions, especially if we consider them in a dialogue with set rules. Imagine, for example, a dialogue in which Plato says, 'Socrates is mortal' and Aristophanes responds by asking, 'Why is that so?' In trying to understand what has happened, one could ask, 'Why did Aristophanes ask his question?' Now, there is at least one answer we could give purely as a result of the dialogue protocol, namely, 'Because Plato had made a statement'. That is to say, there is a functional relationship between the proposition, *Plato says, `Socrates is mortal'* and the proposition, *Aristophanes asks why it is that Socrates is mortal*. That relationship can be seen as a scheme, a pattern of reasoning (but perhaps not as a conventional inferential scheme as for RA-nodes) of which the grounds lie in the definition of the dialogue game. Thus, by analogy to the ontological machinery of schemes, we can view transitions as Forms that are fulfilled by an S-node for transitions between locutions, which we call transition application nodes (TA-nodes).

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† This subsection was originally entitled: "Dialogue in the AIF".

29 Here, we refer to O'Keefe's (1977) two characterizations of the term "argument": argument$_1$ and argument$_2$. Argument$_1$ refers to an argument as a static object (in pragma-dialectical terms, the reasoning underlying the argumentation) and is described by sentences such as "he prepared an argument". Argument$_2$ refers to a dialogue (the pragma-dialectical notion of *critical discussion*) and is described by sentences such as "they had an argument". [‡ This note was changed slightly in order to more correctly reflect the pragma-dialectical viewpoint.]

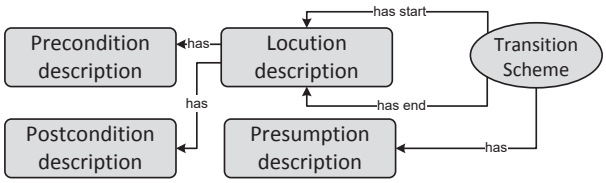

Figure 3.2 *Transition schemes and locutions*

Many protocols for dialogue games associate constraints with what are here called transitions. A transition scheme can thus be interpreted as having a *presumption* in much the same way that specific inference schemes have presumptions (cf. the scheme for argument from analogy in Table 3.1). These transitions and the conditions on them, are not all there is to a protocol: some locutions have conditions which do not directly refer to another locution in the dialogue, that is, constraints on individual locutions. We specify these constraints as pre- and post-conditions on operators that correspond to locutions. Figure 3.2 shows the ontological structure of locutions and transitions.

For examples of locutions and transition schemes, consider Table 3.2 and 3.3, which show the *Challenge* and *Resolve* locutions and the *Challenge-Resolve* transition from Mackenzie's (1979) DC protocol. Notice the difference between constraints-as-presumptions and constraints-as-preconditions: the precondition for a Challenge always holds, no matter to which other locution the Challenge responds. The presumptions on a Challenge-Resolve transition, however, only hold when a Resolve is offered as a response to a Challenge.

Locution name	**Challenge**	**Resolve**
Format	Why P?	Resolve whether P
Precondition description	P is not in speaker's commitment	none
Postcondition description	P is in hearer's commitment Why P? is in speaker's commitment	none

Table 3.2 *Two locutions from Mackenzie's DC protocol*

One interesting question is how exactly L-nodes are connected to I-nodes in argument$_1$. So, for example, what is the relationship between the proposition Socrates is mortal and the proposition Plato says, 'Socrates is mortal'? The answer to

the question is already available in the work of Searle (1969), later together with Vanderveken (1985): the type of the link between a locution and its propositional content is dependent on the type of illocutionary force, which the performer of the speech act assumes. In the AIF+ ontology, the relation between a locution and its propositional content is hence captured by illocutionary schemes. Specific applications of these schemes are then, following the now familiar pattern, represented as YA-nodes, which describe passage between L-nodes ("elements" of argument$_2$) and I-nodes ("elements" of argument$_1$). For example, Plato says, 'Socrates is mortal' is linked to Socrates is mortal by a YA-node which is an instance of the "asserting" illocutionary scheme.

Scheme name	**Challenge - Resolve**
Start Locution Description	Why P?
End Locution Description	Resolve whether 'if Q then P'
Presumption Description	P is an immediate consequence of Q Q is a conjunction of statements to all of which the hearer is committed

Table 3.3 *A transition in Mackenzie's DC protocol*

A link between an L-node and an I-node is warranted by the constitutive rules for the speech act that is performed. In natural contexts, the most important types of constitutive rules are the preparatory and sincerity rules, for which unfulfilment results in defectiveness of a speech act (Searle and Vanderveken 1985). AIF naturally supports different conceptions of speech acts and of illocutionary force in that it allows for multiple sets of illocutionary schemes (just as it allows for multiple sets of argument schemes). As a result, it can represent van Eemeren and Grootendorst's (1984) modifications to Searle's and, later, Searle and Vanderveken's, rules and conditions on speech acts. For example, an assertion may be successful but still defective, if its performer declared what in fact he disbelieves: a locutor may not satisfy constitutive rules and still have a chance to perform a successful speech act, since a receiver may not notice their unfulfilment.† Thus, the successful adherence to constitutive rules can be viewed as *presumptions* on the applications of illocutionary schemes and all of the existing AIF machinery handles the representation of attacks on the successful application of illocutionary force.

† Van Eemeren and Grootendorst (1984, 19-46; 1992, p. 26-33) have clarified the difference between identity or recognisability conditions and correctness conditions of speech acts.

3.3.3 Calculated properties‡

The language of the AIF+ ontology allows us to "record" arguments of both type 1 and 2 and the links between them. However, arguments based on, for instance, counting, weighing, comparing or evaluating other arguments all involve processes (counting, weighing, comparing, evaluating) that cannot be captured in the AIF itself (and nor should they be, for otherwise the AIF would swell to some general purpose programming language). These various processes might collectively be thought of as ways of *calculating properties* about the arguments that the AIF+ ontology represents. It is not that such arguments cannot be represented at all. But rather, if arguments are based on these calculated properties – arguments such as "the prosecution has not provided sufficient evidence for a conviction, so the accused is released" – then they can only be represented in the same way as normal propositions, i.e., as I-nodes. The language of the AIF+ ontology has no way of capturing the link between such a statement and, say, the existence or non-existence of a set of other nodes. For argument$_1$ structures this is a relatively small problem, but it excludes, as the previous example demonstrates, some relatively common forms of legal argument. But for dialogue, the matter is more serious. Protocol rules are very often defined on the basis of calculated properties of dialogue histories: the existence or non-existence of particular claims, the current status of claims and commitments.

3.4 Critical discussion in the Argument Interchange Format†

Having introduced the pragma-dialectical model of a critical discussion in Section 3.2 and the AIF in Section 3.3, we now turn our attention to the correspondence between the two in Section 3.4. We will begin by relating the core concepts of the pragma-dialectical model to the building blocks of the AIF ontology. Then, we will tentatively re-introduce the model of a critical discussion in terms of a dialogue protocol by means of a flow-chart that visualises the moves discussants can make within a discussion game. We will also highlight some of the most noteworthy and interesting locution pairs found within the protocol.

‡ This subsection was originally entitled: "Calculated properties in the AIF".

† This subsection was originally entitled: "Critical discussion in the AIF".

3.4.1 Pragma-dialectical notions in Argument Interchange Format terms‡

Evaluating argumentative discourse in accordance with the standard pragma-dialectical model of a critical discussion requires the construction of an analytic overview (van Eemeren and Grootendorst 2004, pp. 118-122). This overview covers all analytically relevant argumentative elements of the discourse. In the paragraphs that follow, these core elements of pragma-dialectical analysis are correlated to the core ontology of the AIF.

Standpoints

In pragma-dialectical theory, a standpoint is a combination of a proposition and an attitude towards that proposition. Clearly, the propositional content of a standpoint corresponds very closely to an I-node in the AIF, but I-nodes (necessarily) omit agent-relativised attitudes towards their content, so an I-node capturing some proposition *p* cannot directly correspond to a standpoint such as +/*p*. Houtlosser (1994) elucidates the pragma-dialectical foundation that suggests a central role for speech acts, and intimates that offering a standpoint is a distinct speech act, albeit one that may be performed simultaneously with others. We might call the illocutionary force that accompanies such a speech act (rather cumbersomely), 'standpointing'. Armed with this type of illocutionary force, we have a further point of correspondence: a propositional report of a discourse event such as *Bob says p is the case* is captured by an L-node; its propositional content, *p*, is captured by an I-node, and the connection between them is captured by a YA scheme instantiating an illocutionary scheme for standpointing. Bearing in mind that the AIF can directly represent the underlying 'Sentence-level' assertion that also connects the L- and I-nodes, the picture is as in Figure 3.3, below.

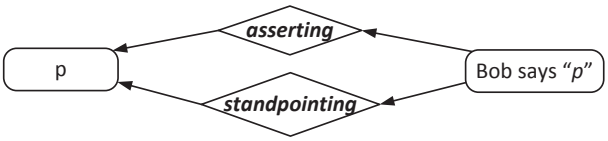

Figure 3.3 *Standpointing as illocutionary force*

Whilst Figure 3.3 represents a reasonable AIF interpretation of the speech act constitution of standpoints, it fails to provide us with the locus of a standpoint – although we have a representation of standpointing, we do not yet have one for a standpoint. Two observations lead to a solution. The first observation is that van Eemeren and Grootendorst (1984) provide a propositional interpretation of a standpoint (as applied to our example): *Bob's point of view in respect of the expressed opinion* p *is that this expressed opinion* p *is (not) the case* (van Eemeren and

‡ This subsection was originally entitled: "Pragma-dialectical notions in AIF terms".

Grootendorst 1984, p. 114). The second is that this proposition can be deduced from an AIF graph in which there is a sentence level assertion and a higher textual level speech act of standpointing between a single L-node and a single I-node. In other words, the standpoint can indeed be represented as an I-node (it is, after all, a proposition like any other), but one which is a calculated property.

This characterisation of the speech-act nature of standpoints does have some limitations. For van Eemeren and Grootendorst, the relationship between the speech act of standpointing and the speech act of asserting is one of supervention, that is, the content of the standpointing act is precisely the asserting act. The AIF, however, enforces strict type limitations, and is founded upon the early speech act model in which all speech acts (if they have any substantive content at all) have propositional content. As speech acts themselves are not propositions, for the AIF, the passage of illocutionary force captured by the illocutionary scheme cannot itself be the subject of illocutionary force. In this way the current ontology of the AIF prohibits direct connections between one illocutionary scheme and another. Exploring this restriction further in response to the pragma-dialectical approach is an interesting avenue for further investigation.

On the other hand the analysis also has some strengths. The AIF interpretation can cope with Houtlosser's reconstruction of arbitrary speech acts (not just assertives) between the propositional report of the discourse event and the propositional content (i.e. the content of the standpoint), and can similarly handle multiple such speech acts if, for example, both a directive and a (reconstructed) assertive are identifiable at the sentence level. The AIF interpretation also preserves a clear distinction between a standpoint and other speech acts, which is important for subsequent dialogical mechanics (see Subsection 3.4.3). And finally, it is possible to expand the analysis presented in Figure 3.3 explicitly to capture Houtlosser's (1994) more refined account of the complex speech act of standpointing in which it is the acceptability of the sentence level assertive which is the target of the speech act. Illocutionary schemes capture presumptions and constitutive requirements on speech acts in the same way that argument schemes capture presumptions and constitutive requirements on inferences. In addition to Searlean conditions and constitutive rules, the illocutionary scheme for asserting might also typically capture the implicit presumption of acceptability generated by the Interaction Principle. These implicit components act as potential growth points for argument and can be made explicit when appropriate. We could thus revise the picture as in Figure 3.4, which makes explicit the proposition corresponding to the presumption of acceptability, and then renders that presumption the target of the illocutionary force of standpointing.

Figure 3.4 is a significantly more complex interpretation, so for the sake of clarity in what follows, we retain the analysis in Figure 3.3, because nothing is lost in our investigation if we do so.

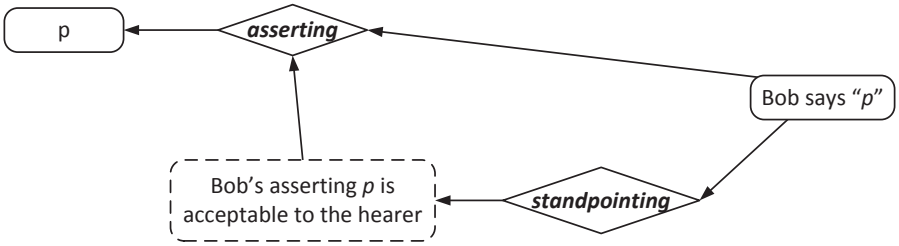

Figure 3.4: *Standpointing with acceptability of sentence level assertion*

Discussion roles

The distribution of the discussion roles is externalised in the opening stage. The discussion parties mutually commit to the distribution for the remainder of the discussion. From then on, every L-node is marked with a specific *agent* property corresponding to a unique name for an interlocutor, and the mapping between these unique names and their roles in this particular dialogue is handled by the commitments established during the opening stage. Thus, for example, we might imagine a move *m* in a dialogue which requires the protagonist to have earlier said *x*. We may have a representation of the utterance of *x* for which the agent property is *Bob*, and furthermore, we may have the parties having committed that for this dialogue Bob is protagonist. The precondition on the move *m* would thus express that there exists some agent for whom there exists a commitment of taking on the role of protagonist, and that this agent must be the value of the agent property of an L-node earlier in this same dialogue.

Starting points

The starting points of an argument are the conceded propositions mutually agreed upon as a part of the common ground, as checked in the intersubjective identification procedure. For the AIF, starting points are represented as I-nodes (starting points in the pragma-dialectical theory do not include derivations or applications of inferences, or instances of conflict relations, so they do not include complexes of I-nodes and S-nodes). In the pragma-dialectical theory, starting points may also include rules of inference, which correspond to components of the Forms ontology (referred to as F-nodes by Rahwan, Zablith and Reed (2007)). Direct reference to F-nodes from within instances of AIF graphs is not currently possible: it is not possible to argue about or agree to or talk about general rules of inference, as it is in some other systems – particularly those with a legal heritage where the evolution of legal rules is of central importance. This is a known limitation of the AIF which is under investigation elsewhere. Here we limit ourselves to handling propositional starting points.

Clearly the propositions that are the subject of the starting points are I-nodes. However, the fact that they are starting points needs to be handled explicitly

too. As with much of the pragma-dialectical theory, the establishment of starting points has a dialogical basis. As such, the fact that a given proposition is a starting point in a given dialogue is a commitment – that is, an I-node corresponding to a property calculated on the basis of a (set of) L-node(s). So for example, the two L-nodes, *Bob said that he thought they both agreed on* p, and *Wilma said that she agreed*, might be used to calculate the property that p *is a starting point*, which itself would be represented as an I-node.

Argumentation

The concept of 'an argumentation' in pragma-dialectical theory is related to O'Keefe's (1977) characterisation of argument$_1$. As a result, an argumentation is simply any connected subgraph of an AIF graph which does not include applications of transitional (TA) or illocutionary (YA) schemes. To include TAs or YAs would be to include dialogue as such, so they must be excluded. Notice however that the definition does allow L-nodes. This is because L-nodes can be used to play a role in arguments$_1$. For example, one might use the premise, *Bob said bananas are yellow* as a basis for an inference to the conclusion that *Bob can speak*, or *Bob knows English*, or *Bob has seen a banana*, and so on. In fact, one rather common use of L-nodes in this way is in arguments from authority (and related forms) – so we must not prohibit L-nodes from appearing in argumentation.

Argumentation structures

The pragma-dialectical model recognizes several distinct structures of argumentation, each of which corresponds directly to particular arrangements or constraints on AIF graphs.

Single argumentation corresponds to a subgraph of AIF involving exactly three nodes: an I-node corresponding to some proposition *p*, an I-node corresponding to some proposition q, and an RA-node connecting *q* to *p*, with the further constraint that there are no other incoming RA-nodes to *p* (in fact this last constraint is rather more difficult to determine since it is relativised to the current dialogue – clearly there might be many other arguments for *p*, but their existence is of no import if they are not adduced in the dialogue at hand).

Multiple argumentation corresponds to a subgraph of AIF involving at least five nodes: an I-node corresponding to some proposition *p*, two further I-nodes corresponding to propositions *q* and *r*, and two RA-nodes, one connecting *q* to *p*, the other connecting *r* to *p*. There may be any number of other RA- and I-nodes in the subgraph in addition: the structure described is sufficient for the subgraph to count (at least) as a multiple argumentation structure.

Coordinative argumentation corresponds to a subgraph of AIF involving at least four nodes: an I-node corresponding to some proposition *p*, two further I-nodes corresponding to propositions *q* and *r*, and an RA-node which connects *q* and *r* to *p*. There may be any number of other RA- and I-nodes in the subgraph in

addition: the structure described is sufficient for the subgraph to count (at least) as a coordinative argumentation structure.

Subordinative argumentation corresponds to a subgraph of AIF involving at least five nodes: three I-nodes corresponding to propositions *p*, *q* and *r*, and two RA-nodes, the first connecting *q* to *p*, and the second connecting *r* to q. There may be any number of other RA- and I-nodes in the subgraph in addition: the structure described is sufficient for the subgraph to count (at least) as a subordinative argumentation structure.

Argument schemes and critical questions

Argument schemes in the pragma-dialectical theory have a direct counterpart in the AIF's representation of rules of inference. The schemes themselves are characterised abstractly (that is to say, uninstantiated) in the Forms ontology, and are then instantiated by RA schemes in specific examples. For the AIF it is important to distinguish the form of, say, Argument from Authority (which defines the form that its premises and conclusion take, defines its presumptions and exceptions, and defines its critical questions), from a given instance of Argument from Authority (which has specific premises, conclusions and possibly some of the implicit presumptions and exceptions made explicit, and possibly some of the critical questions asked).

The pragma-dialectical scheme set, summarised by van Eemeren, Grootendorst and Snoeck Henkemans (2002) as comprised of symptomatic, causal and analogical schemes can be represented in the AIF Forms ontology in the usual way, with instances fulfilling the constraints and properties of those forms as with other scheme sets already characterised, including those based on Walton, Reed and Macagno's work (2008). Instances of schemes are captured by RA-nodes, and the critical questions correspond, as they do with schemes from other sources, to a variety of structural patterns, including implicit premises (I-nodes) for presumptions, implicit conflicts (I-node plus CA-node) for exceptions, and implicit undercutters (I-node plus CA-node plus I-node complex). Rahwan, Zablith and Reed (2007) offer some examples of these patterns.

Critical questions form a key part of the machinery of argument schemes, and the dual argument$_1$ / argument$_2$ nature of schemes and critical questions has been remarked upon previously (Reed and Walton 2007). On the one-hand, schemes and the presumptions and exceptions that the critical questions embody have a distinctly argument$_1$ character, in that they structure the connections between argument$_1$ components. On the other hand, critical questions are inherently argument$_2$, as they need to be asked in order to 'fire'. According to the pragma-dialectical theory, the asking of critical questions is controlled by an intersubjective procedure. Though the results of that procedure correspond to RA-nodes and their connected I-nodes, the procedure itself is a part of the dialogical process of critical discussion – in just the same way that Reed and Walton (2007) advocate including a 'Pose' move into a simple dialogue game in order to accommodate the posing of critical questions. It is to the characterisation of these dialogical issues that we turn next.

3.4.2 Towards a critical discussion dialogue game protocol

Drawn from the fifteen rules for a critical discussion and the speech acts that may (or should) be performed by interlocutors in the four stages of a critical discussion, we can characterise the routes along which a dialectical exchange can develop. These possible routes are visualised as a directed graph (or flow-chart) in Figure 3.5.

The discussants start out at the top with one party advancing a standpoint in the confrontation stage. Following the ideal procedure of a critical discussion the discussants can take various routes by performing certain speech acts at specific points during the discussion to move through the opening and argumentation stages and end up in the concluding stage at the bottom of the graph. Momentarily we will treat the intersubjective procedures as 'black boxes', leaving it to the discretion of the discussants to determine the process therein and outcome thereof. These intersubjective procedures are shown as oval nodes in the graph. As is indicated in Subsection 3.2.4, the pragma-dialectical theory does provide insight into these procedures. Adding them will be one of the next tasks in the venture of correlating the pragma-dialectical framework to the AIF.

Another proviso we need to make is that in our current tentative take we do not distinguish between the discussion roles and the parties that initially advance a standpoint or doubt it. Remember that either the proponent of the standpoint or the challenger can assume the role of protagonist (or antagonist) in the discussion stage, but ordinarily it will be the proponent of the standpoint who will actually argue for it.

A further assumption we make is that the standpoint is positive (i.e. +/p) and is only faced with doubt, not with a contradictory stance. If the challenger would actually take the opposite standpoint instead of merely doubting it, two separate discussions will have to be completed in order to test both the positive standpoint (+/p) and the negative one (−/p). This will solicit a problem of order for the discussants who will have to determine which of the two discussions they will engage in first – and should not be taken as a problem of choice where settling the one dispute would automatically settle the other.[30]

At present this fork in the confrontation stage of the discussion has not been incorporated into the flow-chart visualisation of the protocol yet. Catering the protocol for a negative standpoint could be done by allowing for a substitution of the current positive standpoint (+/p) with a negative standpoint (−/p) and requiring the force of the argumentation not to be justificatory for the standpoint but rather refutatory. For the sake of simplicity we will nevertheless stick to characterising a single non-mixed difference of opinion in which a positive standpoint is at issue. Similarly we assume the discussants have no problem in understanding each other's utterances and therefore have no need for performing or requesting usage declaratives – which the rules for a critical discussion do allow at any moment (see rule 15 (van Eemeren and Grootendorst 2004, p. 157)).

30 Remember that a standpoint can only be constructively defended. See van Eemeren and Grootendorst's (2004, p. 141) explanation of the matter of *order* (not *choice*) in a mixed or multiple difference of opinion.

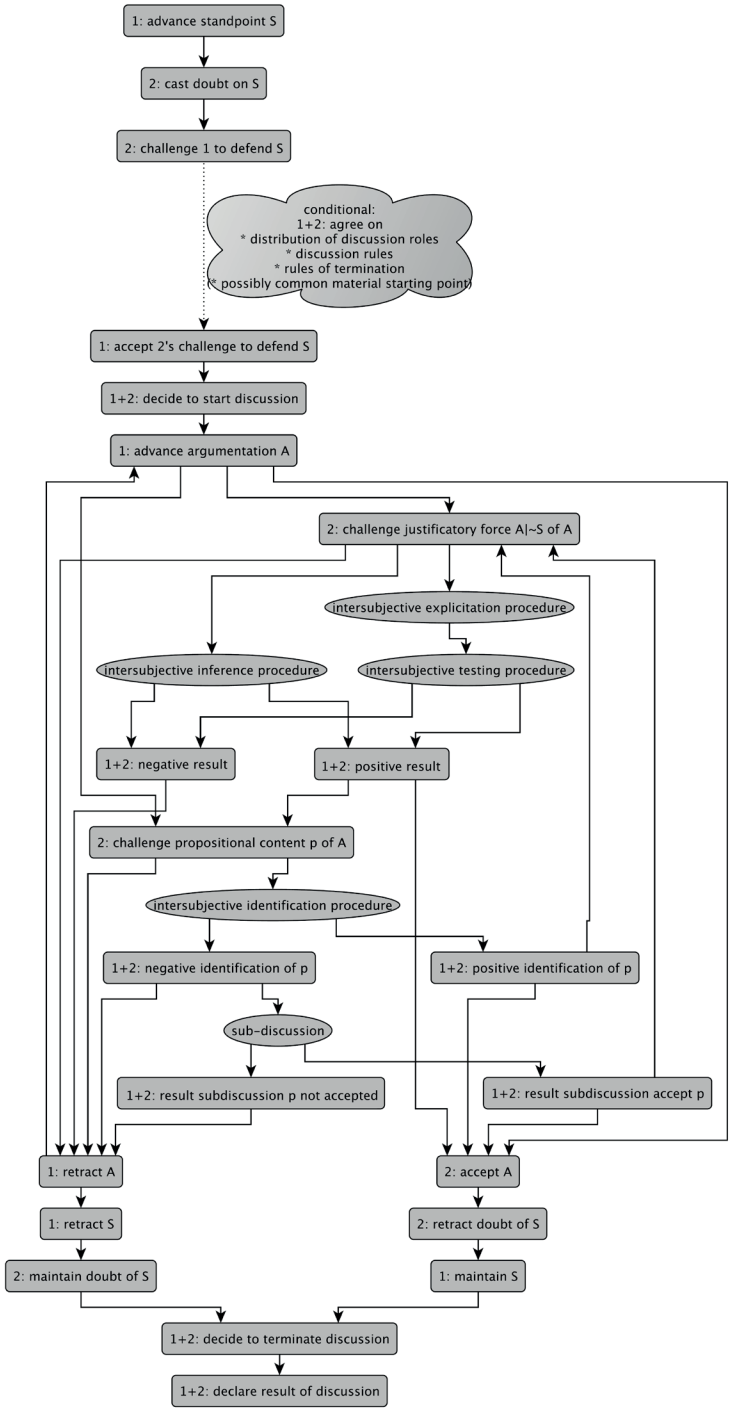

Figure 3.5 *The (simplified) dialogue protocol of a critical discussion as flow-chart*

Each node in Figure 3.5 represents a locution performed as indicated by parties 1 or 2 or both and with its particular discursive function. The edges between nodes represent routes that discussants may take. The first two moves in the discussion will be party 1 advancing a standpoint, which allows party 2 to respond to it by casting doubt. Of course in actual discourse interlocutors have the opportunity to perform many more locutionary acts than those shown here. The protocol expressed through the chart only and exactly covers the locutions and locution-pairs, which are argumentatively relevant for the dialectical procedure of the critical discussion.[31]

Any digression from this procedure will be irrelevant to reasonably resolving the difference of opinion and is not part of the critical discussion procedure. That is to say the protocol presented is normative. For example discussion party 1 has the possibility to not advance any argumentation and retract his prior standpoint (e.g. for the sake of being done with it.) This could be regarded as a move heading directly to the mutual decision to terminate the discussion at the bottom of the flow-chart. But as the discussants did not 'play by the rules' of a critical discussion this path has not been incorporated into the protocol. Such a move would mean that there never was a critical discussion to begin with: the merits of the standpoint were never put to the test.

A possible difficulty in the procedure represented in the protocol is the move from the antagonist's challenge to either the intersubjective inference or the explicitation procedure. As it stands the first route has to be taken if the argumentation was both fully externalised and dependent on logical validity in its potential transfer of the acceptability of the premises employed to the standpoint. This approach appears to be in line with van Eemeren and Grootendorst's (2004, pp.148-150). Nonetheless, when we regard the reconstructive and interpretative steps available in the analysis of argumentative discourse, it appears to be possible to evaluate argumentation that is not presented as fully externalised on the basis of its logical validity. In the absence of pragmatic factors that would suggest otherwise, the analyst can use the transformation method of addition to add any unexpressed premise(s). Such maximally reasonable (charitable) reconstruction is justified because the interlocutors are taken to be bound by the communicative principle of co-operation and therefore as performing speech acts aimed at the goal of resolving the difference of opinion (van Eemeren and Grootendorst 2004, pp.115-118).

The protocol could be amended accordingly (i.e. by allowing the path [challenge force of argumentation] - [intersubjective explicitation procedure] - [intersubjective inference procedure].) This would warrant the question whether in the light of the recent developments in non-monotonic and defeasible logics the strict separation between the intersubjective inference and testing procedures is still viable or even necessary. Although from the perspective of computational complexity inefficient, the current protocol allows for the same functionality as a more elaborated procedure which takes the analysis through the logical minimum – the bare-bones needed for coherent inference – and the pragmatic optimum – dressing the bare-

31 With the current exclusion of the usage declarations allowed by rule 15 in an attempt to maintain a more-or-less comprehensive chart.

bones to account for the contextual discursive embedding – into account. An interlocutor could retract argumentation, which has failed on the inference procedure side in order to subsequently re-advance it either in fully externalised form or as not based on logical validity this time around. Similarly an analyst can use this method to end up with a fitting maximally reasonable evaluation.

3.4.3 The protocol and locution-pairs in the Argument Interchange Format†

By regarding the pragma-dialectical discussion procedure as a dialogue protocol Figure 3.5 shows that locutions come in pairs, where the first might be followed up by one specific, or possibly a choice of several successor locutions. Some of the pairs are of more interest than others and by means of an example we will characterise six of them in terms of Transition Schemes in the AIF+ ontology. As a result of the universality of the language of the AIF, some of the intricacies of the pragma-dialectical speech acts and critical discussion model need to be treated as calculated properties or left out altogether. Subsequent studies could investigate these omissions further to attempt a more precise correspondence.

A discussion starts with one of the parties advancing a standpoint. The other party may then accept the standpoint, in which case there will be no critical discussion. The more interesting thing to do, from an argumentative perspective, is to doubt the standpoint. Consider the two locutions *advance standpoint* and *cast doubt* in Table 3.4. In our characterisation of the locutions, we present them in a "semi-formal" way. In Table 3.4, p_i stands for the party (or player if we see the discussion as a dialogue game) that advances the locution.

Locution name	**Advance standpoint**	**Cast doubt on standpoint**
Format	p_i: standpoint *S*	p_i: doubt *S*
Precondition description	The propositional content p of *S*… …is not in the common starting points …has not been the content of another standpoint *S`* in the same discussion	none
Postcond. description	p_i is committed to (defend) *S*	none

Table 3.4 *Locutions 'standpoint' and 'doubt'*

† This subsection was originally entitled: "The protocol and locution-pairs in the AIF".

So in order to advance a standpoint, the propositional content p of the standpoint cannot be in the common starting points because the standpoint should in principle not be regarded as fully acceptable (or accepted for that matter) by the other (see van Eemeren and Grootendorst's (2004, p. 191) second commandment).[32] Furthermore, advancing a standpoint commits the party to defend this standpoint (Houtlosser 1994). Notice that there are no pre- and postconditions on the individual *cast doubt* locution. Rather, any conditions on this locution are part of the transition scheme; the characterisation in Table 3.4 leads us to the first pair of locutions in a discussion that can be modelled as such a scheme in AIF+, see Table 3.5.

Scheme name	**Advance Standpoint → Cast doubt on standpoint**
Format	p_i: standpoint $S \rightarrow p_j$: doubt S
Presump. description	$p_i \neq p_j$

Table 3.5 *Transition scheme 'standpoint' – 'doubt'*

Notice that this way of characterising the transition prevents the straw man fallacy by requiring that the standpoint doubted *S* is the same as the one advanced *S* (see van Eemeren and Grootendorst 1992, p. 124-131). The transitional scheme adds to this the presumption that the doubt is cast by a discussion party different from that which advanced the standpoint to account for the dialectical approach.

After casting doubt on a standpoint, there is essentially one possible locution, namely to challenge the party who advanced the standpoint to defend it, see Table 3.6.

Scheme name	**Cast doubt on standpoint → Challenge to defend**
Format	p_i: doubt $S \rightarrow p_i$: challenge_defend S

Table 3.6 *Transition scheme 'doubt' – 'challenge_defend'*

After a challenge, the other party may accept the challenge or the parties may attempt to set the limits of their discussion by establishing the procedural rules for the discussion, common starting points, discussion roles and termination criteria. On this subject, the literature is somewhat ambiguous: whilst van Eemeren and Grootendorst (1984, p. 99) seem to indicate that *first* the challenge is accepted and *then* the limits are set, pragma-dialectical rules 3 and 5 above (van Eemeren and

32 Precondition (b) will be discussed below.

Grootendorst 2004, p. 139; p. 143) state that one is obliged to accept a challenge *unless* there is no agreement on the limits of the discussion. This would indicate that one only has to accept after the limits have been agreed upon. Our (pragmatic) solution is placing the discussion about common starting points and procedures in a meta-dialogue, as is indicated by the cloud-like element of Figure 3.5. However, in order to stay true to rule 3 we will presume that this discussion has taken place and there is an agreement before someone accepts the challenge to defend a standpoint. In other words, the agreement is a presumption in the transition from challenge to acceptance (Table 3.7). A further presumption is that the challenger is a different person from the one who accepts.

Scheme name	**Challenge to defend → Accept challenge to defend**
Format	p_i: challenge_defend $S \rightarrow p_j$: accept_challenge_defend S
Presumption description	$p_i \neq p_j$ agreement on discussion roles and rules, starting points and termination criteria

Table 3.7 *Transition scheme 'challenge_defend' – 'accept_challenge_defend'*

After a challenge, the other party may accept the challenge or the parties may attempt to set the limits of their discussion by establishing the procedural rules for the discussion, common starting points, discussion roles and termination criteria. On this subject, the literature is somewhat ambiguous: whilst van Eemeren and Grootendorst (1984, p. 99) seem to indicate that *first* the challenge is accepted and *then* the limits are set, pragma-dialectical rules 3 and 5 above (van Eemeren and Grootendorst 2004, p. 139; p. 143) state that one is obliged to accept a challenge *unless* there is no agreement on the limits of the discussion. This would indicate that one only has to accept after the limits have been agreed upon. Our (pragmatic) solution is placing the discussion about common starting points and procedures in a meta-dialogue, as is indicated by the cloud-like element of Figure 3.5. However, in order to stay true to rule 3 we will presume that this discussion has taken place and there is an agreement before someone accepts the challenge to defend a standpoint. In other words, the agreement is a presumption in the transition from challenge to acceptance (Table 3.7). A further presumption is that the challenger is a different person from the one who accepts.

Note that the obligation created by the acceptance of the challenge does not have to be explicitly rendered as, for example, a postcondition on the *accept challenge to defend* locution, as the protocol ensures that the player who accepts the challenge also advances an argumentation in favour of his standpoint: from the *accept challenge to defend* locution it is only possible to go to the *decide to start* locution (Figure

3.5). After this locution, there is only one possibility, namely for the party defending the standpoint to *advance an argumentation* in its favour (Table 3.8).

Scheme name	**Advance standpoint & Decide to start → Advance argumentation**
Format	p_i: standpoint S **and** p_i, p_j: decide_start → p_i: argue A
Presumption description	$p_i \neq p_j$ if S = (+/p), then A ⇒ p if S = (–/p), then A ⇒ ¬ p here, Ap means so much as "p follows from A" under the agreed rules.

Table 3.8 *Transition scheme 'standpoint and decide_start' – 'argue'*

Notice that here, there are two locution types that are related to the *advance argumentation* locution. The *decide to start → advance argumentation* transition simply denotes the sequence in which the locutions may be uttered: one cannot advance an argumentation before deciding to start a discussion. The relation between *advance standpoint* and *advance argumentation*, however, is a functional (in this case argumentative) one: the argumentation A has to be a reason for or against the propositional content of the standpoint, depending on whether the standpoint is positive or negative.

Note that an *advance argumentation* move can also follow a *retract argumentation* locution. This means that there is another transition to *advance argumentation*, see Table 3.9. The presumptions of this scheme are slightly different because the utterer of the *retract* and *advance* locutions is the same person.

Scheme name	**Advance standpoint & Retract argumentation → Advance argumentation**
Format	p_i: standpoint S **and** p_i retract A → p_i: argue B
Presumption description	if S = (+/p), then B ⇒ p if S = (–/p), then B ⇒ ¬ p

Table 3.9 *Transition scheme 'standpoint and retract' – 'argue'*

So now we have a few different conditions on the *advance argumentation* locution: it can only follow a *decide to start* or a *retract argumentation* move, and it has

to be in favour of one's standpoint. In a pragma-dialectical discussion, there is another condition on *advance argumentation*, namely that the argumentation has not been advanced yet in this discussion (van Eemeren and Grootendorst 2004, p. 153). This cannot be modelled as a presumption in the transition scheme in Table 3.9 (e.g. B ≠ A), because the fact that the argumentation has not been advanced before does not just refer back to the just-retracted argumentation advanced immediately before the new one, but rather to all the argumentations advanced in the discussion so far. Something like "all the argumentations advanced in the discussion so far" is a typical example of a calculated property, which is represented in the AIF as a simple I-node, in this case a precondition on the *advance argumentation* locution (see Table 3.10).

Locution name	**Advance argumentation**
Format	p_i: argue A
Precondition description	A has not been advanced in this discussion before.
Postcondition description	p_i is committed to (defend) A

Table 3.10 *Locution 'argue'*

After an argumentation has been advanced, the antagonist can either accept the argumentation or challenge the argumentation in various ways (Figure 3.5). Hence, there are a number of transition schemes from *advance argumentation* to the various challenges, Table 3.11 and 3.12.

Scheme name	**Advance argumentation → Challenge propositional content**
Format	p_i: argue A → p_j: challenge p
Presumption description	$p_i \neq p_j$ p is in A

Table 3.11 *Transition scheme 'argue' – 'challenge'*

Scheme name	**Advance standpoint & advance argumentation → Challenge justificatory force**
Format	p_i: standpoint *S* **and** p_i: argue A → p_j: challenge A *S*
Presump. description	$p_i \neq p_j$

Table 3.12 *Transition scheme 'standpoint and argue' – 'challenge'*

As discussed in Subsection 3.4.2, the intersubjective procedures will be left implicit in the current protocol. This means that there are no proper transitional schemes going out from the *challenge argumentation* locutions. The next explicit locution is either a positive or a negative result regarding the justificatory force or a positive or negative identification of the propositional content (Figure 3.5). Now, in the case of a *negative identification of p*, a sub-discussion is started. This means that there is a transition of the type *negative identification of p → advance standpoint p*. Here, the presumption is that the limits set in the opening stage of the main discussion persevere in the sub-discussion. Also, each proposition p can be debated only once. Similar as for argumentations, this is determined in the preconditions because it refers to a calculated property; recall condition (b) for the *advance standpoint* locution, which says that each proposition p can only be advanced as a standpoint once in a discussion.

In the case of a positive result or identification, we can accept the argumentation or challenge some other part of the argument (e.g. the justificatory force if a proposition p was just positively identified). However, it is important that each proposition can only be questioned once for any argument. Again, this can only be modelled as preconditions on the *challenge* locutions: each *challenge* locution has a precondition that the exact same challenge was not made before during the discussion.

A discussion can only stop if the protagonist retracts his argumentation and subsequently his standpoint or if the antagonist after accepting the argumentation retracts his doubt. Important is that the *retract argumentation A* and *retract standpoint S* have as postconditions that the party that retracts them is no longer committed to (defend) A or S, respectively.

The list of emerging locution pairs, their full specification in terms of presumptions and the locutions' individual preconditions and postconditions is by no means complete. We do believe such a full specification could be construed at a later moment. Let us first summarise what we have done in this paper before returning to the possibilities of continuing the current project.

3.5 Conclusion

Perhaps somewhat surprisingly, the pragma-dialectical theory has, by and large, not been taken up in artificial intelligence, due largely to its heavy emphasis on the linguistic and pragmatic structures in natural texts, which are extremely challenging for computational accounts to handle. With the advent of the Argument Interchange Format and its focus on representation of real arguments and therefore on pragmatic and illocutionary facets of argumentative discourse, connections between computational models and the pragma-dialectical approach have become possible in more detailed and thorough ways than previously possible. This paper has taken some initial steps to show how these connections can be made.

In particular, our aim has been to show both the extent and the limitations of computational modelling of the foundational concepts within the pragma-dialectical theory, including standpoints, discussion roles, starting points, argumentation structures and argument schemes. With this basis in place, we have then been able to demonstrate how the complex and sophisticated dialogue game of critical discussion can start to be modelled computationally in terms of the locution types and transitions between locutions, and how that dialogue game can be connected to the underlying argument$_1$ structures that are created, navigated and manipulated by these locutions and transitions. This connection is coherent in both computational AIF terms and in pragma-dialectical terms.

What has been achieved is just a starting point: much remains to be done both in extending the AIF in the face of representational challenges posed by the pragma-dialectical approach (in terms of the illocutionary characterisation of argumentative speech acts, for example), and in continuing to build the connection between AIF and the pragma-dialectical model (in terms of the transitions in the game of critical discussion, for example). An exciting avenue for further investigation is then opened up in being able to computationally explore more recent advances in pragma-dialectical theory such as strategic manoeuvring (van Eemeren 2010). But the current work already demonstrates the potential and the value – for both artificial intelligence and philosophy – of building a computational understanding of the pragma-dialectical approach.

Chapter 4

A basic dialogue game for critical discussion (CRIT$_1$)†

4.1 Introduction

The pragma-dialectical theory of argumentation (van Eemeren and Grootendorst 2004; van Eemeren et al. 2014, pp. 517-613) is without doubt one of the most influential proposals in the modern field of argumentation studies. The name 'pragma-dialectics' expresses the two pillars on which it is built: a pragmatic perspective on language use and communication (Austin 1962; Searle 1969; Grice 1975), and a dialectical perspective on argumentation and discussion (e.g. Hamblin 1970; Barth and Krabbe 1982). Even though the pragma-dialectical discussion model is inspired in part by the formal study of dialectics, the ideal model itself is not presented in a formalised way.

Formalising the pragma-dialectical discussion model can serve various goals. A first benefit of formalisation is the use of formal models as an abstract, theoretical laboratory. In this laboratory the properties of the model can be tested with methods from mathematics and computer science. This function of formal models has been emphasised by Krabbe (e.g., Krabbe 2006, pp. 195-197; Krabbe and Walton 2011, pp. 256-259). A second important benefit is that formalisation makes it easier to computationally implement the model, which is necessary for the development of software to support argumentative practice (Visser 2016e).‡

In the present paper, I will look into the formalisation of the pragma-dialectical ideal model. In Section 4.2, I will discuss the approach that I follow in the formalisation and explain how this differs from existing formalisations. In Section 4.3, I will introduce the starting points of the formalisation. In Section 4.4, I will define the rules of CRIT$_1$, a basic dialogue game for critical discussion. In Section 4.5, I will further explain the dialogue game by means of a visualisation of its sequential structure. In Section 4.6, I will present a dialogue example to illustrate how the dialogue game works.

† Original title: A dialogue game as a formal model of critical discussion.

‡ See Chapter 2.

4.2 Formalisation of the pragma-dialectical discussion model

The pragma-dialectical ideal model of a critical discussion can already be said to be formal in several respects, as Krabbe and his co-authors (Krabbe and Walton 2011, p. 246; Krabbe 2012, p. 12; van Eemeren et al. 2014, p. 304) have pointed out. The model is already $formal_3$ and $formal_4$ in the classification proposed by Barth and Krabbe (1982, pp. 14-19; Krabbe 1982). The fifteen rules for critical discussion (van Eemeren and Grootendorst 2004, pp. 135-157) constitute a procedural regimentation of the discussion model, making it $formal_3$. Furthermore, the model is *a priori*, which makes it $formal_4$, based on a normative view of how argumentative discussion should ideally proceed rather than a descriptive view of how discussions turn out in the less-than-ideal argumentative reality. Through formalisation, the intention is to make the model $formal_2$ as well: defining the linguistic forms that may be used in the discussion and how these may be combined into dialogues.[33]

Several formalisations of the pragma-dialectical discussion model have already been proposed in some form. In the 1990s, Starmans (1996a; 1996b) used the model as a source of inspiration to define an Argument Based Reasoning formalism for common-sense reasoning (an area in Artificial Intelligence). Although the work by Starmans resulted in a formal, computational model based in some way on the ideal model of a critical discussion, he explicitly does not call it a formalisation himself (Starmans 1996b, p. 86).

Another example of a formal, computational interpretation of the pragma-dialectical discussion that I do not consider as a formalisation thereof in the sense intended in the present paper is a recent proposal by Secades (2015). Secades conceived of the ideal model in terms of a UML state diagram, describing the states through which a critical discussion in his view passes.[34] Because critical discussion is a model of an ideal procedure for the reasonable resolution of a difference of opinion, I would expect a formal or computational interpretation of this model to maintain the interactive, dialogical character. It appears, nevertheless, that Secades interprets the pragma-dialectical model as a procedure to check the validity of logical statements, i.e. as an alternative to dialogue logic. It appears that in this way the entire rationale of the model as a normative ideal for the avoidance of fallacious conduct is lost.

Much more in keeping with the rationale of the PD ideal model are Krabbe's formalisations. In their book *Commitment in dialogue*, Walton and Krabbe (1995) sometimes call their 'persuasion dialogue' model 'critical discussion' as well, but it is not really based on the pragma-dialectical ideal model. For example, not all discussion moves in all four stages of critical discussion are taken into account. Krabbe's

33 Barth and Krabbe (1982, pp. 14-19; Krabbe 1982) distinguish two further senses of 'formal', but these are not relevant to the present study: $formal_1$ referring to Platonic forms, and $formal_5$ referring to non-material systems.

34 UML stands for Unified Modeling Language and is the diagrammatic mode of representation that Secades employs for his representation of the pragma-dialectical ideal model. More about UML can be found at: http://www.uml.org/.

(2012; 2013a; 2013b) formalisation of the argumentation stage of critical discussion is directly based on the pragma-dialectical ideal model and keeps close to its rationale. Krabbe's objective with the formal dialectical system CD$_1$ (for critical discussion) was to formalise the model in the sense of formal$_2$. In his formalisation, Krabbe (2013a, pp. 240-241) explicitly diverges from the original ideal model in several respects: the speech act perspective is disregarded, more than one move is allowed per turn, and propositions are criticised individually.[35] In my proposal for formalising the pragma-dialectical model, I intend to stay closer to the original in these respects.

By means of an incremental approach to the formalisation, I propose to systematically address the different facets of the multifaceted pragma-dialectical ideal model. The starting point for the formalisation consists of a *basic dialogue game for critical discussion*, which is introduced in the next sections. The notion of a 'dialogue game' is employed to model language use and reasoning as a game in which the interlocutors make communicative moves to reach some interactional goal. The basic dialogue game serves as a foundation, which can be extended to account for more complex features of the original ideal model. This systematic approach has the practical advantage of decomposing a larger task, so that the smaller components can be developed at different times or by different people. A second advantage, of a theoretical nature, is that the gradual introduction of complex features provides insight into the model itself. By studying variants of the dialogue game (as Krabbe (2013a, pp. 241) also proposes), its properties can be studied in isolation in the absence of other aspects that unduly complicate matters.

4.3 Preamble to the basic dialogue game for critical discussion

The dialogue game for critical discussion is introduced by means of five categories of rules. First, there are rules that specify the initial state of the game. Second, the moves that are available to the players are defined. Third, the effect of making moves on players' commitments is defined. Fourth, the sequential structure is defined, i.e. the order in which moves may be made. Fifth, how the game ends, both when and in whose favour, is defined.

The dialogue game rules assume there to be a formal language $\mathcal{L}$ in which the propositions that the game is about can be expressed. The nature of $\mathcal{L}$ is not the object of the current study. It is therefore at present sufficient to take $\mathcal{L}$ to consist of the sentences of propositional logic closed under the usual, classical operators. All occurrences of *Arg* or *Stp* in the rules refer to (atomic or molecular) propositions of $\mathcal{L}$.

35 According to Krabbe, his CD$_1$ also diverges from the ideal model by considering the initiation of an intersubjective procedure (van Eemeren and Grootendorst 2004, pp. 145-150) as a means of defence for the protagonist. Nevertheless, it is my impression that this is fully in line with van Eemeren and Grootendorst's intention, when they say, for example about the intersubjective identification procedure that: "This *method of defence on the part of the protagonist* therefore consist of a *joint check* being carried out at his request" (1984, p. 166, emphasis added).

Additionally, a (formal) system is required to represent the inferences appealed to by players in the dialogue game. Because the basic dialogue game is only intended as a simplified foundation, propositional logic is also employed as the reasoning system underpinning the inferences used in the game. The assumption is that the players of the dialogue game have access to some external method to decide on the validity of inferences. In extensions to the basic dialogue game, more elaborate or natural reasoning systems can be introduced – such as the pragma-dialectical account of argument schemes with critical questions (van Eemeren, Grootendorst and Kruiger 1978, p. 20; van Eemeren and Grootendorst 1992; Garssen 2002), or non-monotonic systems of defeasible reasoning (e.g., Pollock 1987; Dung 1995; Prakken and Vreeswijk 2002). Any occurrence of $Arg \Rightarrow Stp$ in the basic dialogue game rules can be interpreted as an appeal to a rule of inference from propositional logic on the basis of which the acceptability of *Arg* justifies the acceptability of *Stp*.

To lower its complexity, the dialogue game is simplified in three important respects in comparison to the original ideal model. First, only the dialectical dimension of critical discussion is taken into account, thereby disregarding the pragmatic dimension of the speech act perspective (van Eemeren and Grootendorst 1984), the logical dimension of argument schemes (Garssen 1997), and the rhetorical dimension of strategic manoeuvring in communicative contexts (van Eemeren 2010). Second, the dialogue game offers players fewer choices and opportunities than the original model. This restriction is most evident in the exclusion of complex argumentation and mixed differences of opinion, only allowing a single argument in defence of a positive standpoint against doubt. Third, only the argumentation stage of critical discussion is explicitly reflected in the dialogue game. The other three discussion stages – the confrontation stage, the opening stage, and the concluding stage – are reflected in the commencement and termination rules through specific assumed outcomes.

4.4 The rules of the basic dialogue game for critical discussion CRIT$_1$

The rules of the dialogue game are based on the fifteen 'technical' rules of critical discussion (van Eemeren and Grootendorst, 2004, pp. 135-157).[36] These rules should not be confused with the 'practical' code of conduct consisting of ten commandments for reasonable discussants (van Eemeren and Grootendorst 1992, pp. 208-209), which are based on the aforementioned fifteen rules and are intended to be used as a rule of thumb in evaluating and conducting actual argumentative discussions. Due to the simplifications introduced in the preceding section, in particular rules 6 to 13 of the fifteen rules are relevant. How the dialogue game relates to the rules of the ideal model, will be addressed in more detail in Section 4.5.

36 The definition of dialogue game CRIT$_1$ is based on an earlier conference paper (Visser 2015a).

4.4.1 Commencement rules

The initial state of the dialogue game is defined in the commencement rules. These rules cover the circumstances under which the game commences. Because both the confrontation stage and the opening stage of critical discussion are not explicitly modelled, the assumed outcomes of these stages are reflected in the initial state of the game. The purpose of the dialogue game is for the players to resolve their difference of opinion about some proposition.

The assumed outcome of the confrontation stage is that a single positive standpoint is put forward, on which doubt is cast. This restricts the dialogue game to single non-mixed differences of opinion about a single positive standpoint. Differences of opinion about more than one standpoint or about a negative standpoint are thereby excluded. Rule B1 captures the fact that one proposition *Stp* is at issue.

B1 $Stp \in \mathcal{L}$

Based on the assumed outcomes of the opening stage, the players are designated as *Prot* and *Ant* in B2, corresponding to the discussion roles of protagonist and antagonist.[37] *Prot* is defending a positive standpoint with respect to *Stp*, while *Ant* critically assesses the defence, having doubt regarding the acceptability of *Stp*.

B2 $Players = \{Ant, Prot\}$

Another outcome of the opening stage is the agreement upon a set of material and procedural starting points. In rule B3 of the dialogue game, the material starting points are represented by a static set *SP* (for starting points) of propositions both players accept. Because the players need at least one common starting point to engage in a meaningful discussion (van Eemeren and Grootendorst 2004, p. 139), *SP* is assumed to be non-empty.

B3 $SP \neq \emptyset$

The procedural starting points are represented in the dialogue game by three principles. First, the players cannot but play by the rules (cheating is not possible). Second, the game is turn-based. Players take turns in which they must make one move and then pass the turn to the other player. Third, the players have agreed upon propositional logic as the reasoning system on which arguments are based.

4.4.2 Move rules

In each turn one of the players makes one move. The players cannot pass the turn without making a move. The moves are of the form *function(φ)*. The function the

37 Analogous to the convention in formal dialectical systems, *Ant* will be referred to with female pronouns, and *Prot* with male pronouns.

move fulfils in the context of the dialogue game is designated by *function*. The content φ of the move, i.e. what the move is about, is made up by either an (atomic or molecular) proposition $p \in \mathcal{L}$, or the application of an inference rule ($\Rightarrow$) on a pair of propositions $p, q \in \mathcal{L}$. Each unique instantiation of a move, i.e. the combination of a function and content, can only be used as a move by a player once per game – in other words, players may not repeat moves.

The dialogue game for critical discussion is asymmetrical where the role of the two players is concerned. This results in two sets of moves, one for each of the players, depending on their role. Player *Prot* has the moves in rules M1 to M4 at his disposal to defend his standpoint. Player *Ant* can use the moves in rules M5 to M9 to critically assess *Prot*'s defence.

Rule M1 lets *Prot* advance an argument *Arg* in defence of the standpoint *Stp*. Technically, *Stp* is the propositional content of the standpoint that *Ant* doubted (see van Eemeren and Grootendorst 1984, pp. 78-79; Houtlosser 1995, pp. 65-91). That *Arg* is an argument in support of *Stp* does not have to be made explicit in M1. This is implied by the limitation of the basic dialogue game to a single argument in defence of a single standpoint.

M1 *argument(Arg)*

Aside from advancing an argument in defence of his standpoint, *Prot* can initiate the intersubjective identification procedure or the intersubjective inference procedure (van Eemeren and Grootendorst 2004, pp. 145-150).[38] Although the procedures are carried out by the players together, it is in *Prot*'s interest that the procedure is carried out. The procedures can therefore be initiated by *Prot*, in accordance with M2 and M3.

The intersubjective identification procedure is used to test the acceptability of the material premise (*Arg*) of the argument, by checking whether $Arg \in SP$. The material premise reflects the propositional content of the argumentation speech act complex that the protagonist in a critical discussion advances in defence of the standpoint. According to the felicity conditions of this speech act complex, the proposition is presumed to be acceptable to the antagonist.

The intersubjective inference procedure is used to test the linking premise ($Arg \Rightarrow Stp$), i.e. to check the validity of inferring *Stp* from *Arg*, by determining whether $Arg \vdash Stp$ according to propositional logic. The linking premise reflects the justificatory force of the argumentation that the protagonist advances in a critical discussion. The justificatory force constitutes the transfer of acceptability from the material premise to the conclusion of the reasoning. The conclusion (*Stp*) of the rea-

38 The intersubjective explicitisation procedure and the intersubjective testing procedure are not part of the basic dialogue game, because there is no need for, respectively, the explicitisation of unexpressed premises (because the dialogue game is fully explicit to start with), or the testing of defeasible inferences based on argument schemes (because all inferences are based on propositional logic, per definition).

soning, in turn, is the propositional content of the standpoint speech act complex that the protagonist is argumentatively defending.

M2 *identification(Arg)*
M3 *inference(Arg⇒Stp)*

Instead of continuing his argumentative defence, *Prot* can use M4 to retract his argument. What is retracted through this move is the commitment to the acceptability of the proposition (see Subsection 4.4.3), not an earlier move with which this commitment was effectuated. Retraction does not mean going back in time and making changes to the record of moves: what has been said cannot be unsaid. One can, nonetheless, change one's mind – this is even one of the higher order conditions that are a prerequisite for reasonable discussion (van Eemeren, Grootendorst, Jackson and Jacobs 1993, pp. 30-34) – and make a move to the effect of retracting commitment to the acceptability of a proposition.

M4 *retraction(Arg)*

Player *Ant* has the moves from M5 to M9 at her disposal. With M5, she can accept an argument. With M6, she can cast doubt on the material premise *Arg* of an argument. With M7, she can cast doubt on the linking premise *Arg⇒Stp* of an argument. With M8, *Ant* can claim to have successfully attacked the material premise of an argument. Finally, with M9, she can claim to have successfully attacked the linking premise of an argument.

M5 *acceptance(Arg)*
M6 *doubt(Arg)*
M7 *doubt(Arg⇒Stp)*
M8 *attacked(Arg)*
M9 *attacked(Arg⇒Stp)*

Because all of the moves are fully explicit and transparent, there is no need for moves reflecting the request or performance of usage declaratives. In the pragma-dialectical ideal model, usage declaratives may be used to clarify the intended meaning of a discussion move as sanctioned by the fifteenth rule of critical discussion (van Eemeren and Grootendorst 2004, pp. 156-157).

4.4.3 Commitment rules

As a result of making moves, players acquire (and lose) commitments. If a player has a commitment in this sense, it means he is obliged to defend the acceptability of the proposition or the inferential link if prompted to do so – in other words, he assumes a potential burden of proof with respect to the acceptability of the proposition or the inference. The commitments of players are kept track of in commitment stores (Hamblin 1970, p. 257). The commitment stores are represented by two sets, CS_{Prot}

and CS_{Ant}. The sets are publicly readable (meaning that the contents are not secret, but available for all players) and privately writeable (meaning that a player can only directly update his own commitment store, not that of the other player).

At the start of the game, the players' commitment stores are considered to be non-empty. Based on the requirements at the start of the game, *Prot*'s commitment store contains the common starting points and the standpoint *Stp* (see C1), while *Ant*'s commitment store only contains the common starting points (see C2). It is important to note that the commitment stores may contain additional commitments on top of those mentioned here, so long as $Stp \notin CS_{Ant}$ – otherwise *Ant* would already be committed to the standpoint before starting the game, so that no difference of opinion arises in the first place.

C1 $CS_{Prot} = SP \cup \{Stp\}$
C2 $CS_{Ant} = SP$

As a result of moves made during the game, the commitment stores can be updated. The performance of two of the moves results in the acquisition of new commitments, while one move causes the retraction of commitments. Rules C3, C4 and C5 specify these changes to the commitment stores, with the move before the symbol », and the changes after it. An addition of commitments is indicated by the union symbol, ∪, whereas the deletion of a commitment is indicated by a minus, –.[39]

C3 $argument(Arg) \text{ » } CS_{Prot} = CS_{Prot} \cup \{Arg, Arg \Rightarrow Stp\}$
C4 $retraction(Arg) \text{ » } CS_{Prot} = CS_{Prot} - \{Arg, Arg \Rightarrow Stp\}$
C5 $acceptance(Arg) \text{ » } CS_{Ant} = CS_{Ant} \cup \{Arg, Arg \Rightarrow Stp\}$

4.4.4 Sequence rules

The preceding two subsections presented respectively which moves there are in the basic dialogue game for critical discussion and what the effect is of making these moves in terms of the players' commitments. The sequence rules introduced in this subsection define when moves can be made. As an illustration, consider a dialogue game modelling the interaction between two interlocutors that can ask and answer questions. In such a game an *answer*-move may follow a *question*-move, while an answer-move would not be a permissible continuation if the preceding move was itself an *answer* and not a *question*.

In the sequence rules, the symbol "◀" means that a move of the kind preceding it is a sanctioned continuation of moves of the kinds listed after it as (a), (b), etc. If a further condition has to hold for a continuation to be sanctioned, then this is specified after a vertical line "|".

The dialogue game always starts with *Prot* making a move *argument(Arg)* to advance an argument *Arg* in defence of the standpoint at issue *Stp*. To indicate that

39 Because the *CS*-sets are not multisets, nothing happens when a move would otherwise add a proposition to a set that already contains it.

this is the first move of the game, there is a *null* value in S1 as the preceding move. In order to rule out circular reasoning, *Arg* may not refer to the same proposition as *Stp*. This is indicated behind the vertical line in S1. The other possible sequences resulting from the sequence rules will be discussed in Section 4.5, together with a visualisation of the sequential structure of the dialogue game.

S1 *argument(Arg)* ◄
(a) *null* | (*Arg* ≠ *Stp*)
S2 *identification(Arg)* ◄
(a) *doubt(Arg)*
S3 *inference(Arg⇒Stp)* ◄
(a) *doubt(Arg)*
S4 *retraction(Arg)* ◄
(a) *doubt(Arg)*
(b) *doubt(Arg⇒Stp)*
(c) *attacked(Arg)*
(d) *attacked(Arg⇒Stp)*
S5 *acceptance(Arg)* ◄
(a) *argument(Arg)*
(b) *identification(Arg)* | (*Arg* ∈ *SP*)
(c) *inference(Arg⇒Stp)* | (*Arg*⊢*Stp*)
S6 *doubt(Arg)* ◄
(a) *argument(Arg)*
(b) *inference(Arg⇒Stp)* | (*Arg*⊢*Stp*)
S7 *doubt(Arg⇒Stp)* ◄
(a) *argument(Arg)*
(b) *identification(Arg)* | (*Arg* ∈ *SP*)
S8 *attacked(Arg)* ◄
(a) *identification(Arg)* | (*Arg* ∉ *SP*)
S9 *attacked(Arg⇒Stp)* ◄
(a) *inference(Arg⇒Stp)* | (*Arg*⊬*Stp*)

4.4.5 Termination rule

The concluding stage is not explicitly incorporated in the basic dialogue game for critical discussion. In the dialogue game, winning and losing are therefore not based on the outcome of the critical discussion as a whole, but rather on the outcome of the argumentation stage. In accordance with T1, the dialogue game terminates if *Prot* retracts his argument, or if *Ant* accepts it. In the first case, *Ant* wins, in the second case, *Prot*. Because the dialogue game does not continue beyond this point, *Ant* will not make a move to accept *Stp* on the basis of *Prot*'s conclusive defence of the standpoint, nor will *Prot* make a move to retract *Stp* on the basis of a conclusive attack. Drawing such conclusions with respect to the acceptability of the standpoint on the

basis of the argumentation stage is what happens in the concluding stage of critical discussion, which is not part of the basic dialogue game.[40]

T1 Whenever a move *retraction(Arg)* or *acceptance(Arg)* is made, then:
if $Arg \notin CS_{Prot}$, *winner* = *Ant*,
if $Arg \Rightarrow Stp \in CS_{Ant}$, *winner* = *Prot*

4.5 A visualisation of the sequential structure of CRIT$_1$

The sequential structure of the dialogue game is visualised in Figure 4.1. The nodes of the graph (the text boxes) represent the dialogue game moves. The directed edges (the arrows) represent the transitions between moves, from one turn in the game to the next.

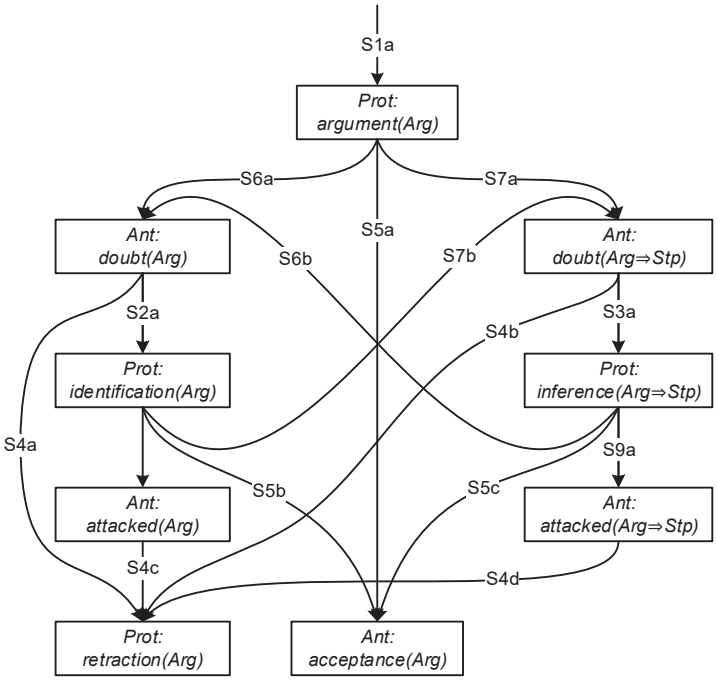

Figure 4.1 *The sequential structure of the basic dialogue game* CRIT$_1$

Figure 4.1 can be regarded as an alternative way of specifying (the moves and sequences of) the basic dialogue game for critical discussion, which Krabbe (2002, p. 154) calls the extensive form of the dialogue game. The graph-visualisation of the

40 In extensions of the dialogue game for critical discussion (Visser 2016b; 2016d), the concluding stage is also accounted for.

dialogue game is closely related to the notion of 'dialectical profile' (van Eemeren, Houtlosser and Snoeck Henkemans 2000).[41] Dialectical profiles were introduced as "a specification of the sequential pattern of the moves that the parties are allowed to make, or should make, in a particular stage or sub-stage of a critical discussion in order to realise a particular dialectical goal" (van Eemeren, Houtlosser and Snoeck Henkemans 2007, p. 18).

Dialectical profiles are visualised as tree structures, such as the one in Figure 4.2 – reproduced from van Eemeren, Houtlosser and Snoeck Henkemans (2007, p. 195). The nodes of the tree represent the analytically relevant moves that discussion parties can make in a critical discussion to achieve an outcome of a particular stage of the discussion (van Eemeren, 2010, pp. 171-172). The formulation of the moves in Figure 4.2 is in accordance with a system of abbreviations used by van Eemeren, Houtlosser and Snoeck Henkemans (2007), because the exact meaning of the abbreviations is not relevant to the current discussion, I refer to the authors' explanation thereof. The edges of the tree – i.e. the 'parent'-'child' relations between the nodes – denote the dialectically sanctioned transitions between the discussion moves.

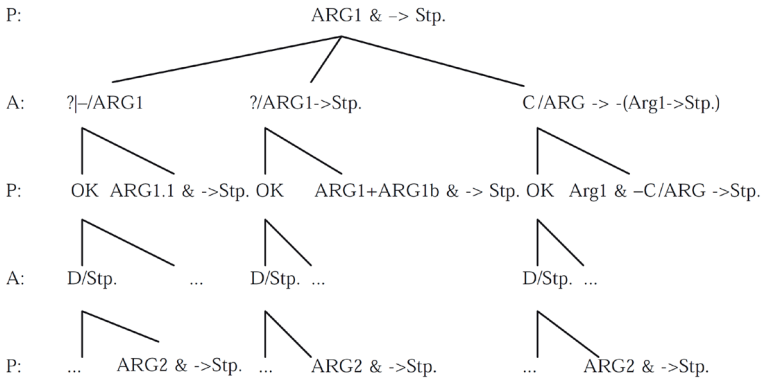

Figure 4.2 *Dialectical core profile for the different types of argumentation structures*

The dialectical profiles are presented as partial or 'core' profiles. It is not possible to compose a complete dialectical profile of the ideal model of a critical discussion, covering all sequences of moves. This is because of the open-endedness of the discussion process and the ideally limitless subsequent argumentative moves that could reasonably be made to continue a discussion instead of concluding it. Barring practical (or institutionally enforced) circumstances, there is in principle no limit to, for example, the number of standpoints or arguments advanced. Nor should there be. This limitlessness cannot be captured in an explicitly determined tree

41 This comes as no surprise, since the 'extensive form' that Krabbe refers to is an instance of a normative variant of a 'profile of dialogue'; a notion introduced by Walton and Krabbe (Walton 1989; Krabbe 1992; Walton and Krabbe 1995; Krabbe 2002) that directly inspired the concept of dialectical profiles.

structure – basically because it would require a tree of infinite dimensions. But if we lift the restriction of acyclicity, which we inherited from thinking about dialectical profiles as trees, we could remedy this and still end up with a visual representation of the dynamic of a critical discussion, by allowing cycles in the structure. This method is employed in the visualisation of the basic dialogue game for critical discussion in Figure 4.1.

To clarify the sequential structure of the basic dialogue game for critical discussion, I will now present a walk-through of Figure 4.1.[42] Additionally, the representational adequacy of the dialogue game will be supported with references to the relevant sections of the fifteen rules for critical discussion as formulated by van Eemeren and Grootendorst (2004, pp. 135-157). The dialogue game starts at the top of Figure 4.1. The first move has to be made by *Prot* and consists of advancing an argument *Arg* in defence of the standpoint *Stp*. This way of defending a standpoint is in line with rule 6a, which regulates the right to argumentatively defend the standpoint. By advancing an argument, *Prot* becomes committed to the acceptability of both its material premise and its linking premise (van Eemeren and Grootendorst 1984, p. 44; p. 72).

In accordance with rule 13b and 13c, the players take turns, so now *Ant* has to make a move. She has three options: cast doubt on the acceptability of the argument's material premise, cast doubt on the linking premise, or accept the argument. When *Ant* criticises the material premise or the linking premise, this does not affect her commitments. In accordance with rules 6b and 10, *Ant* has the right to challenge both the material premise and the linking premise, regardless of the order she does this in. On the other hand, once she accepts the argument, there is no way back: accepting arguments (as a justification of the standpoint) in the argumentation stage has the consequence of being obligated to accept the standpoint in the concluding stage (in line with rule 14b).[43]

Assuming *Ant* has chosen to criticise the acceptability of the material premise (on the left side in Figure 4.1), *Prot* has two options. First, he can retract his argument; in accordance with the right that rule 12 awards throughout the discussion. Second, he can initiate the intersubjective identification procedure (in line with rule 7a). In this procedure the players consult their list of common starting points, *SP*, agreed upon in the opening stage of the discussion, and check whether the proposition can be identified.

If the proposition turns out not to be part of the common starting points, *Ant* can claim to have successfully attacked the argument (as an outcome of rule 7b). *Prot* can only respond to this by retracting this argument, thereby terminating the dialogue game. Conversely, if the intersubjective identification procedure yields a positive result, *Ant* has to either accept the argument (thereby terminating the

42 The walk-through of the dialogue game is based on an earlier conference paper (Visser 2013).

43 Accepting the argument outright is a possible move for *Ant*, because there is no obligation to externalise criticism in the ideal model of critical discussion (see van Eemeren and Grootendorst, 2004, p. 151). Commitment rule C5 ensures that, as a result of the move to accept the argument, *Ant* becomes committed to both its material premise and its linking premise.

dialogue game) or proceed to cast doubt on its linking premise. This last move may only be made if the linking premise has not been challenged yet, which reflects the prohibition of repeating moves within one and the same discussion in rule 13a. If repetition were allowed, the dialogue game (and the critical discussion) runs the risk of never coming to an end because *Ant* could just repeatedly cast doubt on the material premise and the linking premise, one after the other without ever incurring further commitments.

The right side of Figure 4.1 contains the moves that relate to *Ant*'s challenge of the linking premise. Challenging the linking premise can follow either in direct response to an advanced argument, or after a successful intersubjective identification procedure (under condition that the linking premise had not been challenged yet). In response to criticism regarding the justificatory link from the argument to the standpoint, *Prot* has two options again: to retract his argument (rule 12), or to initiate the intersubjective inference procedure (implied by rule 8a).

When the intersubjective inference procedure is called upon to determine whether the argument justifies the standpoint, the players together check the validity of the inference from *Arg* to *Stp*. The intersubjective inference procedure can return a positive or a negative result. In the case of a positive result, *Ant* has to either accept the argument or challenge its material premise (provided she has not done so yet). If the inference procedure yields a negative result, this means that the argument does not properly justify the standpoint. In line with rule 8b, *Ant* can then claim to have successfully attacked the linking premise of the argument. The only response open to *Prot* is to retract the argument, thereby terminating (and losing) the dialogue game. The two nodes at the bottom of Figure 4.1 are the two terminating moves of the game; the left associated with a win for *Ant*, the right with a win for *Prot*.

4.6 A dialogue example of the basic dialogue game for critical discussion

To illustrate how the basic dialogue game for critical discussion works as a whole, I will now discuss an example game. I will explain how the dialogue example is constructed by following the rules of CRIT$_1$. In Table 4.1, I have provided an overview of the successive turns of the dialogue, the moves that are made, the rules these are based on, and the resulting commitment stores. In the example, a standpoint 'I will be late' (= *Stp*) is supported with an argument 'the train is delayed' (= *Arg*).

The dialogue game is played between the players *Prot* and *Ant*, as per rule B2. The game is played to resolve a difference of opinion about the proposition 'I will be late', which *Prot* holds, but which *Ant* doubts. The set *SP* with the material starting points contains the proposition 'the train is delayed'. *Prot*'s commitment store, CS_{Prot} contains 'I will be late' aside from the common starting points, whereas CS_{Ant} obviously does not contain 'I will be late'.

Turn ***Player***	**Move**	**Rules**	**Resulting commitments**
1 *Prot*	*argument(the train is delayed)*	S1a M1 C3	CS_{Prot} = *{I will be late, the train is delayed, the train is delayed therefore I will be late}* CS_{Ant} = *{the train is delayed}*
2 *Ant*	*doubt(the train is delayed)*	S6a M6	CS_{Prot} =*{I will be late, the train is delayed, the train is delayed therefore I will be late}* CS_{Ant} = *{the train is delayed}*
3 *Prot*	*identification(the train is delayed)*	S2a M2	CS_{Prot} = *{I will be late, the train is delayed, the train is delayed therefore I will be late}* CS_{Ant} = *{the train is delayed}*
4 *Ant*	*doubt(the train is delayed therefore I will be late)*	S7b M7	CS_{Prot} = *{I will be late, the train is delayed, the train is delayed therefore I will be late}* CS_{Ant} = *{the train is delayed}*
5 *Prot*	*retraction(the train is delayed)*	S4b M4 C4	CS_{Prot} = *{I will be late}* CS_{Ant} = *{the train is delayed}*

Table 4.1 *An example of the basic dialogue game for critical discussion* $CRIT_1$

Player *Prot* makes the first move. In accordance with rules M1 and S1a, he advances the proposition 'the train is delayed' in defence of the standpoint. As a result of rule C3, *Prot* now adds the linking premise 'the train is delayed therefore I will be late' to his commitment store. (To improve the readability, the symbol ⇒ in the linking premise is formulated as 'therefore'.)

In turn 2, player *Ant* can respond in three ways. First, she can accept the argument. Second, she can cast doubt on the material premise. Third, she can cast doubt on the linking premise. In the example, *Ant* chooses to cast doubt on the material premise (M6/S6a). This move does not have any consequences for the players' commitment stores.In turn 3, *Prot* has two options in his response to *Ant*'s doubt. Through rules M2 and S2a, he can initiate the intersubjective identification procedure to check whether the proposition is acceptable because if forms part of the common material starting points. Or, through rules M4 and S4a, he can retract his argument. In the example, *Prot* chooses for the first option: the intersubjective identification procedure. The players check whether the proposition is part of the material common starting points and this leads to a positive outcome.

Based on the positive outcome of the intersubjective identification procedure, *Ant* has two options in turn 4. She can accept the argument through rules M5,

C5 and S5b, or she can now cast doubt on the acceptability of the linking premise through rules M7 and S7b. She goes for the second option.

In turn 5, *Prot* realises that initiating the intersubjective inference procedure will not help him, because according to the propositional logic that was assumed to be the agreed upon inferential system, his reasoning is not valid. *Prot* therefore decides to retract 'the train is delayed' as argument in support of the standpoint (rules M4 and S4b). Due to rule C4, he now loses his commitment to 'the train is delayed' and 'the train is delayed therefore I will be late'. As a result of the restrictions imposed on the dialogue game (in comparison to the ideal model of a critical discussion), this is where the dialogue game stops. In accordance with rule T1, the example is won by *Ant*.

4.7 Conclusion

In this paper, a basic dialogue game for critical discussion was defined as the starting point for the incremental development of a formalisation of the pragma-dialectical discussion model. By starting with a simplified basis, which can be extended to account for more complex features, the dialogue game is incrementally developed to bring it gradually closer to the full scope of features of the pragma-dialectical ideal model. The dialogue game was defined in terms of five categories of rules, for: commencement, moves, commitments, sequences and termination. By following the rules of the basic dialogue game, two players can play a game by entering in a simple dialogue. One of the players presents an argument in defence of a standpoint that has not been mutually accepted. The other player can respond by challenging the material premise or the linking premise of the argument, or by accepting it. A challenge can be parried by initiating the relevant intersubjective procedure to check the acceptability, or it can result in the retraction of the argument. Depending on the outcomes of the intersubjective procedures and the acceptance or retraction of the argument, one of the two players wins the game.

Chapter 5

Speech acts in the dialogue game for critical discussion (CRIT$_2$)†

5.1 Introduction

Computational methods are becoming increasingly important in the study and teaching of argumentation.[44] The use of computational support tools opens up research opportunities in argumentation studies that would not exist otherwise. A good example of such a new opportunity is the use of computer programs for *argument mining* (see Peldszus and Stede 2013; Lippi and Torroni 2015) to do quantitative studies into the argumentative content of large corpora, at a speed human analysts can only dream of. In the teaching of argumentative skills as well, the addition of *e-learning* modules to existing educational methods can be of great benefit (see Scheuer, Loll, Pinkwart and McLaren 2010).

One of the main contemporary theories used in the study and teaching of argumentation, is the pragma-dialectical theory developed by van Eemeren and Grootendorst (1984; 1992; 2004; van Eemeren 2010; van Eemeren et al. 2014, pp. 517-613) and their co-authors. Despite the increasing impact of computational methods on the field of argumentation theory in general, the pragma-dialectical theory has so far not been part of these new developments. To start changing this, a first preparatory step is made by formalising the discussion model that is at the core of the pragma-dialectical theory; the ideal model of a critical discussion. This formal preparation is meant to simplify the subsequent development of computational applications on a pragma-dialectical basis.

Existing formalisations of the discussion model (e.g. Krabbe 2013a; Visser 2015a; 2015b) have focussed primarily on the dialectical dimension of the model – the critical norms of reasonableness – neglecting its pragmatic dimension – a speech act perspective on communication. In the current paper, the focus is widened to explore the pragmatic dimension, thereby bringing the formalisation closer to the full scope of the ideal model. How this speech act perspective can be accommodated in a formalisation of the discussion model, is the main topic addressed in this paper.

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† Original title: Speech acts in a dialogue game formalisation of critical discussion.

44 The present paper is a revised and extended version of a paper presented at the European Conference on Argumentation (Visser 2016c). Some of the sections are also based on an earlier paper in Dutch (Visser 2015b).

In Section 5.2, I will discuss the goal of formalisation in preparation of computational application. In Section 5.3, I will turn to the central role that the speech act perspective plays in the pragma-dialectical theory. In Section 5.4, I will introduce the incremental development of a dialogue game as a formalisation of the discussion model. In Section 5.5, I will explain how the speech act perspective that is inherent in the discussion model is accommodated in the formalisation. In Section 5.6, I will specify the rules of a dialogue game for critical discussion taking into account the speech act perspective.

5.2 Formalisation in preparation of computerisation

In his 2014 keynote address opening the eighth conference of the International Society for the Study of Argumentation (ISSA), Frans van Eemeren (2015a) mentioned formalisation as one of the most important current topics in argumentation research. Formalisation can serve several purposes in argumentation theory. Most obviously perhaps, it can be seen as a next step in the development of a theory. Through formalisation, concepts and relations are defined very precisely, and models can be verified with mathematical means. This function of formal models has been described by Krabbe and others (e.g., Krabbe 2006, pp. 195-197; Krabbe and Walton 2011, pp. 256-259) as an 'abstract theoretical laboratory'. The 'laboratory' makes it possible, for example, to 'experimentally' test the instrumental validity of a model, in order to improve it on theoretical grounds. Additionally, formalisation can serve as a preparation for computerisation. The computational implementation of an informal model or theory implies a preparatory formalisation. Through formalisation, the concepts and 'language' of the theory are brought closer to the formal language inherent in computer programming. This last purpose of formalisation is the primary objective of this paper.

The computational application of argumentation theory has enjoyed an increasing amount of attention over the last decade, not only from argumentation theorists, but also within the research field of Artificial Intelligence. Overviews of the state of the field, such as the chapter 'Argumentation and Artificial Intelligence' in the *Handbook of Argumentation theory* (van Eemeren et al. 2014, pp. 615-675), and the volume *Argumentation in Artificial Intelligence* edited by Rahwan and Simari (2009), show the broad spectrum of computational applications of argumentation theoretical notions and insights. Aside from the aforementioned e-learning and argument mining, there are, for example, computer programs to support legal practitioners in constructing and evaluating legal cases (e.g., Verheij 2005), medical applications where argumentation is used to improve the computerised distribution of donor organs (e.g., Tolchinsky, Cortés and Grecu 2008), software programs to draw diagrams of argumentation structures (e.g., Gordon 2010), and online repositories of analytically annotated argumentative texts (e.g., Bex, Lawrence, Snaith and Reed 2013).

Although various computational support tools could be of value to the pragma-dialectician, one of the most exciting is the automated analysis of argumentative texts. Existing approaches to argument mining allow the automated reconstruction

of argumentative structures in large corpora of texts (e.g. Budzynska et al. 2014), but at the current stage of development, the resulting reconstructions are less elaborate and precise than the analyses of human scholars. Furthermore, to be a useful addition to the pragma-dialectician's analytical toolbox, support software should use pragma-dialectical concepts and theoretical starting points, which is currently not the case. This second issue can be addressed by basing argument mining software on the pragma-dialectical method of analysis (which may additionally lead to progress on the first issue).

5.3 Speech acts as integral part of critical discussion

The foundation of the pragma-dialectical method of analysis (van Eemeren and Grootendorst 1992; van Eemeren, Grootendorst, Jackson and Jacobs 1993; van Eemeren 2010) is the *ideal model of a critical discussion*. Based on a critical conception of reasonableness (van Eemeren and Grootendorst 2004, pp. 16-17), the discussion model is a proposal for an ideal procedure for the resolution of differences of opinion in a reasonable way (van Eemeren and Grootendorst 2004, pp. 42-68). The procedure is specified by means of fifteen 'technical' rules for critical discussion (van Eemeren and Grootendorst 2004, pp. 135-157), representing the 'dialectical dimension' of critical discussion.[45] The 'pragmatic dimension' consists of an amended integration of a Searlean (1969; 1976) speech act perspective on language use and a Gricean (1975) conception of verbal interaction (van Eemeren and Grootendorst 1992, pp. 49-55).[46]

Inspired by the later Wittgenstein's (1953) shift towards the study of the meaning of language in use, Speech Act Theory (Austin 1962; Searle 1969) considers the meaning of language to not merely consist of truth-conditional statements, but rather of performed communicative actions with the potential of changing (communicative) reality. The basic idea is that of doing things with words: acting through speech. Speech acts are analysed in terms of their communicative force – what act is performed – and their propositional content – what the act is about. Examples of stereotypical speech acts are giving advice, issuing a warning, making a promise, and giving orders.

The amended version of Speech Act Theory (van Eemeren and Grootendorst 1984, pp. 19-46), integrated with a Gricean conception of cooperation in verbal interaction (van Eemeren and Grootendorst 1992, pp. 49-55), plays an important role in the pragma-dialectical theory. Discussion moves are realised by means of speech

45 The fifteen Rules should not be confused with the ten 'practical' commandments for reasonable discussants (van Eemeren and Grootendorst 1992, pp. 208-209), which are intended as practical rules of thumb for conducting, analysing and evaluating argumentative discussions. To distinguish the fifteen Rules of the ideal model from the rules of the dialogue game (section 6), the fifteen Rules are referred to as 'Rules' with a capital 'R'.

46 The pragmatic dimension should not be mistaken for one aimed at practical reasoning or action-oriented decision-making.. In the sense intended here, 'pragmatic' refers to the traditional distinction within linguistics between syntax, semantics and pragmatics (Levinson 1983).

acts in a critical discussion (van Eemeren and Grootendorst 2004, p. 62), and the speech act perspective is essential in the reconstruction of the so-called 'unexpressed premises' that constitute the justificatory force of argumentation (van Eemeren and Grootendorst 1984, pp. 119-149). Because the speech act perspective is an inherent part of the ideal model of a critical discussion, it should also be accounted for in a formalisation of that model. Before turning to the accommodation of the speech act perspective, I will introduce the general idea of a formalisation.

5.4 A dialogue game as a formalisation of critical discussion

The formalisation of critical discussion is developed as a *dialogue game*. A dialogue game is a formal rule system, defining a set of dialogues that can be 'played out'. The rules of the game determine which moves can be made by which player, at which moment and to which effect on the developing dialogue. Additionally, the rules state the goal of the dialogue and when this goal is realised. An elaboration on the later Wittgenstein's (1953) goal-driven and isolated 'language games', systems of formal dialectic and dialogue games have been employed by philosophers to study the dynamics of reasoning and dialogue (e.g., Hamblin 1971; Lorenzen and Lorenz 1978; Walton and Krabbe 1995). Based on these philosophical studies, dialogue games are now also commonly used in Artificial Intelligence to model dialogue and communication in multi-agent systems (Norman, Carbogim, Krabbe and Walton 2004; McBurney and Parsons 2009; Prakken 2009).

The dialogue formalisation of critical discussion that is developed in this paper, is intended to be 'formal' in three senses. First, the formalised model has to be procedurally regimented (*formal*$_3$ in the taxonomy by Barth and Krabbe (1982, pp. 14-19; Krabbe 1982)) and *a priori* or normative (*formal*$_4$, or 'formal' as Hamblin (1970, p. 256) contrasts it to descriptive models which are based on empirical observation). Krabbe and his co-authors (Krabbe and Walton 2011, p. 246; Krabbe 2012, p. 12; van Eemeren et al. 2014, p. 304) have noted that the existing pragma-dialectical ideal model is already formal in these two senses. Additionally, the dialogue game should be formal in a third sense, in which the original ideal model is not formal: the rigid definition of well-formed linguistic expressions and the way in which these can be combined (*formal*$_2$).

An earlier proposal to formalise the ideal model of a critical discussion by Krabbe (2012; 2013a), has the same objective: making the system *formal*$_2$. While Krabbe's approach and his resulting dialogue system CD$_1$ are very insightful (and form a valuable point of departure for my own formalisation), I believe the formalisation can stay closer to the original ideal model. As Krabbe (2013a, pp. 240-241) already acknowledges, his formalisation diverges from the original ideal model in several respects. First – and foremost within the context of the present paper – Krabbe's formalisation deals with the dialectical dimension of the ideal model, at the expense of the role of speech acts. Second, CD$_1$ allows for series of moves, instead of enforcing a strict turn-based procedure. Third, in the case of argumentation with a complex propositional content, the elementary propositions are attacked one by one. It is my

intention that the dialogue game developed in this paper: 1) also incorporates the pragmatic dimension of critical discussion, 2) adheres to strict turn-taking, and 3) allows the casting of doubt on the complete propositional content of argumentation in one move.

Krabbe mentions a fourth way in which his CD$_1$ would diverge from the ideal model: by interpreting intersubjective procedures as means of defence for the protagonist. Contrary to Krabbe's concern, in this respect CD$_1$ appears to be in line with what van Eemeren and Grootendorst say with respect to the intersubjective identification procedure (and which they reassert for the other procedures): "This *method of defence on the part of the protagonist* therefore consists of a *joint check* being carried out at his request" (1984, p. 166, emphasis added).

In the concluding section of this paper, I will evaluate whether my proposal manages to stay closer to the ideal model in these respects than Krabbe's. In any case, differences in some properties and aspects between the formalisation and the ideal model are unavoidable and to be expected. The divergence could be the result of the streamlining inherent to the formalisation of informal models: the expressiveness of formalisms is usually more limited than that of natural language. Formal models have to be fully explicit and free of ambiguity to define what is part of the model and what is excluded. This restricted expressiveness means that the formalisation is stricter than the original ideal model. However, if the formalisation yields a result that diverges from the original ideal model, this could also be an indication of an imperfection or obscurity in the original model (see the laboratory function mentioned in Section 5.2).

My formalisation of critical discussion is not developed in its entirety in one go. Instead, a dialogue game is systematically built up, starting from a simplified basis to which additional features are gradually added by extending and changing the dialogue game rules. In this step-by-step fashion, the dialogue game increasingly does justice to the full scope of features of the ideal model. This incremental approach has the practical advantage of decomposing a large task into many smaller constitutive tasks, which can be carried out at different times and by different people. A second advantage (also mentioned by Krabbe (2013a, pp. 241)) is of a theoretical nature: by gradually increasing the complexity of the dialogue game, the properties of the model can be studied in isolation from other features of the model that may otherwise complicate the investigation (which is useful for the laboratory function of formal models, see Section 5.2).

The foundation of the incremental development is made up by the *basic dialogue game for critical discussion* (Visser 2015a; 2015b).† The scope of the basic formalisation is restricted to represent only a simplified core of features of the ideal model of a critical discussion. Based on these restrictions, the dialogue game is defined through five categories of rules. There are rules for the initial state of the game (see also Subsection 5.6.1), for the available moves (see also 6.2), for the commit-

† See Chapter 4.

ments that moves result in (see also 6.3), for the possible sequences of moves (see also 6.4), and for the way in which the game ends (see also 6.5).[47]

The first important simplification of the *basic* dialogue game with respect to the ideal model is its aforementioned restriction to the dialectical dimension. While the pragmatic dimension is attended to in the present paper, the additional 'rhetorical dimension' still remains unattended. Within the pragma-dialectical theory, the rhetorical dimension is concerned with the strategic manoeuvring of discussants and the influence of the institutional context on the discussion (van Eemeren 2010). Analogous to this rhetorical aspect of the effective means of persuasion in communicative activity, players of the dialogue game also have to make choices about their next move. Although the strategies that players employ to improve their chances of winning the dialogue game may be modelled using *game theory* (e.g., Rahwan and Larson 2009), they are not considered an intrinsic part of the rules of the game itself (see Jacobs and Jackson 1982). Rather they have to do with the constitution of the players of the dialogue game, which is not defined by the rules.

In the ideal model, discussants are presumed to be human interlocutors. Because the dialogue game is intended as a preparation for computational application, no such assumption is made here. The dialogue game should be such that in principle both human and artificial agents can play it. Which mechanisms either sort of player employs to internally represent the state of the game, how they determine their strategy, and how they keep track of their own and their opponent's commitments is not specified in the rules of the game. In the case of human agents, their internal constitution is a topic for psychologists, and in the case of artificial agents, it is a topic for software engineers. The rules of the dialogue game do not refer to the internal state or beliefs of the players, but only take into account the commitments that the players externalise during the game.[48]

As a further simplification, the dialogue game represents only two of the four discussion stages distinguished in the ideal model: only the argumentation stage and the concluding stage of critical discussion are part of the dialogue game. The confrontation stage, in which the nature of the difference of opinion is externalised, and the opening stage, in which the starting points of the discussion are set, are only accounted for through the assumptions made in the 'commencement rules' for the initial state of the dialogue game.

The exclusion of the confrontation stage, means that the initial situation of the dialogue game is different from existing dialogue games in which the disputed issue still has to be established in the first moves of the game, such as in Mackenzie's (1979) DC or in Rescher's (1977) formal disputations. The assumed outcome of the

47 With the exception of the commencement rules, this way of specifying a dialogue game follows the 'standard framework' of locution rules, commitment rules, structural rules and win-and-loss rules, albeit with slightly different labels (cf. Walton and Krabbe 1995). The category of commencement rules is also part of McBurney and Parsons' (2009, p. 265) generic framework for the specification of dialogue games.

48 This exclusive focus on externalised commitment implements van Eemeren and Grootendorst's (2004, pp. 53-55) meta-theoretical principle of 'externalisation'.

confrontation stage, as reflected in the commencement rules, is that a single positive standpoint has been advanced and cast doubt on. This simplification constrains the dialogue game to single non-mixed differences of opinion about one positive standpoint, thereby excluding differences of opinion about more than one or about negative standpoints.

The first assumed outcome of the opening stage is that the players agree to only use single argumentation, which may be criticised only by casting doubt, not through contradiction. This means that complex argumentation structures and (potentially mixed) sub-discussions are excluded.[49] The second assumption is that the justificatory force of the single argumentation may only be based on the inference rules of classical propositional logic (e.g., *modus ponens*). This simplifying assumption with respect to the underlying logic does not preclude the later introduction of more complex or nuanced systems into the dialogue game, such as non-monotonic systems for defeasible reasoning (e.g., Pollock 1987; Dung 1995), or the pragma-dialectical argument schemes with accompanying critical questions (van Eemeren and Kruiger 1985; van Eemeren and Grootendorst 1992; Garssen 1997). The assumed simplifying outcomes of the confrontation stage and of the opening stage result in a dialogue game formalisation of the dialectical dimension of the argumentation stage and the concluding stage of a consistently non-mixed discussion about one positive standpoint which is defended with a single justificatory argument. In the remainder of this paper, the addition of the pragmatic dimension is explored.

5.5 Accommodating a speech act perspective in the dialogue game for critical discussion

Van Eemeren and Grootendorst (1984, pp. 98-112) describe the distribution of different (types of) speech acts over the four stages of the ideal model and give an overview of the functions the speech acts have in critical discussion. In this way, every (dialectical) discussion move in the ideal model is associated with a particular (type of) speech act prototypically used to realise it. These associated speech acts form the basis for the extension of the dialogue game rules.

Taking account of the speech act perspective will mainly affect two of the five categories of dialogue game rules. In comparison to the existing *basic* dialogue game, the rules for the initial state of the game (Subsection 5.6.1), for the possible sequences of moves (Subsection 5.6.4), and for ending the game (Subsection 5.6.5) remain largely unchanged. The amendments to the 'move rules' (Subsection 5.6.2) reflect the speech acts that are associated with the realisation of discussion moves in the ideal model. Paraphrases in natural language are added to each move as well. The 'commitment rules' (Subsection 5.6.3) reflect the relevant *felicity conditions* of the associated speech acts.

49 Van Eemeren and Grootendorst (1984, pp. 78-83) follow a similar approach in their introduction of the ideal model of a critical discussion, by starting with an elementary discussion from which more complex discussions can be composed.

Every speech act comes with a number of conditions that should be fulfilled for the speech act to be performed felicitously, the 'felicity conditions' (Searle 1969; van Eemeren and Grootendorst 1984, pp. 19-46). According to van Eemeren and Grootendorst (1992, p. 50), listeners can, in ordinary situations, assume a speaker to "be clear, honest, efficient and to the point" (the 'Communication Principle'). This leads to a speaker's commitment that the felicity conditions of the speech act he performs are expected to be fulfilled. As van Eemeren and Grootendorst (1992, p. 30) explain: "The listener is entitled to assume that a speaker who has asked a question is interested in the answer, that a speaker who has made an assertion is convinced that this assertion is true, that a speaker who has promised something really intends to do it, and so forth."

There can nevertheless be a discrepancy between the speaker's and the listener's perspective on the status of the felicity conditions (van Eemeren and Grootendorst 1989). If the listener has doubt regarding the fulfilment of a condition, this can give rise to a difference of opinion. In this way, the felicity conditions of speech acts contribute to the 'disagreement space', the collection of potentially contentious propositions in a dialogue (van Eemeren, Grootendorst, Jackson and Jacobs 1993, pp. 102-104). If the fulfilment of a felicity condition is indeed disputed by the listener, the speaker should justify his presumption that the felicity condition could be considered to be fulfilled (Jackson 1992, p. 260). The propositional content of the standpoint of which the acceptability is at issue in the resulting difference of opinion consists of a proposition expressing the fulfilment of the felicity condition under consideration (see van Eemeren and Grootendorst 1984, pp. 95-98; Houtlosser 1995, pp. 65-91; van Eemeren 2015b). In the dialogue game such propositions expressing the fulfilment of felicity conditions will be used to represent the commitments that players acquire as the result of making a move (see Subsection 5.6.3).[50]

Van Eemeren and Grootendorst (1984, pp. 95-118; 2004, p. 68) explain that, in the argumentation stage, speech acts of the class of assertives are used to advance argumentation (technically constituting an illocutionary act complex), commissives are used to accept or reject argumentation, and directives are used to request additional argumentation. In the concluding stage, assertives are used to maintain or retract standpoints, and commissives are used to accept or reject standpoints. In all stages of a critical discussion, discussants can also request and perform usage declaratives to ask for or provide clarification, explication, disambiguation, etc. (van Eemeren and Grootendorst 1984, pp. 109-110). While usage declaratives can contribute to the resolution of differences of opinion, there are no moves in the dialogue game representing these speech acts. The dialogue game is such that all moves are fully explicit to begin with, under the assumption that it is also clear what propositions refer to (see Section 5.4). This obviates the need for usage declaratives. Although in principle it is possible to incorporate usage declaratives and requests for

50 The conception of felicity conditions in terms of propositions that speakers become committed to is also conveyed by others. According to Jackson (1985, p128), for example: "the performance of any [speech] act is seen as committing the speaker, in principle to the ... felicity conditions ..., expressible as propositions".

such, this would severely affect the dynamics of the game, making the sequential structure less clear. How the other speech acts are represented in the dialogue game formalisation is explained in the next section.

5.6 The extended rules of the dialogue game for critical discussion CRIT$_2$

Before turning to the dialogue game rules, a preliminary assumption is made about the way the rules can express what the discussion is about. The rules assume there to be some formal propositional language $\mathcal{L}$ that can be used to express the content of moves and of commitments in the dialogue game. Because the particular composition of $\mathcal{L}$ is not the main concern in the current study, no formal definition of $\mathcal{L}$ will be provided. It should be sufficient to think of $\mathcal{L}$ as a propositional language consisting of (an infinite number of) propositions, two connectives, ⇒ and &, and the auxiliary symbols (and). The propositions can be considered to refer to (atomic or molecular) sentences of classical propositional logic (i.e., $\mathcal{L}$ can be thought of as a meta-language 'about' propositional logic).

The first connective, &, can be used to conjoin two propositions of $\mathcal{L}$. The second connective, ⇒, composes two propositions $A, B \in \mathcal{L}$ into $A \Rightarrow B$ (to be read as "*A* therefore *B*"). $A \Rightarrow B$ expresses the justificatory force of the first proposition for the second: claiming that *B* may be inferred from *A* in the reasoning system (or logic) which $\mathcal{L}$ is a meta-language of. The assumption of propositional logic (see Section 5.4) as the underlying system means that any use of $A \Rightarrow B$ can be interpreted as denoting the application of some propositional rule of inference to the effect that the acceptability of *A* justifies the acceptability of *B*. Without going into detail about specific rules of inference, it is sufficient to assume there to be some methods, external to the dialogue game, which the players can call on to determine the acceptability of propositions and inferences in the dialogue game.[51] The external methods are assumed to return a definitive positive or negative outcome.

Propositional identity is restricted to each of the clauses of the rules that follow – in other words, only within each clause of each rule *A* has to have the same referent. It is not the case that the *A* in M1 has to refer to the same proposition as the *A* in T1, whereas each occurrence of *A* in S1a should have the same referent. Furthermore, within each rule any two different placeholders represent different propositions – in other words, within one rule it holds that $A \neq B \neq C$. Finally, to justify the adequacy of the proposed formalisation, reference will often be made to van Eemeren and Grootendorst's (2004) book *A systematic theory of argumentation*.

5.6.1 Beginning the dialogue game

The commencement rules determine the initial state of the game before the first move is made. Because the confrontation stage and the opening stage of critical dis-

51 The external methods are closely related to the intersubjective identification, inference and testing procedures of the ideal model (van Eemeren and Grootendorst 2004, pp. 145-150).

cussion are not explicitly modelled here, the outcomes of these stages are taken to be part of the initial state of the dialogue game. Based on the assumed outcome of the confrontation stage the dialogue game is played by two players to assess the tenability of one positive standpoint. The propositional content of the standpoint is specified in rule B1 as the initial expressed opinion (van Eemeren and Grootendorst 1984, p. 89). The expressed opinion, according to van Eemeren and Grootendorst (1984, p. 5), "may refer to facts or ideas [...] actions, attitudes, and so on", and can therefore be any proposition of $\mathcal{L}$ (thereby also adhering to Rule 1 of the ideal model (van Eemeren and Grootendorst 2004, p. 136) which ensures that there are no special conditions for standpoints).

B1 $\quad initial\_expressed\_opinion \in \mathcal{L}$

Based on the first of the assumed outcomes of the opening stage, the two players are labelled *Prot* and *Ant* in rule B2.[52] These labels match the division of discussion roles of respectively *protagonist* and *antagonist* that discussants agree upon in the opening stage of critical discussion (see Rule 4 of the ideal model (van Eemeren and Grootendorst 2004, p. 142)). The protagonist player, *Prot*, defends a positive standpoint with respect to the initial expressed opinion in the argumentation stage, whereas the antagonist player, *Ant*, critically assesses this defence in view of her doubt about the initial expressed opinion.

B2 $\quad Players = \{Prot, Ant\}$

A second outcome of the opening stage is the agreement on a set of mutually acceptable material and procedural starting points. In the dialogue game B3 represents the material starting points as a (static) set *SP* of propositions that are considered acceptable by both players. Because critical discussants need at least one shared material starting point to have a meaningful discussion (van Eemeren and Grootendorst 2004, p. 139), *SP* is taken to be non-empty.

B3 $\quad SP \neq \emptyset$

The procedural starting points are, for the moment, included in the dialogue game as three meta-principles. These principles supersede all the particular rules of the dialogue game and can be considered as higher order rules. First, perhaps obviously, the players have to play by the rules of the game – in other words: cheating is not possible (in line with Rule 5 of the ideal model (van Eemeren and Grootendorst 2004, p. 143)). Second, the game is turn-based. This means that players take turns in which they must make exactly one move and then pass the turn to the other player, who subsequently does the same (following Rule 13 of the ideal model (van

52 For the sake of clarity, player *Prot* will be referred to with male pronouns, and *Ant* with female pronouns (following the standard way of referring to proponents and opponents in the literature on formal dialectics and dialogue logic).

Eemeren and Grootendorst 2004, p. 154)). Third, the players have agreed upon some specific reasoning system (for example propositional logic) and an accompanying method to check the acceptability of inferences appealed to (see Rules 5 and 8 of the ideal model (van Eemeren and Grootendorst 2004, pp. 143-150)).

Finally, the goal of the dialogue game has to be clear: resolving a difference of opinion about a positive standpoint with respect to some proposition, through *Prot*'s advance of argumentation in defence of the acceptability of that proposition, and *Ant*'s critical reaction to the argumentation. Unsurprisingly, this goal is very similar to that of (the argumentation stage of) critical discussion (see van Eemeren and Grootendorst 2004, p. 61).

5.6.2 Moves

The moves players can make are of the form *type(p, "Paraphrase", A)* or *type(p, "Paraphrase", A, B)*, where *type* indicates the function of the move, $p \in Players$ denotes the player making the move, *Paraphrase* is a description of the move in natural language, and A, $B \in \mathcal{L}$ is the propositional content of the move. In the rules that follow – M1 to M8 – all but one of the moves refer to one proposition, which can be atomic or in some cases molecular. One of the moves (M1) makes reference to two propositions. In accordance with Rule 13a of the ideal model (van Eemeren and Grootendorst 2004, p. 154), which prohibits the repetition of speech acts, every unique instantiation of a move can only occur once per game. This means that no specific combination of the elements that make up a move may be repeated during the course of one game.

The different *type*'s of the moves are based on the speech acts that play a role in critical discussion and on the dialectical requirements of the fifteen Rules of critical discussion. For example, the *type* of the move in rule M1, *argue*, is a representation of the speech act complex 'argumentation' in the ideal model, and the *type* of the move in rule M6, *doubt*, represents the illocutionary negation of an assertive used to indicate non-acceptance in the ideal model.

The *Paraphrase*s of the moves are standardised utterances that uniquely identify the moves, without using the fully explicit (technical) form. They are inspired by the 'standard paraphrases' that van Eemeren and Grootendorst (1984, pp. 112-118) introduced for the speech acts relevant to critical discussion. Besides clarifying the function of a move, the *Paraphrase*s may facilitate natural language interfaces, should the dialogue game be implemented in a computer system.

The dialogue game for critical discussion is asymmetrical with respect to the roles of the two players (see van Eemeren and Grootendorst 2004, p. 142). This results in there being three sets of moves: one for each of the players, depending on their role, and there is one move that is available to both players. Player *Prot* has the moves in rules M1 to M5 at his exclusive disposal to defend his standpoint, and *Ant* makes exclusive use of M6 and M7. Both players can use move M8.

The first move is perhaps the quintessential move of the dialogue game. By means of M1, *Prot* can put forward argumentation in support of the *initial_expressed_opinion* at issue, in accordance with Rule 6a (van Eemeren and Grooten-

dorst 2004, p. 144). This is where it becomes relevant that $A \neq B$. To prevent circular reasoning, *Prot* may not instantiate both *A* and *B* with the *initial_expressed_opinion*. Otherwise, the standpoint would support itself.

M1 *argue(Prot, "My argument for ... is ...", A, B)*

To defend his argumentation, *Prot* can use M2 and M3 to initiate respectively the agreed upon intersubjective identification procedure to assess the acceptability of the propositional content of his argumentation, or the intersubjective testing procedure to assess the acceptability of the justificatory force. These moves are based on Rules 7a (van Eemeren and Grootendorst 2004, p. 147) and 8a (van Eemeren and Grootendorst 2004, p. 150) of the ideal model. Even though the intersubjective procedures are performed mutually by the two players, they are assumed to be initiated by *Prot* (see van Eemeren and Grootendorst 1984, pp. 166-169).

M2 *identify(Prot, "I invoke the intersubjective identification procedure to verify the acceptability of ...", A)*

M3 *test(Prot, "I invoke the intersubjective testing procedure to verify the acceptability of ...", A⇒B)*

When his argumentation or standpoint turns out to be untenable, *Prot* can use M4 to *retract* his commitment to it. It is important to note that the object of the retraction is not the earlier move, because what has been said cannot be 'unsaid': once made, a move stays on the record. In other words, the dialogue game is cumulative with respect to moves (see Woods and Walton 1978). What is retracted, is a proposition, *A*, to the effect of the player giving up his commitment to the acceptability thereof (see Subsection 5.6.3). The explicit retraction of his argumentation by *Prot* is an addition in the dialogue game that is not based on a direct corollary speech act in the ideal model. The move has been added to accommodate the right to retract argumentation, as guaranteed by Rule 12 of the ideal model (van Eemeren and Grootendorst 2004, p. 153).[53] The possibility to retract a standpoint is necessary because of Rule 14a (van Eemeren and Grootendorst 2004, p. 154) that requires the retraction of standpoints that have been conclusively attacked.

M4 *retract(Prot, "I am no longer of the opinion that ...", A)*

Contrary to a retraction, *Prot* can use a *maintain*-move M5 to maintain his standpoint after a conclusive defence thereof. According to Rule 9a of the ideal

53 In subsection 6.4, another advantage of the addition of the explicit retraction of the argumentation will become clear. Making this move explicit circumvents a *prima facie* conflict between the progression from the argumentation stage to the concluding stage and Rule 13 of the ideal model (van Eemeren and Grootendorst 2004, p. 154). According to van Eemeren, Houtlosser and Snoeck Henkemans (2007, p. 224) the progression between the stages may result in one discussant making two consecutive discussion moves, while Rule 13 prohibits discussants from making two moves in a row.

model (van Eemeren and Grootendorst 2004, p. 151), a standpoint is conclusively defended if the acceptability of the propositional content and the acceptability of the justificatory force of the argumentation have been successfully defended. The *maintain*-move is also *Prot*'s way of transitioning from the argumentation stage to the concluding stage, as is also shown in the dialectical profile of the concluding stage of a critical discussion (van Eemeren, Houtlosser and Snoeck Henkemans 2007, pp. 224-225).

M5 *maintain(Prot, "I maintain my standpoint with respect to ...", A)*

To critically test *Prot*'s defence of the standpoint, player *Ant* can use the moves in rules M6, M7 and M8. According to M6, *Ant* can cast *doubt* on the acceptability of the propositional content or the justificatory force of an argument, a right awarded to her on the basis of Rule 10 (van Eemeren and Grootendorst 2004, p. 152) of the ideal model. If the propositional content of the *doubt*-move is made up of the *initial_expressed_opinion*, then the *doubt*-move also serves as counterpart to *Prot*'s *maintain*-move and progresses the discussion to the concluding stage, this time in *Ant*'s favour.

M6 *doubt(Ant, "I doubt whether ... is acceptable", A)*

According to van Eemeren and Grootendorst (2004, p. 143), the antagonist also has to be able to retract doubt about, and thereby *accept,* argumentation or standpoints (see Rule 14b (van Eemeren and Grootendorst 2004, p. 154)). This *accept*-move is handled by rule M7.

M7 *accept(Ant, "I accept that ...", A)*

Available to both players, move M8 accounts for Rules 7 and 8 (van Eemeren and Grootendorst 2004, pp. 147-150) of the ideal model. These Rules concern the successful defence and attack of, respectively, the propositional content and the justificatory force of the argumentation. The propositional content is successfully defended if the intersubjective identification procedure yields a positive result (Rule 7a) and successfully attacked otherwise (Rule 7b). The justificatory force is successfully defended if the intersubjective testing procedure yields a positive result (Rule 8a), and successfully attacked otherwise (Rule 8b). *Prot* can request *Ant* to *resolve* a positive outcome of an intersubjective procedure (see the preliminaries at the beginning of Section 6) by accepting the argumentation now that it was successfully defended against an attack. Analogously, in the case of a negative outcome of an intersubjective procedure, *Ant* can request *Prot* to *resolve* the outcome by retracting what was successfully attacked.

M8 *resolve(p,"I request resolution with respect to ...", A)*

5.6.3 Commitments

By making moves, players change the state of the game. As will become clear in Subsection 5.6.4, every move determines the possible moves the other player can make in the next turn. Additionally, some moves result in certain dialogical commitments for players. These commitments are the positions that players can be held accountable for as a result of the moves they make. The commitments are represented as propositions the acceptability of which a player has to argumentatively defend if prompted to do so (van Eemeren and Grootendorst 1992, p. 38). The propositions players become committed to are kept track of in personal commitment stores (see Hamblin 1970, p. 257). The players' commitment stores in the dialogue game take the form of two sets, $CS_{p,t}$, of propositions A, B, … $\in \mathcal{L}$, for player $p \in Players$, and with an index $t \in \mathbb{N}$ as a turn counter. Every turn the t counters of the commitment stores are increased by one.[54]

Based on the requirements at the beginning of the dialogue game, at $t=0$, *Prot*'s commitment store $CS_{Prot,0}$ contains the shared starting points and the propositional content of the standpoint; *initial_expressed_opinion* $\in \mathcal{L}$. The shared starting points are also contained in $CS_{Ant,0}$, but *initial_expressed_opinion* explicitly is not – otherwise *Ant* would already be committed to the proposition under discussion when starting the game, preventing a difference of opinion from arising in the first place. Rules C1 and C2 specify the content of the commitment stores at $t=0$.

C1 $\quad CS_{Prot,0} = SP \cup \{initial\_expressed\_opinion\}$

C2 $\quad CS_{Ant,0} = SP$

During the game, some of the moves made in a turn t modify the players' commitments. Starting from a speech act perspective makes clear that commitments cannot be equated with moves, but should be treated separately. The moves in the dialogue game are based on the speech acts that are the prototypical realisations of discussion moves, while the commitments are based on the felicity conditions of those speech acts. In contrast to moves, commitments can be retracted (through rules M4 and C4), meaning that while the dialogue game is cumulative with respect to moves, this is not the case with respect to commitments.

In principle all dialogue game moves result in a number of commitments covering the felicity conditions of the relevant speech act. Nevertheless, the commitment rules currently only incorporate a small selection of these felicity conditions. This is a deliberate choice in order to keep the rules concise without impacting the game dynamics. Most of the commitments based on the fulfilment of felicity conditions would not play any part in the remainder of the dialogue game, because they are never referred to in the dialogue game rules. They would, on the other hand,

54 In the dialogue game, only dialogical commitments of the kind described are taken into account. Action and other commitments, such as obligations to do something in the future, or obligations outside of the discussion, are not taken into account. Walton and Krabbe (1995) provide a detailed study of commitment.

cause the commitment stores to become cluttered with irrelevant commitments, making it harder to see how the dialogue progresses. Relevant for inclusion in the dialogue game, then, are only those felicity conditions that create or discharge dialectical obligations within the restrictions posed to the full extent of the ideal model in Section 5.4.

Rules C3, C4 and C5 define the results of the three moves with relevant felicity conditions in terms of the players' commitments. The moves are indicated before the » symbol, with the commitment store changes after it. Moves of the type *retract* delete a proposition from a commitment store, thereby removing the dialectical obligation to defend it, but potentially also cutting short a line of argumentative defence. Moves of the type *accept* add commitments, thereby limiting the possibilities of doubt and criticism. Moves of the type *argue* are based on the argumentation speech act complex, and cause the addition to the commitment store of two propositions expressing respectively the propositional content and the justificatory force of the argumentation (based on the felicity conditions that van Eemeren and Grootendorst (1992, p. 31) describe for the speech act complex). For all the other moves holds that $CS_{p,t} = CS_{p,t-1}$. In the case of a conjunction, the separate conjuncts are added to or deleted from a commitment store (i.e. conjunctions are eliminated prior to operations on the commitment store). To improve the readability, the *paraphrases* are omitted in the rules that follow.

C3 *argue(Prot, "…", A, B)* » $CS_{Prot,t} = CS_{Prot,t-1} \cup \{B, B \Rightarrow A\}$[55]

C4 *retract(Prot, "…", A)* » $CS_{Prot,t} = CS_{Prot,t-1} - \{A\}$

C5 *accept(Ant, "…", A)* » $CS_{Ant,t} = CS_{Ant,t-1} \cup \{A\}$

5.6.4 Sequences

The dialogue game always starts with a move *argue(Prot, "My argument for … is …", A, B)* in which *Prot* advances a proposition *B* as a reason for the propositional content *A* of the standpoint at issue. Which subsequent moves may be made, depends on the state of the game at the point when the move is considered. Three properties of the state of the game can be relevant in this respect. The move made in the preceding turn is always of importance. In some cases it is also important what the content of the players' commitment stores is, or what the outcome of an external procedure is, in which case these conditions are also specified in rules S1 to S8.

In the sequence rules, the ◄ symbol can be read as 'is a sanctioned continuation of the following moves', meaning that a move before the ◄ may be made in reaction to one of the moves following the ◄. The various preceding moves are listed as (a), (b), etc. Because the *argue*-move is always the opening move of any game, it may always be performed when no preceding move has been made. This is indicated in S1 by a *null* value.

55 Because $CS_{Prot,t}$ and $CS_{Ant,t}$ are not multisets, a proposition can only be a member of the same set once. Any attempt to add a proposition to a commitment store of which it already is a member has no effect.

Some of the sequences are further restricted, indicated in the S-rules by a vertical line: | . After the | , the conditions are listed that have to hold for the sequence of moves to be legal. The colon : is used to indicate a particular substitution of a proposition in a move. For example, according to S7a, a move of the *accept*-type may be made in response to a move of the *argue*-type, provided the proposition in the *accept*-move is substituted with a conjunction of propositions representing the commitments to the propositional content and the justificatory force that result from the *argue*-move.

S1 *argue(Prot, "…", A, B)* ◄
(a) *null* | (*A* : *initial_expressed_opinion*)

S2 *identify(Prot, "...", A)* ◄
(a) *doubt(Ant, "...", A)* | ((*A*⇒*B*) ∈ $CS_{Prot,t}$)

S3 *test(Prot, "...", A⇒B)* ◄
(a) *doubt(Ant, "...", A⇒B)*

S4 *retract(Prot, "...", A)* ◄
(a) *doubt(Ant, "...", A)*
(b) *resolve(Ant, "...", A)*

S5 *maintain(Prot, "... ", A)* ◄
(a) *accept(Ant, "...", B&(B⇒A))*

S6 *doubt(Ant, "...", A)* ◄
(a) *argue(Prot, "…", B, A)*
(b) *argue(Prot, "…", B, C)* | (*A* : *(C⇒B)*)
(c) *resolve(Prot,"...", B)* | ((*B⇒C)* ∈ $CS_{Prot,t}$; *A* : *(B⇒C)*)
(d) *resolve(Prot,"...", A⇒B)*
(e) *retract(Prot, "...", B)* | ((*B⇒A)* ∈ $CS_{Prot,t}$)
(f) *retract(Prot, "...", B⇒A)*

S7 *accept(Ant, "...", A)* ◄
(a) *argue(Prot,"...", B, C)* | (*A* : *(C&(C⇒B)))*
(b) *identify(Prot, "...", A)* | (*A* ∈ *SP*)
(c) *test(Prot, "...", B⇒C)* | (*B*⊢*C*; *A* : *(B⇒C)*)[56]
(d) *resolve(Prot,"...", B)* | ((*B⇒C)* ∈ $CS_{Prot,t}$; *A* : *(B&(B⇒C)))*
(e) *resolve(Prot,"...", B⇒C)* | (*A* : *(B&(B⇒C)))*
(f) *maintain(Prot, "... ", A)*

S8 *resolve(p,"...", A)* ◄
(a) *accept(Ant, ..., A)* | (*p* : *Prot*)
(b) *accept(Ant, ..., B⇒C)* | (*A* : *B⇒C*; *p* : *Prot*)
(c) *identify(Prot, "...", A)* | (*A* ∉ *SP*; *p* : *Ant*)
(d) *test(Prot, "...", B⇒C)* | (*B*⊬*C*; *A* : *(B⇒C)* ; *p* : *Ant*)

56 The turnstile symbol ⊢ indicates that *B* is actually (strictly) derivable from *A* in classical propositional logic, due to the simplifying assumption from section 4.

The sequential structure of the dialogue game is visualised in Figure 5.1.[57] The nodes of the graph – the text boxes – represent the dialogue game moves. The edges – the arrows – represent the transitions between moves from one turn of the game to the next. The labels on the edges indicate which sequence rule the transition instantiates. The topmost node of Figure 5.1 is the first move of the game (S1): *Prot*'s argumentation (M1). The route straight through the middle is the shortest, where *Ant* immediately accepts (M7) the argumentative defence of the standpoint (S7a).

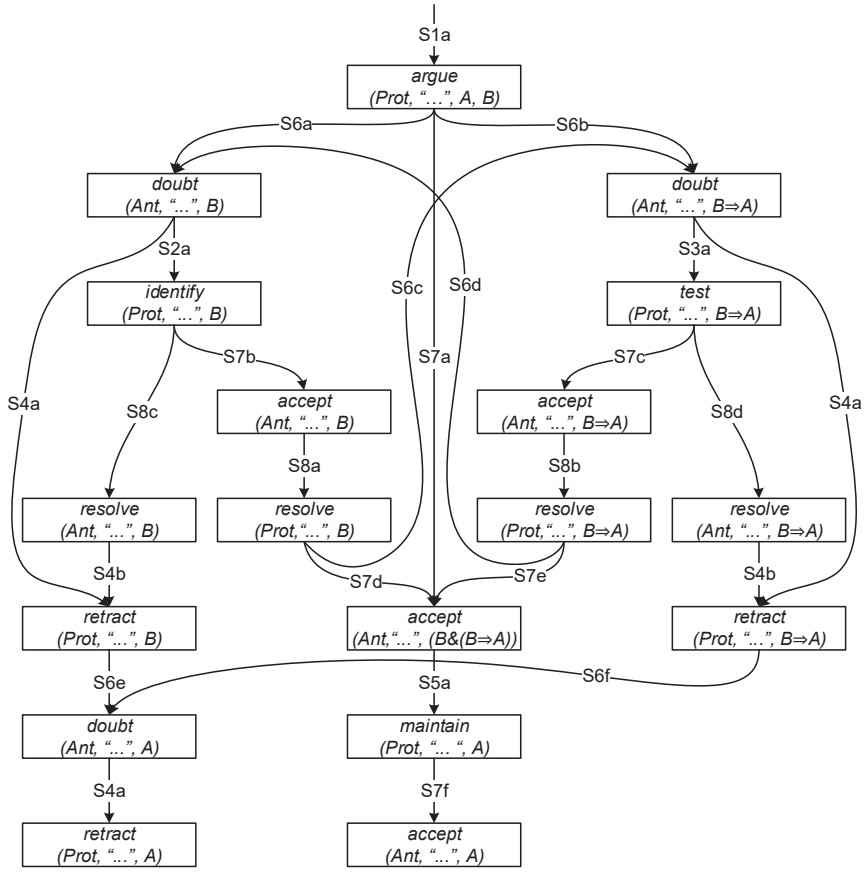

Figure 5.1 *The sequential structure of the dialogue game for critical discussion*

The possibility of *Ant* accepting the argumentation straight away reflects the absence of an obligation in the ideal model of a critical discussion to express criticism with respect to the argumentation provided (van Eemeren and Grooten-

57 The visualisation is meant to elucidate the dynamics of the dialogue game. Its relation to the pragma-dialectical notion of 'dialectical profile', and a reconstruction of a natural language dialogue are provided elsewhere (Visser 2016a; 2016b).

dorst 2004, p. 151), as long as the argumentation is critically evaluated (van Eemeren and Grootendorst 2004, p. 61). This latter requirement is met in the dialogue game by means of the interaction between rule S7a and rule C5. The first of these rules ensures that the propositional content of *Ant*'s *accept*-move is a conjunction of the propositional content and the justificatory force of *Prot*'s argumentation. The second of the two rules subsequently adds both conjuncts to *Ant*'s commitments, thereby committing *Ant* to the acceptability of both the propositional content and the justificatory force of the argumentation.

Alternatively to accepting the argumentation, *Ant* can choose the routes on the left side or on the right side of Figure 5.1, by casting doubt (M6) on respectively the propositional content (S6a) or the justificatory force (S6b) of *Prot*'s argumentation. In response to such doubt, *Prot* can either retract (M4) the propositional content (S4a) or the justificatory force (again S4a, but with a different substitution), or he can initiate (M2 and M3) one of the intersubjective procedures (S2 and S3).†

The intersubjective identification procedure is modelled in S7b and S8c as a simple check whether the proposition at hand is part of the set of material common starting points *SP*, an interpretation based on van Eemeren and Grootendorst's explanation (2004, p. 146). In S7c and S8d, the intersubjective testing procedure is modelled as checking whether the initial expressed opinion can indeed be inferred from the propositional content of the argumentation. Depending on the outcome of the procedures, *Ant* either (S7b/S7c) accepts what she doubted before (M7), or (S8c/S8d) she requests *Prot* to resolve the outcome (M8).

If the outcome of the intersubjective procedure was positive and *Ant* accepted, *Prot* can react (S8a/S8b) by requesting (M8) *Ant* to now accept his entire argumentation. *Ant* can subsequently (S7d/S7e) do so (M7), or, if she did not do so yet, she can shift to the other side of the figure by now casting doubt (M6) on another aspect of the argumentation (S6c/S6d).

If, on the other hand, the outcome of the earlier intersubjective procedure was negative, and *Ant* requested resolution, *Prot* has to retract (M4) the propositional content (S4b) or justificatory force (S4b, with a different substitution) of his argumentation. When this happens, or when *Ant* accepts the entire argumentation, the players may move to the concluding stage by either *Prot* maintaining (M5) his standpoint (S5), or *Ant* maintaining her doubt (M6) about it (S6e/S6f). In the first case, *Ant* is forced to now also accept (M7) the propositional content of the standpoint (S7f). In the second case, *Prot* is forced to retract (M4) his commitment to the propositional content of the standpoint (S4a). These two terminating moves can be seen at the bottom of Figure 5.1.

† The individual retraction of the propositional content or the justificatory force is a change in comparison to the basic dialogue game $CRIT_1$ of Chapter 4. In $CRIT_1$, the argumentation was retracted as a whole. The potential issue with that approach is the following. In the course of a dialogue, a retraction-move with respect to a complete argument makes it possible that *Prot* is no longer committed to, e.g., the propositional content of an argument, while *Ant* is (and is so as a result of an earlier move by *Prot*). This is an undesirable situation, which is circumvented by allowing the individual retractions.

5.6.5 Ending the dialogue game

The dialogue game ends when neither of the players has a way to continue the game in accordance with the rules, resulting in a win for one player and a loss for the other. This situation occurs when *Ant* makes a move to accept the initial expressed opinion or when *Prot* makes a move to retract his commitment to the initial expressed opinion. Rule 14 of the Rules of the ideal model (van Eemeren and Grootendorst 2004, p. 154) states that in the concluding stage of critical discussion the protagonist has to retract his standpoint or the antagonist has to retract her doubt on the basis of the outcome of the argumentation stage. In accordance with the concluding stage of the ideal model and in reference to Rule 9 (van Eemeren and Grootendorst 2004, p. 151), *Prot* can win the dialogue game by successfully defending both the propositional content and the justificatory force of his argumentation for the standpoint, whereas *Ant* can win by successfully attacking either the propositional content or the justificatory force.

There are several possible ways of specifying a dialogue game rule that determines who the *winner* of the dialogue game is. One way is to simply look at which player made the last move. However, in T1, winning and losing are defined on the basis of the players' commitment stores in order to facilitate future extensions of the dialogue game – such as the inclusion of mixed differences of opinion, where both parties can advance argumentation in favour of conflicting standpoints. Termination rule T1 defines that, after making one of the finishing moves in turn *t*, if it is the case that *initial_expressed_opinion* $\in CS_{Ant,t}$, then *Prot* wins. In this case, *Ant* accepted the standpoint about *A* after a conclusive argumentative defence by *Prot*. In all other cases *Ant* wins, because *Prot* had to retract his commitment to *A* after a conclusive attack on his single argumentative defence.

T1 Whenever a move *retract(p, "…", A)* or *accept(p, "…", A)* is made in turn *t*, then:
if *A* = *initial_expressed_opinion*, then:
if $A \in CS_{Ant,t}$, *winner* = *Prot*,
otherwise: *winner* = *Ant*;
otherwise:
continue playing the game with the next move

5.7 Conclusion

The specified dialogue game is part of a series of dialogue games, systematically geared towards the formalisation of the pragma-dialectical ideal model of a critical discussion. The incremental approach starts from a simplified, basic dialogue game for restricted critical discussion, to which more elaborate or complex features can be gradually added. Characteristic of the current incarnation of the dialogue game, and the central issue in the paper, is the addition of the speech act perspective that is inherent in the pragma-dialectical discussion model. This perspective is accommodated in the dialogue game by basing the moves on the speech acts that are pro-

totypically used to realise the discussion moves in the ideal model, and by using the fulfilment of the associated felicity conditions as the basis for commitments in the dialogue game.

In Section 5.4, I laid down two more desiderata for the dialogue game formalisation of critical discussion. These had to do with maintaining strict turn-taking, and letting criticism target the full propositional content of argumentation instead of first decomposing potentially complex propositions. In both respects, the dialogue game for critical discussion seems to perform adequately. During each turn, a player may only make one move, after which the turn passes to the other player. Additionally, there can be no instance where one player has to take two turns in a row because the other player passes without making a move. Furthermore, when *Ant* casts doubt on the acceptability of the propositional content of the argumentation, the only way of doing this is by targeting the whole of the propositional content. Admittedly, this latter result is not of great value yet because of the current restriction to single argumentation. When complex argumentation structures, such as multiple or coordinatively compound argumentation, are introduced in the dialogue game, then this desideratum should be revisited.

By accounting for the speech act perspective of critical discussion, the dialogue game is brought one step closer to being a formalisation with the full scope of features of the ideal model. Further extensions to the dialogue game are obviously still required, several of which have been alluded to in Section 5.4 of this paper. In addition, the dialogue game has to be computationally implemented to test whether it indeed forms an adequate preparatory step for the computational application of the pragma-dialectical theory.

Chapter 6

Argumentation structures in the dialogue game for critical discussion ($CRIT_3$)†

6.1 Introduction

The pragma-dialectical theory of argumentation, developed by van Eemeren and Grootendorst (1984; 1992; 2004) and their co-authors (van Eemeren 2010; van Eemeren et al. 2014, pp. 517-613), is one of the most influential contributions to the field of argumentation theory. Although van Eemeren (van Eemeren and Houtlosser 2006) gave a keynote speech about the pragma-dialectical theory at the computation oriented second ArgMAS workshop on argumentation in multi-agent systems, computational development has so far not become part of the pragma-dialectical research programme (see van Eemeren et al. 2014, pp. 520-523). Notwithstanding the current situation, the development of computational tools to support the practical application of the pragma-dialectical theory has great potential. Particularly the teaching of argumentative skills and the pragma-dialectical method of analysing argumentative texts (van Eemeren and Grootendorst 1992; van Eemeren, Grootendorst, Jackson and Jacobs 1993; van Eemeren 2010) can benefit from computational support tools.

E-learning modules would be a valuable addition to existing pragma-dialectical textbooks on, for example, persuasive writing (van Eemeren, Garssen and Rietstap 2014), argumentation in the legal domain (van Eemeren et al. 2005), or the analysis, evaluation and production of argumentative texts (van Eemeren, Grootendorst and Snoeck Henkemans 2002). With respect to the analysis of argumentative texts, a full automation would be over-ambitious at present, but smaller computational tools to diagram argumentation structures or to identify argumentative indicators in texts (a constitutive part of argument mining (Lippi and Torroni 2015)), can be realised. In both of these cases – e-learning and analytical support – a central role is played by the pragma-dialectical discussion model. If software is to be developed on the basis of the pragma-dialectical theory and approach, it will in some way be based on this discussion model (as a heuristic in the analysis, for example). At present, it is not clear how the discussion model should be computationally implemented, because it is presented in an informal manner. The current paper is part

† Original title of paper: Argumentation structures in a dialogue game for critical discussion.

of a project to formalise the pragma-dialectical ideal model in order to facilitate the computational implementation thereof.

The specific focus of the current paper is on the role of the structure of argumentation in the formalisation. Argumentation can be more or less complex in its structure, as will become clear in the presentation of the pragma-dialectical approach to argumentation structures in Section 6.2.[58] Because the argumentation structure influences the way in which the argumentation should be evaluated (for fallacies and acceptability), the reconstruction of the structure is very important both in the analysis of argumentative discourse and in the teaching of argumentative skills.

The pragma-dialectical discussion model is formalised in terms of a dialogue game. Dialogue games are commonly used to model communicative interaction in multi-agent systems (Norman, Carbogim, Krabbe and Walton 2004; Prakken 2009) and are characterised by McBurney and Parsons (2009, pp. 261-262) as "rule-governed interactions between two or more players (or agents), where each player 'moves' by making utterances, according to a defined set of rules". In Section 6.3, a dialogue game for critical discussion is presented in which only an elementary type of argumentation structure can occur. On this basis, in Section 6.4, the central question of how complex argumentation should be accounted for in a formalisation of the pragma-dialectical discussion model is addressed by extending the dialogue game. In Section 6.5, the relation of complex argumentation structures to the extended dialogue game is further clarified by means of an example dialogue.

6.2 Argumentation structures in the pragma-dialectical ideal model of a critical discussion

The structure of argumentation can be very simple, when one argument is put forward in defence of a standpoint. The structure can also become more complex, as happens in Paul's argumentative defence of his standpoint in the dialogue fragment of six turns in Example 6.1. In the example, Paul provides two arguments, the second of which is not a direct defence of his original proposal, but rather supports his first argument.

58 Because of the importance of argumentation structures, the topic is studied from many perspectives besides the pragma-dialectical one. Preceding the reinvigoration of argumentation theory as a research field that resulted from the publication of Perelman's (Perelman and Olbrechts-Tyteca 1958) and Toulmin's (1958) work, Wigmore's (1913) approach to diagramming legal reasoning, for example, was strongly focussed on structural aspects. Several other studies on complex argumentation are found in the Informal Logic tradition as well; for example Freeman's (2011) approach. Because my current objective is to investigate the role of complex argumentation in a formalisation of the pragma-dialectical-dialectical discussion model, I will not discuss the alternative approaches. For that, I refer to Snoeck Henkemans' (2001, pp. 101-134) comparison between the main approaches to complex argumentation as a prelude to her elaboration of the pragma-dialectical interpretation.

Example 6.1

(1)	Paul:	Let's go to the new Star Wars movie tonight.
(2)	Anna:	Is that really such a good idea?
(3)	Paul:	Of course, it's now or never!
(4)	Anna:	Really?
(5)	Paul:	Yes, this is the last day that the movie will be shown in the theatres.
(6)	Anna:	Ah, I see.

In Example 6.1, Paul tries to convince Anna. The standpoint at issue is Paul's proposal (turn 1) to go to the movies to see the new Star Wars movie in the evening. Paul argues, in turn 3, that this is their last chance to go see it. So far, the structure of Paul's argumentation is single: one argument in defence of the standpoint. When Anna's response, in turn 4, shows that she is not convinced that this is indeed the last chance to go, Paul provides a further argument by saying that this is the last day that the movie is shown in the theatres. As a result, the argumentation structure becomes complex: Paul's second argument supports his first, which in turn supports the standpoint.

Within the pragma-dialectical theory, complex argumentation structures are interpreted in relation to the *ideal model of a critical discussion*. The pragma-dialectical ideal model is based on a critical conception of reasonableness (van Eemeren and Grootendorst 2004, pp. 127-134). The model is 'dialectical' in the sense that it is a proposal for a procedure that ensures the rights and obligations for discussants who want to resolve a difference of opinion in a reasonable way (van Eemeren and Grootendorst 2004, pp. 42-68). The rights and obligations of the discussants are laid down in a set of fifteen Rules (van Eemeren and Grootendorst 2004, pp. 135-157).[59] The model is 'pragmatic' because the discussion moves are realised through the performance of speech acts (van Eemeren and Grootendorst 1984, pp. 95-118).[60] Argumentation, in particular, is interpreted as a speech act complex (van Eemeren and Grootendorst 1984, pp. 19-46). As with any speech act, argumentation comes with a set of conditions that should be fulfilled for the speech act to be performed felicitously (van Eemeren and Grootendorst 1984, p. 44). Most importantly, associated with

59 In the rest of the paper, the fifteen Rules will be referred to as 'Rules' with a capital 'R' to distinguish them from the dialogue game rules (with a lower case 'r') that will be defined in Section 6.3, Section 6.4 and Section 6.5. The fifteen 'technical' Rules of the ideal model should not be confused with the ten 'practical' commandments for reasonable discussants (van Eemeren and Grootendorst 1992, pp. 208-209). These ten commandments are meant to be used as rules of thumb for conducting, analysing and evaluating argumentative discussions in practice.

60 The pragmatic dimension should not be mistaken for a practical reasoning oriented one. In the sense intended here, 'pragmatic' refers to the traditional distinction within linguistics between syntax, semantics and pragmatics (Levinson 1983).

argumentation is the presumption that its propositional content and the justificatory force are acceptable (van Eemeren and Grootendorst 1992, p. 31).[61]

Characteristically, the focus in the ideal model of a critical discussion is not exclusively on the inferential aspects of argumentation. By taking the full argumentative discussion into consideration, four discussion stages are distinguished (van Eemeren and Grootendorst 2004, pp. 57-62). First, in the *confrontation stage*, the interlocutors externalise their difference of opinion about an expressed opinion (e.g., an opinion, a belief, a plan of action, etc.). Second, in the *opening stage*, the discussants agree upon a set of mutually accepted material and procedural starting points. The discussants need at least one shared material starting point in order to have a meaningful discussion (van Eemeren and Grootendorst 2004, p. 139) and with respect to the procedure, they need to agree who will perform the role of protagonist and who will be the antagonist, among other things (van Eemeren and Grootendorst 2004, p. 141).[62] Third, in the *argumentation stage*, the protagonist will provide one or more arguments in defence of the standpoint, while the antagonist critically examines the arguments. Fourth, in the *concluding stage*, the discussants draw a conclusion on the basis of the critical testing of the arguments. If the argumentation was conclusive, both discussants will have to accept the standpoint. In case the criticism was conclusive, both discussants may no longer accept the standpoint.[63]

The fifteen Rules for critical discussion specify the ways in which discussants can reasonably defend and attack standpoints. Assuming only one standpoint is at issue in the discussion, the protagonist defends it by advancing argumentation.[64] If this argumentative defence is not successful at convincing the antagonist, further argumentation may be called for. Depending on the kind of criticism the additional argumentation is meant to overcome, different structures develop.

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61 The propositional content of the argumentation constitutes the material premise of the underlying reasoning. The justificatory force constitutes the linking premise that transfers the acceptability of the material premise to the conclusion of the reasoning. The conclusion of the reasoning is the propositional content of the standpoint, i.e. the initial expressed opinion.

62 In the remainder of this paper, as in van Eemeren and Grootendorst's introduction of the ideal model, the assumption will be that the interlocutor putting forward the standpoint, will also be the one defending it as protagonist in the argumentation stage of the discussion. For reasons of clarity, the protagonist will be referred to with male pronouns, and the antagonist with female pronouns (following the standard way of referring to proponents and opponents in the literature on formal dialectics and dialogue logic). The same convention will be followed in Section 6.3 and later for the players *Prot* and *Ant* in the dialogue game.

63 No longer accepting a standpoint should not be confused with accepting an opposite standpoint. This mistake would constitute an instance of the fallacy of 'making an absolute of the failure of the defence' (van Eemeren and Grootendorst 1992, pp. 187-191)

64 In the elementary case, only one standpoint is at issue, which was met with doubt in the confrontation stage. This leads to a single non-mixed difference of opinion, and this is the type of difference of opinion that is the assumed starting point in the current paper. More complex differences of opinion can occur when more than one standpoint is at issue (leading to a multiple difference of opinion) or when instead of doubt a contradictory standpoint was advanced in the confrontation stage (resulting in a mixed difference of opinion). The complex differences of opinion can be decomposed into two or more elementary differences, which is why the focus will be on the elementary case from now on (see van Eemeren and Grootendorst 1984, pp. 78-82).

The first type of argumentation structure distinguished within the pragma-dialectical theory is *single argumentation* (van Eemeren and Grootendorst 1984, pp. 90-91). In a single argumentation structure, the protagonist advances only one argument in defence of the standpoint. In Figure 6.1, which is a diagrammatic visualisation of the argumentation structure, the propositional content of the argumentation (i.e. the material premise of the underlying reasoning), is numbered 1.1. The propositional content of the standpoint (i.e. the initial expressed opinion) is numbered 1. The arrow indicates the intended transfer of acceptability, which is the justificatory force of the argumentation (or the linking premise in the underlying reasoning). The justificatory force is indicated in the diagram with a prime: (1.1'). Because the justificatory force is (generally) not made explicit in the speech act, it is put between brackets. Nevertheless, it can still be included in the diagram, because the protagonist is committed to it, due to the felicity conditions of the speech act complex 'argumentation' (van Eemeren and Grootendorst 1992, pp. 60-72).

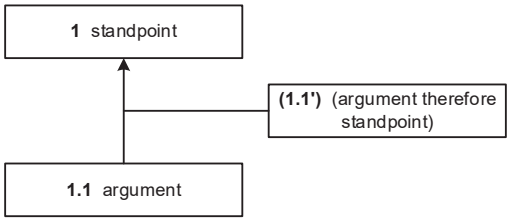

Figure 6.1 *A diagram of single argumentation*

Argumentation is single when either the antagonist accepts the argumentation after due consideration, or she does so after the protagonist makes use of an intersubjective procedure to defend the argumentation. These four procedures are carried out jointly by the discussants, external to the discussion itself. In response to criticism with respect to the acceptability of the propositional content, the protagonist can appeal to the intersubjective identification procedure. In the intersubjective identification procedure, the discussants determine whether a particular proposition is actually one of the common starting points that the discussants agreed upon as part of the opening stage (van Eemeren and Grootendorst 2004, pp. 145-147). In response to criticism about the justificatory force of the argumentation, the protagonist has three intersubjective procedures at his disposal. If the justificatory force of the argumentation depends on logical validity, the intersubjective inference procedure is used to check whether the inference is valid according to a logical system that the discussants agreed upon in the opening stage (van Eemeren and Grootendorst 2004, p. 148). If the linking premise is not fully expressed, the intersubjective explicitisation procedure is used to make it explicit (van Eemeren and Grootendorst 2004, pp. 148-149). Once the linking premise has been made explicit, and it has become clear what the relevance of the argument for the standpoint is, then the intersubjective testing procedure can be used to jointly determine whether the reasoning appealed

to is acceptable – based on the defeasible reasoning or argument scheme used (van Eemeren and Grootendorst 2004, pp. 149-150).

If the antagonist does not immediately accept the argumentation and there is no successful appeal to an intersubjective procedure, the protagonist can advance additional argumentation to continue his defence of the standpoint. Van Eemeren and Grootendorst (1984, p. 93) gave a dialogical interpretation of complex argumentation structures, which was later elaborated by Snoeck Henkemans (1992). In the dialogical interpretation, the different complex argumentation structures come about as a result of the kind of criticism that is addressed.

If the antagonist's criticism concerns the acceptability of the propositional content of the argumentation, the protagonist can defend the argument by providing new argumentation in support of the propositional content (van Eemeren and Grootendorst 1992, pp. 82-85). This defence constitutes *subordinatively compound argumentation*, as visualised in Figure 6.2. Subordinative argumentation (for short) leads to a sub-discussion, in which an additional argument [1.1.1] is provided in defence of the propositional content of the original argumentation [1.1].

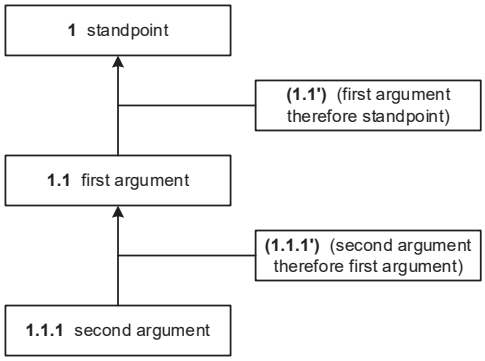

Figure 6.2 *A diagram of subordinative argumentation with respect to the propositional content*

Instead of (or after) criticising the acceptability of the propositional content, the antagonist can criticise the justificatory force of the argumentation. To defend the argumentation against doubt about its relevance to the standpoint, the protagonist may again advance *subordinative argumentation*, this time in support of the linking premise (as shown in Figure 6.3). Analogous to the defence of the propositional content in a sub-discussion, the added argument [(1.1').1] is intended as a justification of what was criticised, in this case, the linking premise or inferential link between the original argument and the main standpoint [(1.1')].

Contrary to subordinative argumentation in defence of the propositional content, no mention is made in the fifteen Rules for critical discussion of the possibility of subordinative argumentation in defence of the justificatory force. Furthermore, the possibility does not appear in the dialectical profile – a normative pattern specifying the possible discussion moves per discussion stage – of the argumenta-

tion stage of a critical discussion (van Eemeren, Houtlosser and Snoeck Henkemans 2007, p. 195). Nevertheless, Snoeck Henkemans (1992, p. 92) treats this type of subordinative argumentation as an argumentative means of defence for a protagonist who aims to maintain both his original argumentation and his original standpoint after relevance-criticism by the antagonist. Because van Eemeren and Grootendorst (1992, pp. 85-86) also discuss this structure in one of their examples, I consider subordinative argumentation a sanctioned way of defending the justificatory force.

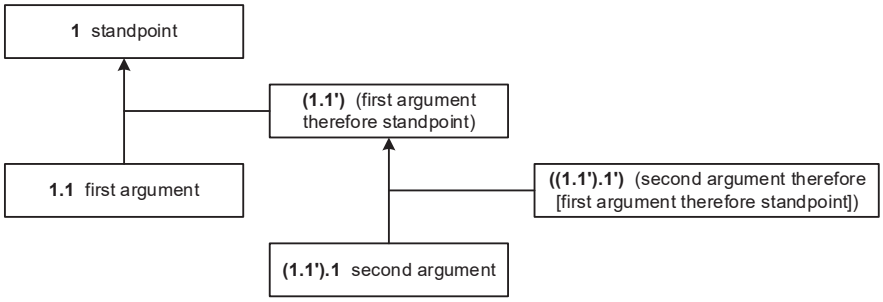

Figure 6.3 *A diagram of subordinative argumentation with respect to the justificatory force*

If the antagonist does not consider the argumentation provided as sufficient to justify the standpoint or if she has a counter-argument, then the protagonist can react by adding another argument, which defends the standpoint together with the original argument. The resulting structure is *coordinatively compound argumentation* (van Eemeren and Grootendorst 1992, pp. 76-82). If a second argument is added, such as [1.1b] in Figure 6.4, such that the two arguments together defend the standpoint [(1.1a+b')], the structure is *cumulative* (Snoeck Henkemans 1992, pp. 96-97). If a counter-argument was put forward, this can be refuted by the protagonist, leading to a *complementary* structure (which is not further discussed in the current paper, because it involves mixed differences of opinion, see footnote 7) (Snoeck Henkemans 1992, pp. 97-98). The dialogical interpretation of the difference between cumulative and complementary, gives further substance to Pinto and Blair's (1989, p. 221) distinction between the two (with respect to premise sets).

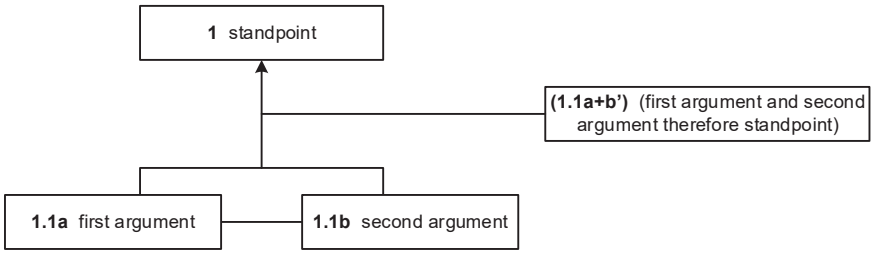

Figure 6.4 *A diagram of cumulative argumentation*

If the protagonist agrees with the antagonist that his argument is untenable, but he does not want to give up his original standpoint, he can retract his first argument and advance a new line of argumentation. This new attempt at defence of the standpoint is independent of the retracted argumentation. Because more than one argumentative defence of the standpoint is advanced, the arguments together constitute *multiple argumentation* (van Eemeren and Grootendorst 1992, pp. 73-76). The resulting argumentation structure is visualised in Figure 6.5. The first line of argumentation [1.1] and the second line [1.2] each have their own justificatory force for the standpoint (respectively [(1.1')] and [(1.2')]) and are therefore independent attempts at defence.

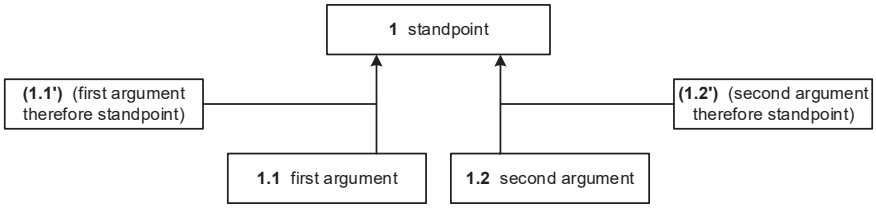

Figure 6.5 *A diagram of multiple argumentation*

In practice, the first argument is not necessarily always retracted (Snoeck Henkemans 1988). For example, when dealing with a composite audience, the protagonist may anticipate different criticisms from the various constitutive parts of the audience, and advance separate lines of argument to address each (Snoeck Henkemans 1992, p. 95; van Eemeren 2010, pp. 109-110). In the ideal model, the assumption is that the discussion is fully externalised, which is why, in the case of multiple argumentation, the first lines of argument are presumed to have been unsuccessful and retracted (Snoeck Henkemans 1992, p. 81).

The three main types of complex argumentation structure – subordinative, coordinative, and multiple – are all composed on the basis of the elementary form of single argumentation (van Eemeren and Grootendorst 1984, p. 91). Depending on the interaction between the protagonist and the antagonist in the argumentation stage of a critical discussion, the argumentation structure can become increasingly complex, if several of the complex argumentation structures are used in combination. How this, in principle open-ended, combination of argumentation structures can be realised in a dialogue game formalisation of the ideal model, is what the rest of this paper is concerned with.

6.3 Single argumentation in a dialogue game for critical discussion CRIT$_2$

The dialogue game for critical discussion is defined through five categories of rules: commencement rules defining the initial state of the game, move rules defining the moves players can make, commitment rules defining the commitments resulting

from the moves, sequence rules defining the structure of dialogues, and a termination rule defining the end conditions of the game. Some may still consider this definition to be semi-formal, because it is not fully axiomatised. Axiomatisation and independence from material, non-logical meaning, is indeed one sense in which a model can be called 'formal' (a combination of *formal*$_2$ and *formal*$_5$ in Barth and Krabbe's (1982, pp. 14-19; Krabbe 1982) classification of senses of 'formal'). Nevertheless, this is not the sense that is intended in the 'formalisation' undertaken by means of the dialogue game for critical discussion in the current paper. The sense of 'formal' pursued in the dialogue game is *formal*$_2$: the definition of well-formed expressions and the way in which these can be combined. The ideal model of a critical discussion itself is already procedurally regimented (*formal*$_3$) and normative (*formal*$_4$) (Krabbe and Walton 2011, p. 246; Krabbe 2012, p. 12; van Eemeren et al. 2014, p. 304). These two senses should, obviously, be retained in the formalisation.

Reflecting the compositional approach to complex argumentation in the ideal model, the elementary case in the dialogue game is also constituted by single argumentation. The dialogue game for critical discussion, restricted to single argumentation, is introduced in the current section.[65] In the next section, the rules of the existing dialogue game are extended to accommodate complex argumentation structures. To make it easier to focus on the accommodation of complex argumentation, the dialogue game is simplified in comparison to the original ideal model in areas that do not relate to complex argumentation. Before turning to the definition of the dialogue game rules, I will introduce these simplifications.

To start with, the dialogue game is a formalisation of only two of the four discussion stages of the ideal model. As was explained in Section 6.2, in the pragma-dialectical ideal model, four discussion stages are distinguished: the confrontation stage, the opening stage, the argumentation stage, and the concluding stage. In the dialogue game, specific outcomes of the first two discussion stages are presumed at the outset of the dialogue game. Only the last two discussion stages are explicitly modelled (apart from the commencement rules in which the presumed initial state of the dialogue game is determined).

The exclusion of the confrontation stage means that the initial situation of the dialogue game is different from other dialogue systems in which the disputed issue still has to be established in the first moves of the game, such as Mackenzie's (1979) DC or Rescher's (1977) formal disputations. The assumed outcome of the confrontation stage, as reflected in the commencement rules, is that a single positive standpoint has been advanced and cast doubt on. This simplification constrains the dialogue game to discussions about one proposition, which is defended with a supporting argument, thereby excluding discussions in which more than one proposition is initially at issue, or in which a standpoint is refuted instead of justified.

Based on the presupposed outcome of the opening stage, there are two players, labelled *Prot* and *Ant*. These labels match the division of discussion roles of

65 The dialogue game for critical discussion, restricted to single argumentation structures, that is presented in this section is an amended and summarised version of a dialogue game I presented in another paper (Visser 2016d).

respectively protagonist and antagonist that discussants agree upon in the opening stage of critical discussion. Player *Prot* defends a positive standpoint with respect to the initial expressed opinion in the argumentation stage, whereas *Ant* critically assesses this defence on account of her doubt about the initial expressed opinion (van Eemeren and Grootendorst 2004, p. 142). The players do this by taking turns, in which they make one move and then pass the turn to the other player, until the end condition is reached (van Eemeren and Grootendorst 2004, p. 154).

As part of the commencement rules of the dialogue game, a non-empty set *SP* of propositions reflecting the material starting points is instantiated. In addition to the material starting points, the players have to decide upon a reasoning system or logic (or on a combination of several such systems, which they deem suitable), to substantiate the justificatory force of the argumentation that transfers the acceptability of the argument to the standpoint (van Eemeren and Grootendorst 1992, pp. 60-72). The logical system can, for example, be some classical logic, or a non-monotonic system for defeasible reasoning (e.g., Pollock 1987; Dung 1995), or a set of argument schemes with critical questions (e.g., Garssen 1997; Walton, Reed and Macagno 2008).

To complement the material starting points and the reasoning system, the players of the dialogue game are presumed to have agreed upon two external methods. The first of these methods reflects the intersubjective identification procedure of the ideal model and is used to determine the acceptability of a proposition (for example by checking whether it is part of the set of material starting points). The second of these external methods corresponds to the intersubjective inference procedure and the intersubjective testing procedure, and is used to test the acceptability of the justificatory force of argumentation (for example by checking whether the standpoint is logically entailed by the argument or whether an acceptable argument scheme is correctly applied).[66] Both of the external methods return positive or negative outcomes that are binding for the players.

A last important outcome of the opening stage is that the discussants have decided to resolve their difference of opinion by playing the dialogue game for critical discussion in accordance with the rules (van Eemeren and Grootendorst 2004, pp. 142-143). In doing so, *Prot* defends a positive standpoint with respect to the proposition at issue by advancing argumentation that justifies its acceptability, and *Ant* critically assesses the argumentation due to her initial doubt with respect to the standpoint.

Before turning to the actual rules of the dialogue game, two technical preliminaries have to be introduced: an object language and commitment stores. Again, in order not to overcomplicate the dialogue game and risk distraction from the focus on complex argumentation structures, both language and commitments are kept rather simple.

The rules assume there to be some propositional language $\mathcal{L}$ that is used to express the content of moves and commitments in the dialogue game. Although

66 Because the dialogue game is fully explicit at the outset, the intersubjective explicitisation procedure is not taken into account.

more complex interpretations are possible, within the scope of the current paper, it should be enough to conceive of $\mathcal{L}$ as a language with which it is possible to refer to (conjunctions of) propositions and to the (supposed) inference of one proposition from another. Propositions are referred to in the rules as *A*, *B*, etc., conjunctions are indicated as *A*&*B*, and inferences as $A \Rightarrow B$ ('*A* therefore *B*'). In pragma-dialectical terms, an expression $A \Rightarrow B$ can be interpreted as the supposed justificatory force of an argument *A* in defence of a standpoint *B*.[67] Within the scope of the individual clauses of the rules of the dialogue game, it holds that $A=A$ and $A \neq B$.

Several of the moves in the dialogue game have an effect on the players' commitments. These are kept track of in two commitment stores (see Hamblin 1970, p. 257). In the dialogue game, the commitment stores take the form of two sets $CS_{p,t}$ of propositions *A*, *B*, … $\in \mathcal{L}$, for player $p \in Players$, and with a turn counter $t \in \mathbb{N}$ (which is increased by one every turn). A player's commitments reflect the propositions that he considers acceptable within the scope of the dialogue game, such that he cannot just deny them. More detailed conceptions of commitment, such as that of Walton and Krabbe (1995, pp. 13-63), are not taken into consideration in the current dialogue game.

6.3.1 Commencement rules

The initial state of the dialogue game is defined through three commencement rules. A constant *initial_expressed_opinion* is instantiated (B1), to denote the propositional content of the standpoint at issue. There are two players, labeled *Prot* and *Ant* (B2). There is a non-empty, conflict-free set *SP* of common material starting points (B3).

B1	$initial\_expressed\_opinion \in \mathcal{L}$
B2	$Players = \{Prot, Ant\}$
B3	$SP \neq \emptyset$

6.3.2 Move rules

There are eight different types of moves in the dialogue game. Because the dialogue game is not symmetrical with respect to the two players, each player has their own set of available moves, with the exception of one which is available to both players. The moves are presented as *type(p, "Paraphrase", A)* or *type(p, "Paraphrase", A, B)*. The function of the move (cf. the type of speech act in the ideal model) is indicated by its *type*. The player making the move is denoted by $p \in Players$. Because the dialogue game is asymmetrical in this respect, all but one of the moves are restricted to

67 Technically, the *B* in this case is the expressed opinion that is the propositional content of the standpoint speech act complex in which a positive position is taken up with respect to this proposition: +/*B*.

one of the players. The *paraphrase* is a description of the move in natural language.[68] The propositional content of the move consists of A, $B \in \mathcal{L}$. During a game, any instantiation of the four (or five) parameters of a move must be unique. This means that the same move may not be repeated during the course of one game (this prohibition is based on Rule 13A of the ideal model (van Eemeren and Grootendorst 2004, p. 154), and prevents a player from stalling the game by repeating the same sequence of moves over and over.) After the specification of the dialogue game rules, the individual moves, the resulting commitments, and their sequential interaction will be further explained in Subsection 6.3.6.

M1	*argue(Prot, "My argument for ... is that ...", A, B)*
M2	*identify(Prot, "I invoke the intersubjective identification procedure to verify the acceptability of ...", A)*
M3	*test(Prot, "I invoke the intersubjective testing procedure to verify the acceptability of ...", A⇒B)*
M4	*retract(Prot, "I am no longer of the opinion that ...", A)*
M5	*maintain(Prot, "I maintain my standpoint with respect to ...", A)*
M6	*doubt(Ant, "I doubt whether ... is acceptable", A)*
M7	*accept(Ant, "I accept that ...", A)*
M8	*maintain_doubt(Ant, "I maintain my doubt about ...", A)*†
M9	*resolve(p,"I request resolution with respect to ...", A)*

6.3.3 Commitment rules

The players' commitments stores $CS_{Prot,0}$ and $CS_{Ant,0}$ are initialised at the beginning of the dialogue game (C1 and C2). Both sets contain the common starting points *SP*. *Prot*'s store also contains the *initial_expressed_opinion*, while *Ant*'s does not. If *Ant* would also be committed to the acceptability of the *initial_expressed_opinion*, no difference of opinion would arise to begin with.

Only three of the eight types of moves have an effect on the players' commitments. For the other five types there is no change in the commitment stores: $CS_{p,t} = CS_{p,t-1}$. Based on the role of speech acts in the ideal model of a critical discussion, all moves could be said to affect the commitments. Every speech acts comes with a set of felicity conditions, that can be modelled in the dialogue game in terms of

68 The *paraphrases* do not only describe the function of the move in natural language, but can also be used to uniquely identify the moves, and may facilitate a natural language interface in a computational implementation.

† The *maintain_doubt*-move is new in CRIT$_3$. In CRIT$_2$, the same function of transitioning to the concluding stage was fulfilled by means of the ordinary *doubt*-move. This has advantages for the generalisability of the dialogue game moves. Nevertheless, in CRIT$_3$, I introduce the dedicated *maintain_doubt*-move to prevent *Prot* from making use of rule S2a to initiate the intersubjective identification procedure again, but this time during the concluding stage of the discussion, and directly aimed at the expressed opinion. The introduction of *maintain_doubt(…)* as a move was a trade-off between the generalisation of the moves (in view of the speech act perspective of Chapter 5) and maintaining a sequential structure that accommodates complex argumentation.

changes to the players' commitments brought about by the performed moves (Visser 2016d). Nevertheless, most of these commitments resulting from the speech acts' felicity conditions play no part in the dialectical proceedings of the discussion. The only commitments that are therefore considered to be relevant in the dialogue game are those creating or discharging dialectical obligations.†

The » symbol is used to indicate the operations on the commitment stores for each of the moves. The addition or deletion of a conjunction of propositions, results in the addition or deletion of the separate conjuncts (i.e. the conjunction is eliminated by disjoining the conjuncts into separate propositions and adding or deleting each separately). Because $CS_{Prot,t}$ and $CS_{Ant,t}$ are not multisets, any attempt to add a proposition to a commitment store which already contains it has no effect. To improve the readability of the rules that follow, the *paraphrases* are omitted.

C1 $CS_{Prot,0} = SP \cup \{initial\_expressed\_opinion\}$
C2 $CS_{Ant,0} = SP$
C3 $argue(Prot, \text{“…”}, A, B) \text{ » } CS_{Prot,t} = CS_{Prot,t-1} \cup \{B, B \Rightarrow A\}$[69]
C4 $retract(Prot, \text{“…”}, A) \text{ » } CS_{Prot,t} = CS_{Prot,t-1} - \{A\}$
C5 $accept(Ant, \text{“…”}, A) \text{ » } CS_{Ant,t} = CS_{Ant,t-1} \cup \{A\}$

6.3.4 Sequence rules

The sequence rules determine for each type of move, in response to which predecessor it may be made. The starting move of the dialogue game is always *argue(Prot, "My argument for … is …", initial_expressed_opinion, B)*, in which *Prot* puts forward a proposition *B* as justification for the *initial_expressed_opinion*. Because the current dialogue game only allows single argumentation structures, the *argue*-move can only occur once, at the beginning of the game (in response to *null*: no preceding move). The sequence rules will be explained further in Subsection 6.3.6.

Aside from the preceding move, the content of the commitment stores or the outcome of an external procedure may also be of importance. The ◄ symbol can be read as 'is a sanctioned continuation of the following moves', meaning that a move before the ◄ may be made in reaction to one of the moves following the ◄. The various preceding moves are listed as (a), (b), etc. A vertical line | is used to list the additional conditions that may hold for the performance of a move. The colon : is used to mandate a particular instantiation of one of the move's parameters.

S1' *argue(Prot, "…", A, B)* ◄
(a) *null* | *(A* : *initial_expressed_opinion)*
S2 *identify(Prot, "...", A)* ◄
(a) *doubt(Ant, "...", A)* | $((A \Rightarrow B) \in CS_{Prot,t})$

† See Chapter 5

69 Although in principle different constellations are possible, the assumption in the dialogue game is that the propositional content of the initial *argue*-move covers the 'material premise' of the reasoning, whereas the justificatory force $A \Rightarrow B$ reflects the 'linking premise'.

S3 *test(Prot, "...", A⇒B)* ◀
(a) *doubt(Ant, "...", A⇒B)*

S4 *retract(Prot, "...", A)* ◀
(a) *doubt(Ant, "...", A)*
(b) *maintain_doubt(Ant, "...", A)*
(c) *resolve(Ant, "...", A)*

S5 *maintain(Prot, "... ", A)* ◀
(a) *accept(Ant, "...", B&(B⇒A))*

S6 *doubt(Ant, "...", A)* ◀
(a) *argue(Prot, "…", B, A)*
(b) *argue(Prot, "…", B, C)* | (*A* : *(C⇒B)*)
(c) *resolve(Prot,"...", B)* | ((*B⇒C*) ∈ $CS_{Prot,t}$; *A* : *(B⇒C)*)
(d) *resolve(Prot,"...", A⇒B)*

S7 *accept(Ant, "...", A)* ◀
(a) *argue(Prot,"...", B, C)* | (*A* : *(C&(C⇒B))*)
(b) *identify(Prot, "...", A)* | (*A* ∈ *SP*)
(c) *test(Prot, "...", B⇒C)* | (*B*⊢*C*; *A* : *(B⇒C)*)[70]
(d) *resolve(Prot,"...", B)* | ((*B⇒C*) ∈ $CS_{Prot,t}$; *A* : *(B&(B⇒C))*)
(e) *resolve(Prot,"...", B⇒C)* | (*A* : *(B&(B⇒C))*)
(f) *maintain(Prot, "... ", A)*

S8 *maintain_doubt(Ant, "...", A)* ◀
(a) *retract(Prot, "...", B)* | ((*B⇒A*) ∈ $CS_{Prot,t}$)
(b) *retract(Prot, "...", B⇒A)*

S9 *resolve(p,"...", A)* ◀
(a) *accept(Ant, ..., A)* | (*p* : *Prot*)
(b) *accept(Ant, ..., B⇒C)* | (*A* : *B⇒C*; *p* : *Prot*)
(c) *identify(Prot, "...", A)* | (*A* ∉ *SP*; *p* : *Ant*)
(d) *test(Prot, "...", B⇒C)* | (*B*⊬*C*; *A* : *(B⇒C)* ; *p* : *Ant*)

6.3.5 Termination rule

There is one rule that determines the win-loss conditions, T1. The dialogue game ends when either *Prot* is forced to retract his original standpoint, or when *Ant* has to accept the standpoint.

T1 Whenever a move *retract(p, "…", A)* or *accept(p, "…", A)* is made in turn *t*, then:
if *A* = *initial_expressed_opinion*, then:
if *A* ∈ $CS_{Ant,t}$, *winner* = *Prot*,
otherwise: *winner* = *Ant*;
otherwise:
continue playing the game with the next move

70 The turnstile ⊢ is used to indicate that *B* can actually be inferred from *A* on the basis of the reasoning system that the players chose. This is different from *Prot*'s supposition *A⇒B*, which start out as untested.

6.3.6 A walk-through of the dialogue game

The sequential structure of the dialogue game introduced so far is visualised in Figure 6.6. In this graph, the nodes represent the moves of the dialogue game, and the directed edges represent the transitions between moves, with the labels on the edges indicating the relevant sequence rule.[71] Figure 6.6 is the point of reference for the explanation of the dialogue game. In the course of the walk-through of the visualised structure, the relevant rules of the dialogue game will be indicated in parentheses. To justify the adequacy of the dialogue game as a formalisation of critical discussion, the relevant parts of the pragma-dialectical ideal model will be referred to.

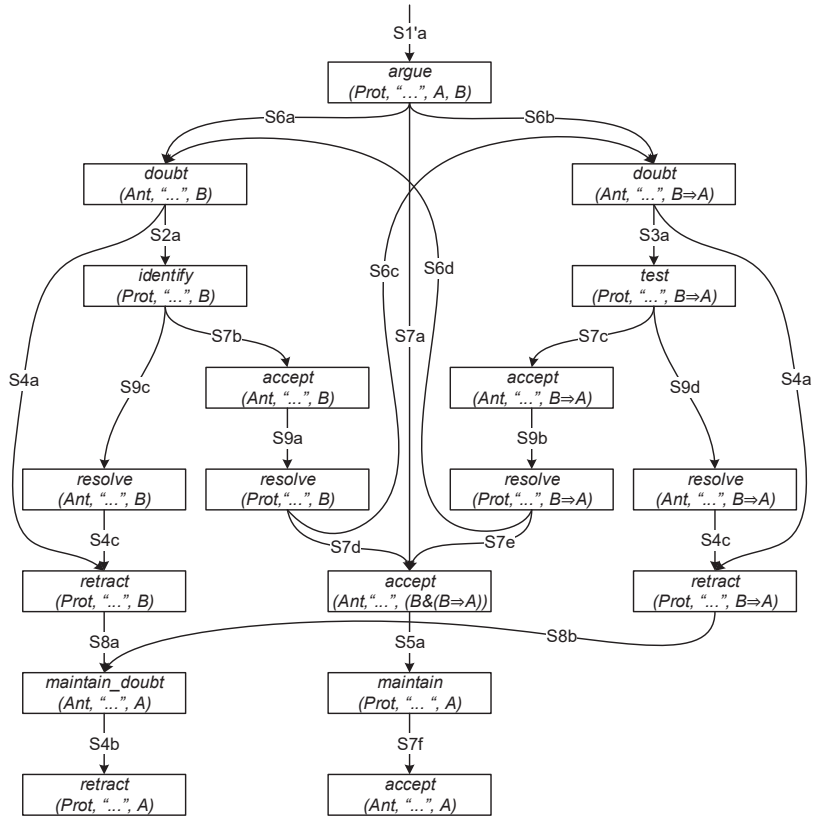

Figure 6.6 *The sequential structure of the dialogue game for critical discussion restricted to single argumentation*

71 The visualisation of the sequential structure of the dialogue game in terms of a graph is similar to the dialectical profiles used as a heuristic in the pragma-dialectical analysis of argumentative texts (van Eemeren, Houtlosser and Snoeck Henkemans 2007) and the profiles of dialogue as employed by Walton (e.g., 1989) and Krabbe (e.g., 1992). The relation to dialectical profiles is discussed elsewhere (Visser 2016a).

The first move in the dialogue game, shown at the top of Figure 6.6, always is *Prot*'s *argue*-move, because rule S1' is the only one allowing a move to be made in reaction to *null*, or no preceding move. With this move (M1) *Prot* puts forward a proposition *B* in defence of his standpoint with respect to proposition *A*, reflecting Rule 6A of the ideal model (van Eemeren and Grootendorst 2004, p. 144) which awards the protagonist the unconditional right to defend his standpoint. Due to the first commencement rule (B1), the proposition *A* should be instantiated with the *initial_expressed_opinion* (see van Eemeren and Grootendorst 1984, p. 89). There are no special conditions relating to what the *initial_expressed_opinion* is, reflecting Rule 1 (van Eemeren and Grootendorst 2004, p. 136), which allows any standpoint to be discussed.

Because within each dialogue game rule *A* and *B* do not refer to the same proposition, circular reasoning is precluded in rule S1': a proposition cannot be used to justify itself. In the ideal model of critical discussion, circular reasoning is also prohibited. The felicity conditions of the speech act complex 'argumentation' (van Eemeren and Grootendorst 1992, p. 31) lead to the presumption that the speech act is acceptable as a defence of the standpoint, whereas the felicity conditions of the speech act complex 'standpoint' presume the propositional content not to be acceptable to the interlocutor (Houtlosser 2001, p. 32). In line with the felicity conditions of argumentation, the commitment rule (C3) dealing with the *argue*-move causes *Prot* to add propositions to his commitment store expressing the propositional content *B* and the justificatory force $B \Rightarrow A$ of the argumentation.

After *Prot*'s opening move, due to the turn-taking principle, it is *Ant*'s turn. She has three options: she can choose to accept the argumentation (S7a), cast doubt on the acceptability of the propositional content (S6a), or cast doubt on the justificatory force (S6b). In the first case, she follows the route down the middle of Figure 6.6, by using the *accept*-move (M7) on a conjunction of the commitments associated with the preceding *argue*-move. Because of the accompanying commitment rule (C5), this means that *Ant* adds both the propositional content *B* and the justificatory force $B \Rightarrow A$ to her commitment store as well. Whereas in the ideal model there is no obligation to *express* criticism (van Eemeren and Grootendorst 2004, p. 151), the critical evaluation of the argumentation that is essential to critical discussion (van Eemeren and Grootendorst 2004, p. 61) is preserved in the dialogue game because *Ant*'s commitment to the acceptability of the argumentation is irrevocable.

Instead of accepting the argumentation, *Ant* can cast doubt (M6) on the acceptability of one of the two commitments resulting from *Prot*'s *argue*-move. The choice between doubting the propositional content (S6a) – the route on the left in Figure 6.6 – or doubting the justificatory force (S6b) – the route on the right – is not an exclusive one: in accordance with Rule 10 (van Eemeren and Grootendorst 2004, p. 152), *Ant* always has the opportunity to criticise both (as long as she did not do so already).

Until the accommodation of complex argumentation structures in the next section, the only way *Prot* can defend his argumentation is by initiating one of the intersubjective procedures, as mandated by Rule 7 (van Eemeren and Grootendorst 2004, p. 147) and Rule 8 (van Eemeren and Grootendorst 2004, p. 150) of the ideal

model. To determine whether the proposition that the *argue*-move relied on is actually one of mutually agreed material starting points (M2/S2a), the players jointly check if $B \in SP$ (van Eemeren and Grootendorst 2004, p. 146). To test the justificatory force (M3/S3a), the agreed upon external method is used (for example ascertaining if *A* is logically entailed by *B*, see Section 6.3). While both procedures are performed by the two players together, it is in *Prot*'s interest that they are carried out. It is therefore *Prot* who requests the intersubjective procedures to be initiated (van Eemeren and Grootendorst 1984, pp. 166-169).

Instead of continuing his defence, *Prot* can also retract (M4/S4a) the commitment that *Ant* criticised (van Eemeren and Grootendorst 2004, p. 153). It is important to note that what is retracted here, is the commitment that resulted from an earlier move, not the move itself. Through a retraction, a player can change his mind; he cannot go back in time and unmake an earlier move. Because the number of moves can only be added to, while the number of commitments can also be reduced through retractions, the dialogue game is cumulative with respect to moves (see Woods and Walton 1978), but not with respect to commitments (see Hamblin 1970, p. 263).

Assuming *Prot* continues his defence, *Ant*'s next move depends on the outcome of the relevant procedure. If the outcome is negative, she may request *Prot* to resolve (M9) the successful attack (S9c/S9d). In that case, *Prot* has to retract (M4) the successfully criticised commitment in the next turn (S4c). If, on the other hand, the outcome of the procedure is positive, *Ant* has to accept (M7) what she first criticised (S7b/S7c), and *Prot* may in turn request *Ant* to resolve her position (M9) with respect to this successful defence (S9a/S9b). This means that in the next turn, *Ant* has two options. First, she can continue her criticism by casting doubt (M6) on either the propositional content (S6c) or the justificatory force (S6d) of the argumentation, as long as she had not done so yet. Second, she can now capitulate and accept (M7) the full argumentation (S7d/S7e).

If *Ant* accepts the argumentation, *Prot* can maintain (M5) his standpoint (S5), on the basis of his conclusive argumentative defence (van Eemeren and Grootendorst 2004, p. 151). In terms of the ideal model, at this point the discussants enter the concluding stage (van Eemeren, Houtlosser and Snoeck Henkemans 2007, pp. 224-225). On the basis of the conclusive defence of the standpoint (S7f), *Ant* can only accept (M7) it, thereby adding the *initial_expressed_opinion* to her commitment store (C5). Conversely, if *Prot* retracted his argumentation, *Ant* can move the discussion into the concluding stage (S8a/S8b) by maintaining her doubt (M8). The only thing left for *Prot* to do is to retract (M4) his standpoint (S4b) on the basis of the conclusive attack by *Ant* (van Eemeren and Grootendorst 2004, p. 154), thereby losing his commitment to the *initial_expressed_opinion* (C4).

It should be clear from this discussion of the visualisation of the sequential structure of the dialogue game in Figure 6.6, that the current sequence rules can only lead to single argumentation structures. There is only one arrow leading to the *argue*-move at the top of the figure and it does not originate from another move, but from the *null* initial state of the game. This means that the move can at most occur once during a game. Because it became clear in Section 6.2 that complex argumen-

tation structures are always composed of more than one argument, such structures cannot be realised within the current rules. In the next section, rule S1', regulating the occurrence of the *argue*-move, is systematically revised to accommodate the different complex argumentation structures.

6.4 Complex argumentation in the dialogue game for critical discussion

To allow for the possibility of complex argumentation in the dialogue game, the sequence rules should be extended in such a way that the *argue*-move can de made more than once.[72] The question then becomes: in response to which moves by *Ant* may *Prot* make an *argue*-move? Or, looking at Figure 6.6: which routes should be opened by extending the sequence rule regulating the use of the *argue*-move?

In this section, for each of the complex argumentation structures introduced in Section 6.2 – subordinative argumentation, coordinative argumentation, and multiple argumentation – the relation to the dialogue game will be discussed and a new (partial) version of S1, the sequence rule for the *argue*-move, will be introduced. In Section 6.5, the different versions will be integrated into one rule S1, and the dynamics of the resulting dialogue game will be demonstrated.

With the revision of rule S1 the simplification of the dialogue game to single argumentation is lifted. The other simplifications with respect to the full ideal model of a critical discussion remain unaffected. One of these simplifications plays an important role in relation to complex argumentation structures: the restriction of the dialogue game to consistently non-mixed discussions. In Section 6.2 it became clear that according to the pragma-dialectical theory a discussant can not only cast doubt on the propositional content or the justificatory force of argumentation, but she can also put forward an objection, a counter-argument. The latter way of criticism leads to a second position in the difference of opinion (on the main level or on a subordinate level of the discussion), which contradicts something put forward in the current discussion. This contradiction, however, leads to a mixed discussion (at some level), which means that the discussion is no longer consistently non-mixed. Therefore, these cases are excluded from the current dialogue game for critical discussion. This means that complementary coordinatively compound argumentation, in which a counter-argument is refuted, still cannot be accommodated by the extension of the sequence rule S1 for the *argue*-move that is developed in the current paper. The possibility of complementary argumentation can be added to the dialogue game once the rules are extended to also allow for negative standpoints and the resulting mixed discussions.

72 Some of the ideas about complex argumentation in a dialogue game for critical discussion were already presented in an earlier conference paper (Visser 2013), albeit in a less developed form.

6.4.1 Subordinative argumentation

Both the propositional content and the justificatory force of argumentation can be defended against a critical attack by providing subordinative argumentation. In the case of subordinative argumentation in defence of the propositional content, Rule 7A of the ideal model mentions it as a defence 'in the second instance' after a failed defence through the intersubjective identification (van Eemeren and Grootendorst 2004, p. 147). In the dialogue game, subordinative argumentation in defence of the propositional content is added as a defensive means after a negative outcome of the intersubjective identification procedure (S")."[73] On the left in Figure 6.7, the new transition is highlighted from the *resolve*-move that follows the failed identification procedure to the *argue*-move.

S1" *argue(Prot, "…", A, B)* ◄
(a) *null* | *(A : initial_expressed_opinion)*
(b) *resolve(p,"...", A)*

As discussed in Section 6.2, subordinative argumentation in defence of the justificatory force is a little more difficult to position within a critical discussion. Snoeck Henkemans' (1992, p. 92) interpretation and van Eemeren and Grootendorst's (1992, p. 85-89) examples do not show one clear place in the discussion where the subordinative argumentation can be advanced. I have therefore decided to treat subordinative argumentation for the justificatory force analogous to that in defence of the propositional content. It is added as a secondary line of defence in case of a failure of the intersubjective testing procedure (S1"') – see the highlighted new transition on the right in Figure 6.7.

S1"' *argue(Prot, "…", A, B)* ◄
(a) *null* | *(A : initial_expressed_opinion)*
(b) *resolve(p,"...", C⇒D)* | *(A : (C⇒D))*

73 This interpretation appears to be further supported by the use of 'and' instead of 'or' in Rule 7B (van Eemeren and Grootendorst 2004, pp. 147-148), which states that both defensive means have to fail for an attack to be successful.

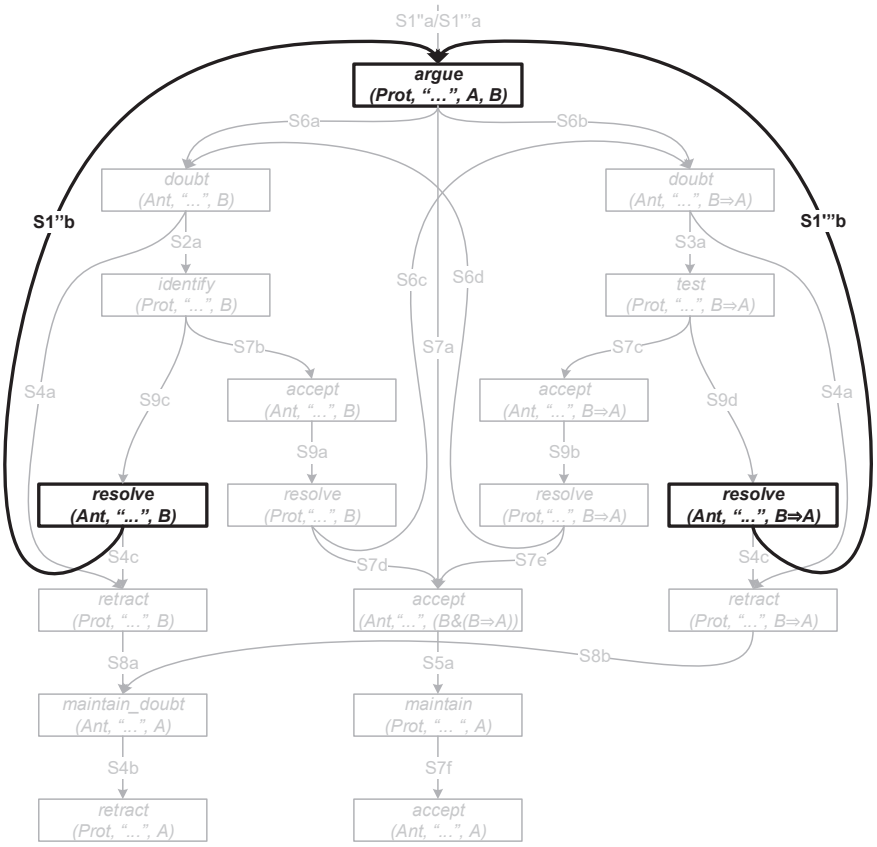

Figure 6.7 *Subordinative argumentation in the sequential structure of the dialogue game for critical discussion*

6.4.2 Cumulative argumentation

In response to *Ant*'s doubt about the justificatory force, *Prot* can revise his argumentation by adding to the propositional content thereof. Without performing a *retract*-move, *Prot* can respond to *Ant*'s *doubt*-move with respect to the justificatory force of the argumentation by making the *argue*-move again, but with an addition to it's propositional content (S1""). The second *argue*-move is a defence of the same standpoint, but contains a conjunction of the propositional content *B* of the original argumentation and a new proposition *C*. The sequence made possible by rule S1"" is highlighted in Figure 6.8.

S1"" *argue(Prot, "…", A, B)* ◄
(a) *null* | (*A* : *initial_expressed_opinion)*
(b) *doubt(Ant, "...", B⇒A)* | (*B* : *(B&C)*)

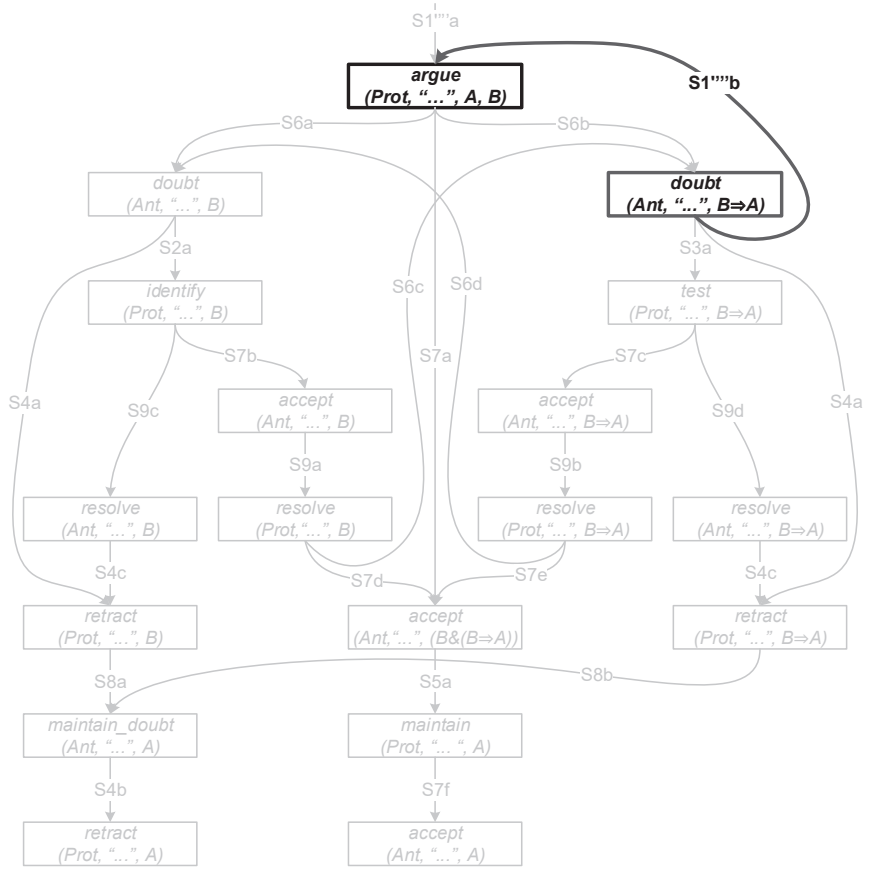

Figure 6.8 *Cumulative argumentation in the sequential structure of the dialogue game for critical discussion*

6.4.3 Multiple argumentation

In Section 6.2 it became clear that in the pragma-dialectical interpretation, multiple argumentation comes about when a new line of argumentation is presented, after the retraction of a failed first attempt at argumentatively defending the standpoint. The new argument counts as an independent defence of the original standpoint. In the dialogue game, this can be accommodated by allowing *Prot* to use the *argue*-move again, after *Ant*'s attempt to progress to the concluding stage by maintaining her doubt. Sequential rule S"" allows *Prot* to make an *argue*-move in response to *Ant*'s *maintain_doubt*-move, instead of retracting his standpoint (shown on the left in Figure 6.9). The propositional content of the *argue*-move is new, but the standpoint to which it refers is the same as in the retracted argumentation.

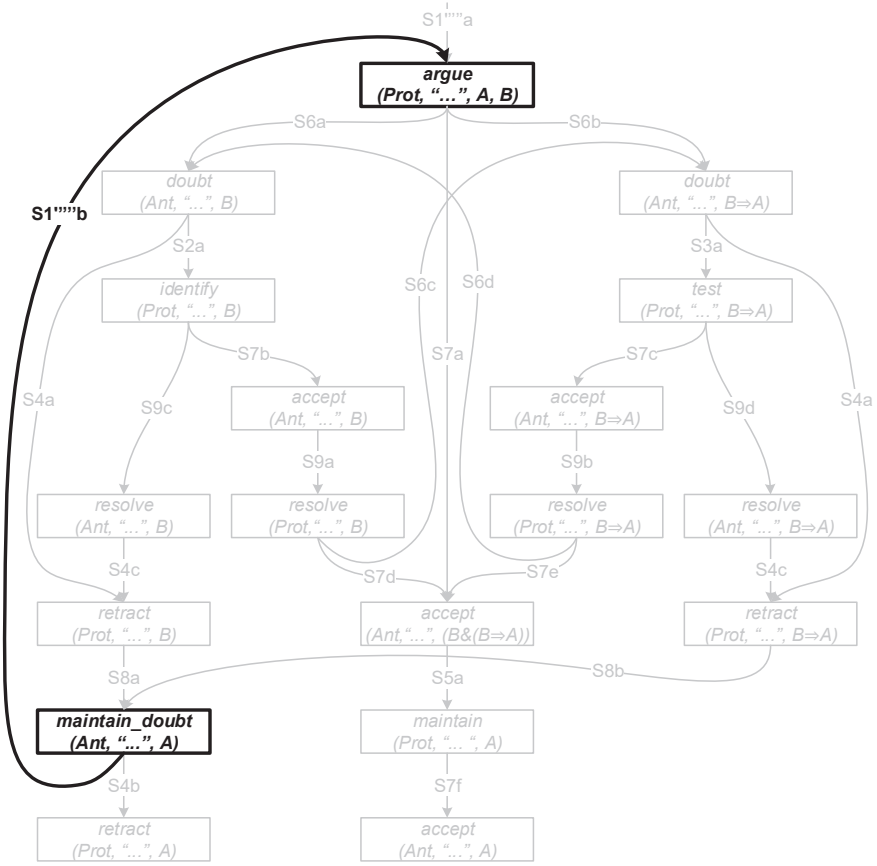

Figure 6.9 *Multiple argumentation in the sequential structure of the dialogue game for critical discussion*

S1'''' *argue(Prot, "…", A, B)* ◀
(a) *null* | *(A* : *initial_expressed_opinion)*
(b) *maintain_doubt(Ant, "...", A)*

6.5 The extended dialogue game CRIT$_3$

In the previous section, I have presented several variants of the sequence rule that regulates the use of the *argue*-move in the dialogue game (S1' to S1''''). The accommodation of complex argumentation in the dialogue game for critical discussion is realised by integrating the different variants into one rule S1 and adding it to the other rules of the dialogue game, thereby replacing S1' in the rules of Section 6.3. Due to the new S1 rule, the *argue*-move becomes a possible reaction to four preceding moves, in addition to the *null* initial situation, as visualised in Figure 6.10.

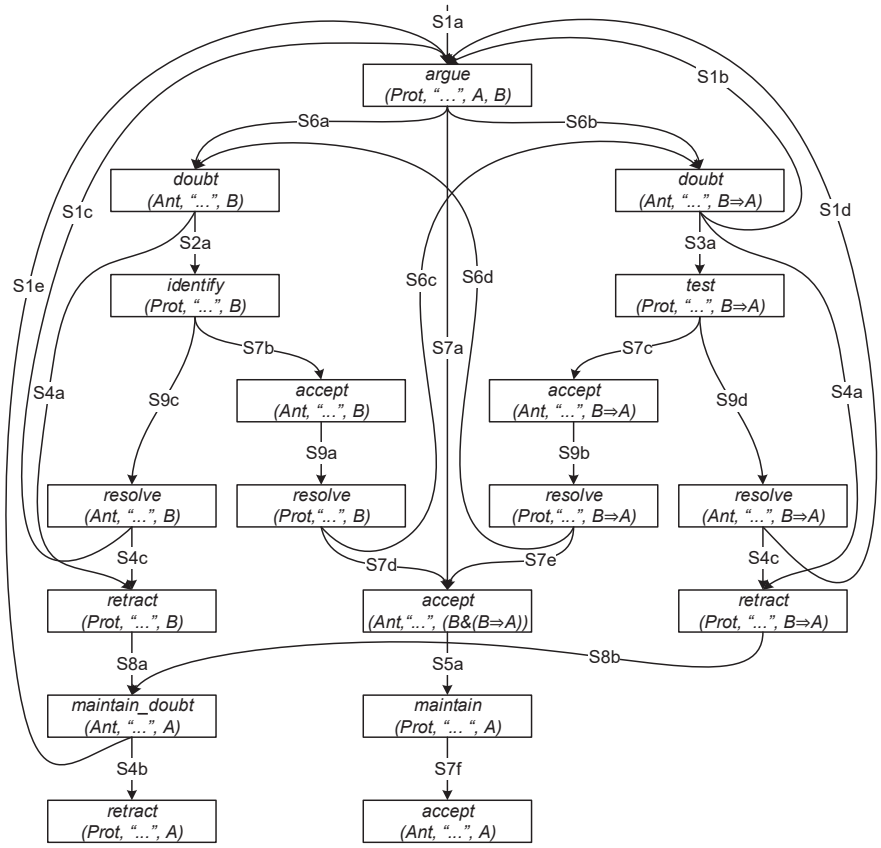

Figure 6.10 *The sequential structure of the dialogue game for critical discussion with complex argumentation*

S1 *argue(Prot, "…", A, B)* ◀
(a) *null* | *(A : initial_expressed_opinion)*
(b) *doubt(Ant, "...", B⇒A)* | *(B : (B&C))*
(c) *resolve(p,"...", A)*
(d) *resolve(p,"...", C⇒D)* | *(A : (C⇒D))*
(e) *maintain_doubt(Ant, "...", A)*

To clarify the relation between the various moves in the extended dialogue game and complex argumentation structures, I will discuss the dialogue of Example 6.2.[74]

74 Although the example can be considered a dialogue reconstruction in terms of the dialogue game, and a corresponding argumentation structure is built up, this should not be confused with a proper pragma-dialectical analysis of an argumentative text (van Eemeren and Grootendorst 1992; van

Example 6.2

(1)	*Prot*:	My argument for we go out for dinner is that the fridge is empty.
(2)	*Ant*:	I doubt whether the fridge is empty is acceptable.
(3)	*Prot*:	I am no longer of the opinion that the fridge is empty.
(4)	*Ant*:	I maintain my doubt about we go out for dinner.
(5)	*Prot*:	My argument for we go out for dinner is that going out for dinner is not unusual.
(6)	*Ant*:	I doubt whether going out for dinner is not unusual is acceptable.
(7)	*Prot*:	I invoke the intersubjective identification procedure to verify the acceptability of going out for dinner is not unusual.
(8)	*Ant*:	I request resolution with respect to going out for dinner is not unusual.
(9)	*Prot*:	My argument for going out for dinner is not unusual is that it is Friday.
(10)	*Ant*:	I doubt whether it is Friday therefore going out for dinner is not unusual is acceptable.
(11)	*Prot*:	My argument for going out for dinner is not unusual is it is Friday and we have no other plans.
(12)	*Ant*:	I accept that it is Friday and we have no other plans and it is Friday and we have no other plans therefore going out for dinner is not unusual.
(13)	*Prot*:	I maintain my standpoint with respect to going out for dinner is not unusual.
(14)	*Ant*:	I accept that going out for dinner is not unusual.
(15)	*Prot*:	I request resolution with respect to going out for dinner is not unusual.
(16)	*Ant*:	I accept that going out for dinner is not unusual and going out for dinner is not unusual therefore we go out for dinner.
(17)	*Prot*:	I maintain my standpoint with respect to we go out for dinner.
(18)	*Ant*:	I accept that we go out for dinner.

Example 6.2 is a complete dialogue played out turn by turn in accordance with the rules of the extended dialogue game. As usual, the two players, *Prot* and *Ant*, have made all the mandatory preparations, such as agreeing on some common material starting points and on a way of checking inferences or reasoning steps. In turn 1, *Prot* commences by making the mandatory *argue*-move (the transition from *null* to this move is highlighted in the graph on the left in Figure 6.11). He puts forward the proposition that 'the fridge is empty' in defence of the proposal of 'we go out for

Eemeren, Grootendorst, Jackson and Jacobs 1993). To improve readability, I have taken some liberty in the formulation of the propositions in the paraphrases of the moves in Example 6.2, but some still sound somewhat unnatural.

dinner'. The structure of *Prot*'s argumentation is single, as is shown in the diagram on the right in Figure 6.11.

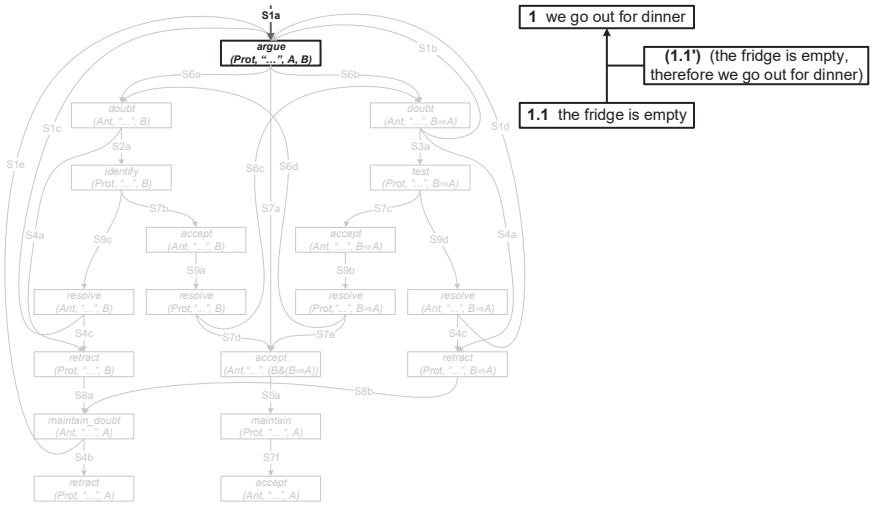

Figure 6.11 *The move and resulting argumentation structure at turn 1 in Example 6.2*

In turn 2, *Ant* casts doubt on the acceptability of 'the fridge is empty'. *Prot* responds in turn 3 by retracting his commitment to 'the fridge is empty'. In turn 4, *Ant* maintains her doubt about the proposal, thereby suggesting to proceed to the concluding stage. *Prot*, nevertheless, has a second argument for the proposal, which he subsequently puts forward in turn 5. In Figure 6.12, this move is shown on the left, with on the right the multiple argumentation structure that is brought about by *Prot*'s suggestion that 'going out for dinner is not unusual' to go out for dinner that night.

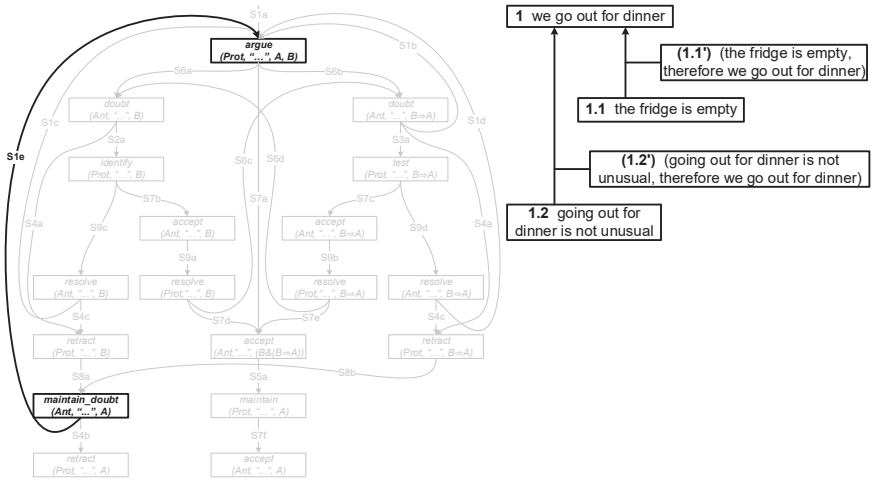

Figure 6.12 *The move and resulting argumentation structure at turn 5 in Example 6.2*

In response to this new argument, *Ant* again casts doubt on the propositional content, in turn 6. *Prot* responds by initiating the intersubjective identification procedure, in turn 7. The procedure returns a negative outcome, giving *Ant* the opportunity in turn 8 to request *Prot* to resolve his position on the basis of the outcome. Instead of retracting his argument again (as he did in turn 3), *Prot* uses the *argue*-move again in turn 9 (see left side of Figure 6.13). The subordinative argument that *Prot* puts forward, 'it is Friday', is added to the diagram of the argumentation structure in Figure 6.13.

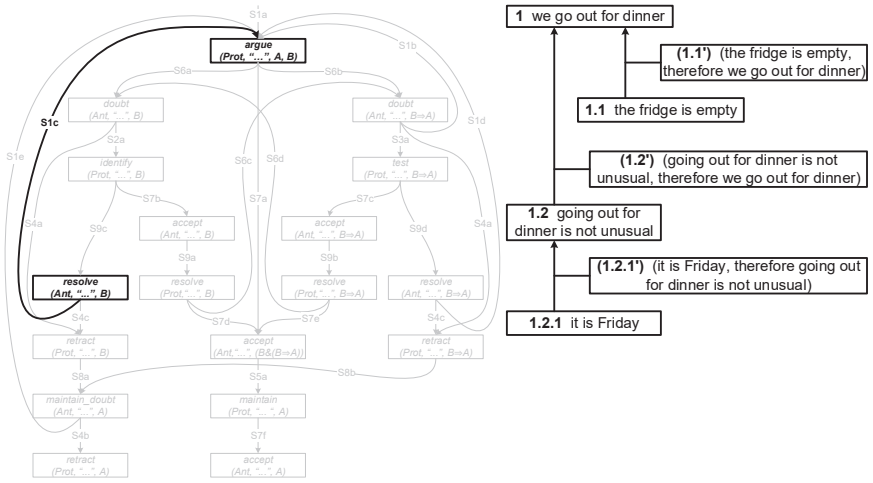

Figure 6.13 *The move and resulting argumentation structure at turn 9 in Example 6.2*

In turn 10, *Ant* attacks the justificatory force of *Prot*'s subordinative argumentation. *Prot* responds in turn 11 by strengthening the defence through the addition that 'we have no other plans'. In doing so, *Prot* does not retract his argumentation and then advance it again in a modified form, rather he adds to the existing argumentation, by going straight to the *argue*-move again, as shown in Figure 6.14. The cumulative argumentation structure this results in is also added to the diagram in Figure 6.14, on the subordinative level. Because the original argumentation was not retracted first, but was expanded, the justificatory force of the argumentation reflects that the two arguments together defend the standpoint (at this subordinative level of the discussion).

This time *Ant* accepts both the propositional content and the justificatory force of the argumentation in turn 12. *Prot* reacts in turn 13 by maintaining his sub-standpoint, which he now conclusively defends (because *Ant* had every opportunity to attack the argumentation, but now accepts it in full). In turn 14, *Ant* has no other choice than to accept the sub-standpoint as well. *Prot* follows up in turn 15 by requesting *Ant* to resolve her position in the main discussion on the basis of the outcome of the sub-discussion. *Ant* does so by accepting the argumentation in the main discussion, in turn 16. Now *Prot* maintains his main standpoint, moving the discussion to the concluding stage. In turn 17, after agreeing that the defence was conclusive, *Ant* accepts the standpoint. She thereby instantiates the end-condition of the dialogue game, such that *Prot* is the winner – they went to a nice restaurant.

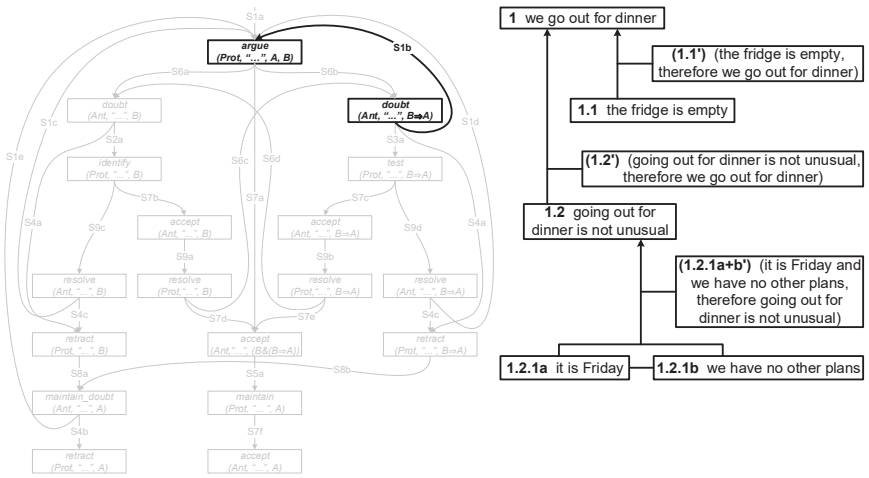

Figure 6.14 *The move and resulting argumentation structure at turn 11 in Example 6.2*

6.6 Conclusion

The main issue addressed in this paper is the accommodation of complex argumentation structures in a dialogue game as a formalisation of the pragma-dialectical ideal model of a critical discussion. In the dialogue of Example 6.2, discussed in the previous section, a complex argumentation structure was built up by following the rules of the dialogue game, as specified in Section 6.3 and Section 6.4. The argumentation structure in the example is a combination of multiple argumentation, subordinative argumentation, and cumulative argumentation, along the lines of the pragma-dialectical interpretation of these complex argumentation structures (see Section 6.2).

In addition to serving as a preparation for computational implementation, formalisation can function as a theoretical means of investigating the original model. This utilisation of formal models has been advocated by Krabbe at several occasions (e.g. 2006, pp. 195-197; Krabbe and Walton 2011, pp. 256-259). As a case in point, Krabbe's (2012) formalisation$_2$ of critical discussion, CD$_1$, is intended as an abstract way of studying the formal properties of the ideal model. Krabbe's formalisation (of the argumentation stage) of critical discussion provided a solid starting point for the dialogue game defined in the current paper. An advantage of the extended dialogue game as defined in Section 6.4 and Section 6.5 over CD$_1$ is that the relation between the moves in the dialogue game and the structure of the argumentation is made explicit. By showing how the different pragma-dialectically distinguished argumentation structures can be accommodated in a dialogue game, the current dialogue game stays closer to the original ideal model than CD$_1$.

It is not easy to determine exactly how Krabbe's system relates to the various argumentation structures. In CD$_1$, the protagonist can put forward one or more propositions at one time in defence of the standpoint. One possibility is to interpret

this as an instance of single argumentation. Characteristic of single argumentation is that the propositional content is put forward at once (not in response to criticism) and that it shares one inferential link to the standpoint at issue. Both of these characteristics seem to be satisfied in the first argumentation-move by the protagonist in CD_1. There is, however, also a good reason not to interpret the argumentation as single. If the protagonist advanced several propositions at once, the antagonist can attack each of them individually. The protagonist can defend against such an attack by providing additional argumentation in support of each of the individual propositions. When this happens, several subordinative lines of argumentation are brought about, in defence of the attacked propositions that formed part of the original argumentation. On the main level, this means that the propositions need to be represented individually, while still sharing one inferential link. The resulting argumentation structure on the main level is therefore more akin to some form of coordinatively compound argumentation than to single argumentation.[75]

In addition to, or instead of, attacking the propositions of the argumentation, in CD_1, the antagonist can attack its inferential link. The protagonist can only defend the argumentation against such an attack by initiating the intersubjective testing procedure. This means that subordinative argumentation in defence of the justificatory force is not accommodated by CD_1. The same appears to hold for cumulative argumentation – at least when Snoeck Henkemans' (1992, pp. 96-97) interpretation is followed of cumulative argumentation; emerging in response to sufficiency criticism directed at the justificatory force of the argumentation. In Section 6.4, I have shown how the various pragma-dialectically distinguished argumentation structures are accommodated in the extended dialogue game for critical discussion. In this respect, the dialogue game proposed in this paper seems to be a step closer to a representative formalisation of the pragma-dialectical ideal model.

75 The protagonist can also initiate the intersubjective identification procedure in CD1 to defend against attacks to the propositional content of the argumentation, but this does not affect the argumentation structure, and is therefore not mentioned here.

Chapter 7

Conclusion

7.1 Main findings

The rationale for the study reported on in this dissertation was that it would be useful to prepare a theoretical foundation for the development of computer tools to support a pragma-dialectical analysis of argumentation. This rationale was given shape by formalising the ideal model of a critical discussion that is central to the pragma-dialectical method of analysis. To achieve this, five research questions were to be answered. The first two research questions pertained to the explorative aim of choosing an adequate approach to the formalisation of the model. The three remaining research questions pertained to the synthetic aim of the study: actually developing the formalisation in line with the chosen approach. In the current section, I will reflect on the results of addressing these five research questions, and on how these results relate to the rationale and aims of the study.

Research Question 1, "How can formalising the pragma-dialectical ideal model of a critical discussion best be approached?", was addressed in Chapter 2, 'Towards computer support for pragma-dialectical argumentation analysis'. The adequacy of the approach depends on the function that the formalisation is to serve. Therefore, I looked into existing computational tools for argumentative tasks, and the potential use of such tools in support of the pragma-dialectical method of analysing argumentation. In a procedural interpretation of this analytical method, it was shown that the ideal model plays a crucial role as a heuristic instrument in the reconstruction and abstraction sub-tasks of the analysis. Computer support for the pragma-dialectical analysis, therefore, has to be based on the ideal model in one way or another. To facilitate the computational implementation of the model, an incremental approach to its formalisation was outlined. A dialogue game as a formalisation of the ideal model was to be developed in a step-by-step fashion, starting from a simplified, elementary case, on the basis of which more complex features could be introduced in subsequent increments.

Research Question 2, "Does the proposed way of formalising the pragma-dialectical discussion model indeed facilitate a connection to computational approaches?", was addressed in Chapter 3, 'Formalisation of critical discussion as a link to computational models of argumentation'. In this chapter the relation between the pragma-dialectical discussion model and the computational Argument Interchange Format (AIF) was explored. First, several notions central to the pragma-dialectical model were translated into AIF terms. Next, the pragma-dialectical discussion procedure was tentatively formalised as a dialogue protocol, constituting a definition of the moves and sequential structure of a provisional dialogue game. On the basis of

this dialogue protocol, some representative examples of discussion moves, and of the transitions between them, were translated into AIF terms. By means of the translations, the link between the formalisation of critical discussion and computational modelling was exemplified.

Research Question 3, "How can the dialectical dimension of critical discussion be accounted for in a formalisation of the pragma-dialectical ideal model in terms of a dialogue game?", was addressed in Chapter 4, 'A basic dialogue game for critical discussion (CRIT$_1$)'. As the starting point for the incremental approach to developing a dialogue-game-formalisation of the pragma-dialectical ideal model, a basic dialogue game for critical discussion CRIT$_1$ was defined. Several restrictions with respect to the original ideal model were introduced in order to simplify the dialogue game and obtain an elementary starting point. Five categories of rules are used to define the dialogue game. The commencement rules specify the initial state of the dialogue game, i.e. the conditions under which it starts. The move rules provide a set of possible moves that players of the game can make. The commitment rules define for each move which operations on the players' commitment stores it effectuates. The sequence rules regulate the sequences of moves that are sanctioned within the dialogue game. The termination rule specifies the conditions under which the game ends. Because the rules of CRIT$_1$ (see Appendix A.1) are based on the fifteen rules of the ideal model that regulate the dialectical procedure of a critical discussion, the dialectical dimension of the ideal model is accounted for in this basic dialogue game.

Research Question 4, "How can the speech act perspective of critical discussion be accommodated in the dialogue game?", was addressed in Chapter 5, 'Speech acts in the dialogue game for critical discussion (CRIT$_2$)'. In the ideal model, discussion moves are prototypically realised by means of specific speech acts. The move rules of the dialogue game are therefore amended to reflect the corresponding speech acts. All the moves in the extended dialogue game CRIT$_2$ are based on the speech acts as they are distributed over the discussion stages of the ideal model. All of the speech acts are associated with felicity conditions that have to be fulfilled in order for the speech act to be performed felicitously. These felicity conditions are reflected in the extended dialogue game as part of the commitment rules. By making a move in CRIT$_2$, players become committed to propositions declaring the acceptability of the felicity conditions that are associated with the speech act that the move corresponds to (albeit that, in CRIT$_2$, only those felicity conditions that are dialectically relevant for the discussion are taken into account). By revising the move rules and the commitment rules of the dialogue game on the basis of the role of speech acts, and their felicity conditions, in the ideal model, the speech act perspective is accounted for in CRIT$_2$ (see Appendix A.2).

Research Question 5, "How can complex argumentation be accommodated in the dialogue game for critical discussion?", was addressed in Chapter 6, 'Argumentation structures in the dialogue game for critical discussion (CRIT$_3$)'. In the pragma-dialectical approach, four main types of argumentation structure are distinguished. Single argumentation is the elementary form, in which only one argument is advanced. In reaction to various kinds of criticism, the argumentation structure can become more complex. Depending on the kind of criticism responded to, this

leads to a multiple, a subordinatively compound, or a coordinatively compound structure. Because the three types of complex argumentation structure depend on the advancement of additional argumentation in response to different kinds of criticism, in the dialogue game, complex argumentation is related to the sequence rules. The sequence rules, namely, regulate which preceding moves may be responded to with an *argue*-move to advance additional argumentation. It is shown how the addition of several moves by the antagonist-player to the set of preceding moves in response to which the protagonist-player can make an *argue*-move, allows the construction of complex argumentation structures in the dialogue game. The definition of sequence rules corresponding to each of the (complex) argumentation structures distinguished in the pragma-dialectical theory results in the extended dialogue game CRIT$_3$ (see Appendix A.3).

The first two research questions pertain to the first aim of the study, "Approach to the formalisation of the pragma-dialectical model". The formalisation of the pragma-dialectical ideal model was approached by developing a dialogue game for critical discussion. This dialogue game was developed in an incremental way, to gradually bring the formalisation closer to the full scope of features of the original ideal model. The adequacy of the dialogue-game-formalisation as preparation for the computational implementation of the model was supported by an indicative translation in terms of the computational Argument Interchange Format.

The last three research questions pertain to the second aim of the study, "Development of a dialogue game as a formalisation of the pragma-dialectical model". In answering the research questions, three versions of the dialogue game for critical discussion were developed. The first, CRIT$_1$, is to serve as a simplified foundation for the incremental development of more extensive formalisations. CRIT$_2$ extends the dialogue game through the introduction of a speech acts perspective. Next, in CRIT$_3$, the dialogue game rules are extended further, to accommodate complex argumentation. CRIT$_3$ can in turn serve as the basis for further extensions and revisions of the dialogue game for critical discussion. In the next section, some of the limitations of the dialogue games defined as part of this dissertation are discussed, and some further developments are suggested.

7.2 Implications of the study

As part of this study, five dialogue games were defined in some form. Four of these were proposed as (provisional) formalisations of the pragma-dialectical ideal model, while one only served an explanatory purpose in the procedural interpretation of the pragma-dialectical method of analysis (see DISC in Chapter 2, Section 2.3). In Chapter 3, the first of the four dialogue games based on the ideal model or a critical discussion was introduced. This provisional dialogue game was used to illustrate the potential for the computational representation of the pragma-dialectical model and is not part of the series of dialogue games incrementally devised to formally approximate the ideal model (see Chapter 2, Section 2.4). In the next three chapters, three

dialogue games were defined as part of the incremental formalisation of the ideal model.

In Figure 7.1, the structures are reproduced side by side of CRIT_1, the basic dialogue game developed in Chapter 4, and of CRIT_2 and CRIT_3, the two extensions developed in Chapter 5 and 6. The visualisations of the structures appear in their original (fully readable) size in the respective chapters. Here they appear side by side to demonstrate the gradual increase of the complexity of the dialogue games. On the left, the structure of CRIT_1 is limited to the dialectical dimension of the argumentation stage of critical discussion. In the middle, the structure of CRIT_2 shows the extension of the dialogue game to account for the concluding stage of critical discussion and to reflect the pragmatic dimension of the ideal model, i.e. the speech act perspective. In CRIT_3, on the right, the sequential structure was extended further to account for complex argumentation structures.

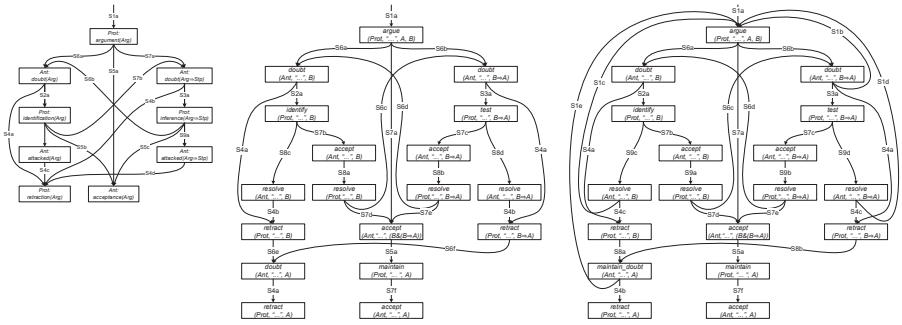

Figure 7.1 *Visualisation of the sequential structures of* CRIT_1, CRIT_2, *and* CRIT_3

The accommodation of the pragmatic dimension of the ideal model is an important difference between the dialogue game CRIT_1, and CRIT_2 and CRIT_3. In CRIT_1, the rules for moves and commitments are based strictly on a dialectical interpretation of critical discussion, whereas those in CRIT_2 and CRIT_3 also reflect the role that speech acts play in the ideal model. An advantage of the speech act perspective is that the commitments that result from discussion moves are made explicit. This explicitisation of (implicit) commitments provides a foundation for the commitment rules in the dialogue game.

The rationale behind the accommodation of speech acts in the dialogue game is to implement the speech act perspective in the move rules and the commitment rules, leaving the other three categories of rules unaffected. In this way, the modelling of speech acts is independent from the sequential structure and the purpose of the dialogue game. The approach results in a general definition of speech-act-based moves that can in principle also be used in other dialogue games (modelling, e.g., consultation, or negotiation). Although in the rules of CRIT_2 and CRIT_3 only the dialectically relevant commitments are taken into account, in a further extension, all of the felicity conditions associated with the various speech act can be accounted for.

Two aspects of van Eemeren and Grootendorst's (1984, pp. 19-39) version of Speech Act Theory are not incorporated in the dialogue game.

First, van Eemeren and Grootendorst's (1984, pp. 32-35) introduction of the notion of a speech act complex is a vital amendment to Searle's (1969; 1976) Speech Act Theory. Advancing argumentation (van Eemeren and Grootendorst 1984, pp. 39-46) and standpoints (Houtlosser 1994) are considered speech act complexes situated at the textual level. The complexes are constituted by assertive elementary speech acts at the sentence level. Whether an assertive is merely an elementary speech act or forms part of a speech act complex, is determined in retrospect (*ex post facto*) on the basis of the functional relations between speech acts. This retrospective approach, in which the membership of a speech act complex may depend on the future performance of other speech acts in the same dialogue, poses a problem to the dialogue game. In the current dialogue game, the moves are all elementary. When going further into the representation of speech act complexes in the dialogue game, a starting point may be found in the way textual relations are modelled in Inference Anchoring Theory (Budzynska and Reed 2011).

Second, in the classification of the types of speech acts instrumental in the four stages of a critical discussion, van Eemeren and Grootendorst make use of illocutionary connectives, such as illocutionary negation (Searle 1969, p. 32). However, since in the dialogue game all moves are treated as elementary, the illocutionary connectives are not accommodated. For example, in the dialogue games CRIT$_2$ and CRIT$_3$, retracting a standpoint or retracting argumentation have been modelled in terms of an elementary move *retract(…)*. In the ideal model of a critical discussion, however, the corresponding move is realised by means of the illocutionary negation of an assertive (van Eemeren and Grootendorst 1984, p. 101). In exploring the relation between illocutionary connectives and the dialogue game, Searle and Vanderveken's (1985; Vanderveken 1991) formalisation of Speech Act Theory as a system of Illocutionary Logic could prove to be a natural starting point.

Further developments and extensions of the dialogue game for critical discussion are also needed to reverse the remaining restrictions that were imposed at the introduction of the basic dialogue game CRIT$_1$ (see Sections 4.3, 5.4, and 6.3). By systematically addressing each of the simplifications (as was done when developing CRIT$_2$ and CRIT$_3$), the dialogue game can gradually be brought closer to the ideal model. On the basis of the dialogue games developed in this dissertation, the two remaining discussion stages of the ideal model – the confrontation stage and the opening stage – can be added through extensions of the dialogue game rules.

As part of an extension of the dialogue game to account for the confrontation stage, negative standpoints (van Eemeren and Grootendorst 1984, pp. 78-84; Houtlosser 1991) and mixed differences of opinion (with two contradictory standpoints) can be accommodated. The accommodation of negative standpoints should be accompanied by an account of refutatory argumentation (to argue that a proposition or an inferential link are not acceptable, i.e. counter-arguments). The accommodation of negative standpoints and refutatory argumentation will also result in the introduction of the complementary coordinatively compound argumentation structure that was left out in CRIT$_3$ (see Section 6.4). The extension with negative

standpoints and refutatory argumentation is of particular interest from the perspective of the computational modelling of argumentation. Especially comparisons with Pollock's (1987) distinction between undercutting and rebutting defeaters and with the relations of argumentative attack in Dung's (1995) abstract argumentation frameworks then become pertinent.

Another simplification that is to be addressed as part of the extensions of the dialogue game for critical discussion is the exclusion of the logical dimension and the rhetorical dimension of the ideal model. In this dissertation, the nature of the inferences underpinning the reasoning in argumentation has not been specified. In particular, the relation between, on the one hand, the logical dimension of inference and argument schemes (van Eemeren and Grootendorst 1992; Garssen 2002), and, on the other hand, the dialogue game, should be examined further (see Reed and Walton 2007).

The rhetorical dimension of the ideal model is concerned with the strategic manoeuvring of the discussants and the influence of the institutional context on the discussion (van Eemeren 2010). In the dialogue game, the rhetorical dimension has not been taken into account. The contextual influence can be accounted for by amending the rules to reflect the specific institutional pre-conditions for argumentative practices in particular argumentative activity types. It may be possible to model the strategic manoeuvring of discussants by using mechanisms from game theory (see Rahwan and Larson 2009).

As a result of the declared objective of this dissertation as a preparation for the computational application of the pragma-dialectical theory, not much attention was paid to the relation between the developed dialogue games and existing computational dialogue models. Because these computational models are not based on the pragma-dialectical model, they are, as a matter of fact, not a suitable foundation for the development of computer tools to support the pragma-dialectical analysis of argumentation. However, the dialogue game for critical discussion can also be interpreted as a contribution to the formal and computational modelling of argumentative dialogue in general. From this perspective, a comparison between the dialogue game for critical discussion and existing computational models of argumentative dialogue becomes relevant (see Toniolo 2016).

In contribution to the computational perspective, the dialogue games for critical discussion can serve as a theoretical foundation for dialogue protocols in multi-agent systems (Walton and Godden 2006) – computer systems in which several autonomous computational or human 'agents' interact, often to solve complex problems. Important for these protocols are the exclusion of fallacious moves and the naturalness of the dialogue, especially if some of the agents that participate in the system are human. The dialogue game is a formalisation of the pragma-dialectical ideal model, the problem-solving validity of which is intended to prevent fallacies from occurring (van Eemeren and Grootendorst 1988), whereas its inter-subjective validity lends it an empirically tested conventionality (van Eemeren, Garssen, and Meuffels 2009). Additionally, the combination of the pragmatic dimension and the dialectical dimension effectuates an inherent connection between dialogue and reasoning, which is one of the challenges in the development of computational models of argumentative dialogue (Reed, 2010).

Appendix A.1

The rules of CRIT$_1$

Commencement

B1 $Stp \in \mathcal{L}$
B2 $Players = \{Ant, Prot\}$
B3 $SP \neq \emptyset$

Moves

M1 *argue(Arg)*
M2 *identify(Arg)*
M3 *infer(Arg⇒Stp)*
M4 *retract(Arg)*
M5 *accept(Arg)*
M6 *doubt(Arg)*
M7 *doubt(Arg⇒Stp)*
M8 *attacked(Arg)*
M9 *attacked(Arg⇒Stp)*

Commitments

C1 $CS_{Prot} = SP \cup \{Stp\}$
C2 $CS_{Ant} = SP$
C3 *argue(Arg)* » $CS_{Prot} = CS_{Prot} \cup \{Arg, Arg⇒Stp\}$
C4 *retract(Arg)* » $CS_{Prot} = CS_{Prot} - \{Arg, Arg⇒Stp\}$
C5 *accept(Arg)* » $CS_{Ant} = CS_{Ant} \cup \{Arg, Arg⇒Stp\}$

Sequences

S1 *argue(Arg)* ◀
(a) *null* | (*Arg* ≠ *Stp*)
S2 *identify(Arg)* ◀
(a) *doubt(Arg)*
S3 *infer(Arg⇒Stp)* ◀
(a) *doubt(Arg)*
S4 *retract(Arg)* ◀
(a) *doubt(Arg)*
(b) *doubt(Arg⇒Stp)*
(c) *attacked(Arg)*
(d) *attacked(Arg⇒Stp)*
S5 *accept(Arg)* ◀
(a) *argue(Arg)*
(b) *identify(Arg)* | (*Arg* ∈ *SP*)
(c) *infer(Arg⇒Stp)* | (*Arg*⊢*Stp*)
S6 *doubt(Arg)* ◀
(a) *argue(Arg)*
(b) *infer(Arg⇒Stp)* | (*Arg*⊢*Stp*)
S7 *doubt(Arg⇒Stp)* ◀
(a) *argue(Arg)*
(b) *identify(Arg)* | (*Arg* ∈ *SP*)
S8 *attacked(Arg)* ◀
(a) *identify(Arg)* | (*Arg* ∉ *SP*)
S9 *attacked(Arg⇒Stp)* ◀
(a) *infer(Arg⇒Stp)* | (*Arg*⊬*Stp*)

Termination

T1 Whenever a move *retract(Arg)* or *accept(Arg)* is made, then:
if *Arg* ∉ CS_{Prot}, *winner* = *Ant*,
if *Arg⇒Stp* ∈ CS_{Ant}, *winner* = *Prot*

Appendix A.2

The rules of CRIT$_2$

Commencement

B1 *initial_expressed_opinion* $\in \mathcal{L}$
B2 *Players* = {*Prot*, *Ant*}
B3 $SP \neq \emptyset$

Moves

M1 *argue(Prot, "My argument for ... is ...", A, B)*
M2 *identify(Prot, "I invoke the intersubjective identification procedure to verify the acceptability of ...", A)*
M3 *test(Prot, "I invoke the intersubjective testing procedure to verify the acceptability of ...", A⇒B)*
M4 *retract(Prot, "I am no longer of the opinion that ...", A)*
M5 *maintain(Prot, "I maintain my standpoint with respect to ...", A)*
M6 *doubt(Ant, "I doubt whether ... is acceptable", A)*
M7 *accept(Ant, "I accept that ...", A)*
M8 *resolve(p,"I request resolution with respect to ...", A)*

Commitments

C1 $CS_{Prot,0} = SP \cup \{initial\_expressed\_opinion\}$
C2 $CS_{Ant,0} = SP$
C3 *argue(Prot, "…", A, B)* » $CS_{Prot,t} = CS_{Prot,t-1} \cup \{B, B \Rightarrow A\}$
C4 *retract(Prot, "…", A)* » $CS_{Prot,t} = CS_{Prot,t-1} - \{A\}$
C5 *accept(Ant, "…", A)* » $CS_{Ant,t} = CS_{Ant,t-1} \cup \{A\}$

Sequences

S1 *argue(Prot, "…", A, B)* ◀
(a) *null* | (*A* : *initial_expressed_opinion*)
S2 *identify(Prot, "...", A)* ◀
(a) *doubt(Ant, "...", A)* | ((*A*⇒*B)* ∈ $CS_{Prot,t}$)
S3 *test(Prot, "...", A⇒B)* ◀
(a) *doubt(Ant, "...", A⇒B)*
S4 *retract(Prot, "...", A)* ◀
(a) *doubt(Ant, "...", A)*
(b) *resolve(Ant, "...", A)*
S5 *maintain(Prot, "... ", A)* ◀
(a) *accept(Ant, "...", B&(B⇒A))*
S6 *doubt(Ant, "...", A)* ◀
(a) *argue(Prot, "…", B, A)*
(b) *argue(Prot, "…", B, C)* | (*A* : *(C⇒B)*)
(c) *resolve(Prot,"...", B)* | ((*B⇒C)* ∈ $CS_{Prot,t}$; *A* : *(B⇒C)*)
(d) *resolve(Prot,"...", A⇒B)*
(e) *retract(Prot, "...", B)* | ((*B⇒A)* ∈ $CS_{Prot,t}$)
(f) *retract(Prot, "...", B⇒A)*
S7 *accept(Ant, "...", A)* ◀
(a) *argue(Prot,"...", B, C)* | (*A* : *(C&(C⇒B)))*
(b) *identify(Prot, "...", A)* | (*A* ∈ *SP*)
(c) *test(Prot, "...", B⇒C)* | (*B*⊢*C*; *A* : *(B⇒C)*)
(d) *resolve(Prot,"...", B)* | ((*B⇒C)* ∈ $CS_{Prot,t}$; *A* : *(B&(B⇒C)))*
(e) *resolve(Prot,"...", B⇒C)* | (*A* : *(B&(B⇒C)))*
(f) *maintain(Prot, "... ", A)*
S8 *resolve(p,"...", A)* ◀
(a) *accept(Ant, ..., A)* | (*p* : *Prot*)
(b) *accept(Ant, ..., B⇒C)* | (*A* : *B⇒C*; *p* : *Prot*)
(c) *identify(Prot, "...", A)* | (*A* ∉ *SP*; *p* : *Ant*)
(d) *test(Prot, "...", B⇒C)* | (*B*⊬*C*; *A* : *(B⇒C)* ; *p* : *Ant*)

Termination

T1 Whenever a move *retract(p, "…", A)* or *accept(p, "…", A)* is made in turn *t*, then:

if *A* = *initial_expressed_opinion*, then:
if *A* ∈ $CS_{Ant,t}$, *winner* = *Prot*,
otherwise: *winner* = *Ant*;
otherwise:
continue playing the game with the next move

Appendix A.3

The rules of CRIT$_3$

Commencement

B1	*initial_expressed_opinion* $\in \mathcal{L}$
B2	*Players* = {*Prot*, *Ant*}
B3	$SP \neq \emptyset$

Moves

M1	*argue(Prot, "My argument for ... is that ...", A, B)*
M2	*identify(Prot, "I invoke the intersubjective identification procedure to verify the acceptability of ...", A)*
M3	*test(Prot, "I invoke the intersubjective testing procedure to verify the acceptability of ...", A⇒B)*
M4	*retract(Prot, "I am no longer of the opinion that ...", A)*
M5	*maintain(Prot, "I maintain my standpoint with respect to ...", A)*
M6	*doubt(Ant, "I doubt whether ... is acceptable", A)*
M7	*accept(Ant, "I accept that ...", A)*
M8	*maintain_doubt(Ant, "I maintain my doubt about ...", A)*
M9	*resolve(p,"I request resolution with respect to ...", A)*

Commitments

C1	$CS_{Prot,0} = SP \cup \{initial\_expressed\_opinion\}$
C2	$CS_{Ant,0} = SP$
C3	*argue(Prot, "…", A, B)* » $CS_{Prot,t} = CS_{Prot,t-1} \cup \{B, B \Rightarrow A\}$
C4	*retract(Prot, "…", A)* » $CS_{Prot,t} = CS_{Prot,t-1} - \{A\}$
C5	*accept(Ant, "…", A)* » $CS_{Ant,t} = CS_{Ant,t-1} \cup \{A\}$

Sequences

S1 *argue(Prot, "…", A, B)* ◀
(a) *null* | *(A : initial_expressed_opinion)*
(b) *doubt(Ant, "...", B⇒A)* | *(B : (B&C))*
(c) *resolve(p,"...", A)*
(d) *resolve(p,"...", C⇒D)* | *(A : (C⇒D))*
(e) *maintain_doubt(Ant, "...", A)*

S2 *identify(Prot, "...", A)* ◀
(a) *doubt(Ant, "...", A)* | *((A⇒B) ∈ $CS_{Prot,t}$)*

S3 *test(Prot, "...", A⇒B)* ◀
(a) *doubt(Ant, "...", A⇒B)*

S4 *retract(Prot, "...", A)* ◀
(a) *doubt(Ant, "...", A)*
(b) *maintain_doubt(Ant, "...", A)*
(c) *resolve(Ant, "...", A)*

S5 *maintain(Prot, "... ", A)* ◀
(a) *accept(Ant, "...", B&(B⇒A))*

S6 *doubt(Ant, "...", A)* ◀
(a) *argue(Prot, "…", B, A)*
(b) *argue(Prot, "…", B, C)* | *(A : (C⇒B))*
(c) *resolve(Prot,"...", B)* | *((B⇒C) ∈ $CS_{Prot,t}$; A : (B⇒C))*
(d) *resolve(Prot,"...", A⇒B)*

S7 *accept(Ant, "...", A)* ◀
(a) *argue(Prot,"...", B, C)* | *(A : (C&(C⇒B)))*
(b) *identify(Prot, "...", A)* | *(A ∈ SP)*
(c) *test(Prot, "...", B⇒C)* | *(B⊢C; A : (B⇒C))*
(d) *resolve(Prot,"...", B)* | *((B⇒C) ∈ $CS_{Prot,t}$; A : (B&(B⇒C)))*
(e) *resolve(Prot,"...", B⇒C)* | *(A : (B&(B⇒C)))*
(f) *maintain(Prot, "... ", A)*

S8 *maintain_doubt(Ant, "...", A)* ◀
(a) *retract(Prot, "...", B)* | *((B⇒A) ∈ $CS_{Prot,t}$)*
(b) *retract(Prot, "...", B⇒A)*

S9 *resolve(p,"...", A)* ◀
(a) *accept(Ant, ..., A)* | *(p : Prot)*
(b) *accept(Ant, ..., B⇒C)* | *(A : B⇒C; p : Prot)*
(c) *identify(Prot, "...", A)* | *(A ∉ SP; p : Ant)*
(d) *test(Prot, "...", B⇒C)* | *(B⊬C; A : (B⇒C) ; p : Ant)*

Termination

T1 Whenever a move *retract(p, "…", A)* or *accept(p, "…", A)* is made in turn *t*, then:

if A = *initial_expressed_opinion*, then:

if $A \in CS_{Ant,t}$, *winner* = *Prot*,

otherwise: *winner* = *Ant*;

otherwise:

continue playing the game with the next move

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Samenvatting [Dutch summary]

Een dialoogspel voor kritische discussie

Een grondslag voor de formalisering en computerisering van het pragma-dialectische argumentatiemodel

In de loop van de afgelopen twintig jaar is het gebruik van computationele methoden binnen de argumentatieleer gestaag toegenomen. Het resulterende onderzoeksveld van de 'computationele argumentatieleer' is echter nog niet zover dat een volledige automatisering van argumentatieanalyse mogelijk is. Wel worden er steeds meer kleinere computerprogramma's ter ondersteuning van menselijke analysatoren ontwikkeld. Zo is het mogelijk om met behulp van een computerprogramma de structuur van argumentatie visueel weer te geven als een diagram met een uniforme opmaak. Een ander voorbeeld van dit soort computationele hulpmiddelen is de 'argument mining'-technologie, waarmee kwantitatief onderzoek gedaan kan worden met grote corpora van argumentatieve teksten.

Doordat elke argumentatietheorie een eigen conceptueel raamwerk heeft, met een eigen onderliggende filosofie en modellen, zijn computerprogramma's gebaseerd op een specifieke theorie niet zondermeer bruikbaar binnen een andere theoretische benadering. De rationale achter het onderzoek waarvan in dit proefschrift verslag gedaan wordt, is dat een formele voorbereiding van de pragmadialectische argumentatietheorie de ontwikkeling mogelijk maakt van computerhulpmiddelen ter ondersteuning van de analyse van argumentatief taalgebruik. Het gebruik van de pragmadialectische methode voor argumentatieanalyse is wijdverbreid, en de methode is gebaseerd op een theorie die gedurende de afgelopen vier decennia steeds verder verfijnd is. Hoewel computerprogramma's langzaamaan niet meer weg te denken zijn uit de gereedschapskist van veel argumentatietheoretici, is zulk gereedschap specifiek toegespitst op de pragmadialectische theorie nog niet beschikbaar.

Aan de basis van de pragmadialectische analysemethode ligt het ideaalmodel van een kritische discussie. Dit model doet dienst als heuristisch instrument in de reconstructie van de relevante delen van een te analyseren tekst. Door deze centrale functie, vormt het ideaalmodel van een kritische discussie een goed fundament voor de ontwikkeling van softwarematige hulpmiddelen

ter ondersteuning van de pragmadialectische analyse van argumentatief taalgebruik. Dit leidt tot de twee doelstellingen van het huidige onderzoek. De eerste doelstelling is exploratief van aard en behelst de methode die gebruikt wordt in de fundamentele voorbereiding van het discussiemodel ten behoeve van latere computationele toepassing. De tweede doelstelling is synthetisch van aard en betreft de feitelijke totstandbrenging van de fundamentele voorbereiding.

Het treffen van voorbereidingen voor de ontwikkeling van analytische software-hulpmiddelen op basis van de pragmadialectische theorie kan beschouwd worden als een stap op een pad dat leidt van filosofisch ideaal naar computerprogramma. Het computerprogramma is immers een toepassing van een computationeel argumentatiemodel, dat een implementatie vormt van een formeel argumentatiemodel. Het formele model is een benadering van een theoretisch model, dat gebaseerd is op een filosofisch ideaal. Op dit pad bevindt het pragmadialectische ideaalmodel zich tussen het theoretische en het formele model in. Door middel van de formalisering die onderdeel vormt van het realiseren van de tweede doelstelling van dit proefschrift, wordt het model een stap dichter in de richting van de computationele implementatie en toepassing gebracht.

Het pragmadialectische model kan ook in de huidige vorm al formeel genoemd worden, in twee betekenissen van het woord. Allereerst is het model niet slechts toegespitst op het resultaat van een argumentatieve discussie, maar neemt het de procedure daarnaartoe in ogenschouw. Daarnaast is het geen empirische beschrijving van de daadwerkelijke argumentatieve praktijk, maar een normatief voorstel voor een ideale procedure voor het redelijk oplossen van meningsverschillen. In het huidige proefschrift wordt het model op een derde manier formeel gemaakt: door de definitie van de talige vormen die gebruikt kunnen worden om discussiezetten te doen en de manier waarop deze gecombineerd kunnen worden.

De beoogde formalisering wordt gerealiseerd door middel van de definitie van een dialoogspel voor kritische discussie. In een dialoogspel wordt talige interactie gemodelleerd in termen van een spel dat twee (of meer) gesprekspartners spelen. Het dialoogspel voor kritische discussie is gedefinieerd met behulp van vijf categorieën van spelregels. In de aanvangsregels wordt de uitgangssituatie van het spel bepaald. In de zettenregels wordt uiteengezet welke zetten er tijdens het spel gedaan kunnen worden. In de gebondenheidsregels wordt gedefinieerd welke dialogische gebondenheden voortvloeien uit gedane zetten. In de opeenvolgingsregels wordt voor elke zet bepaald onder welke omstandigheden deze gedaan kan worden. In de afsluitingsregel wordt vastgelegd wanneer het spel eindigt en hoe winst en verlies bepaald worden.

Om na te gaan of de voorgestelde formaliseringsaanpak daadwerkelijk de beoogde verbinding met het computationeel modelleren van argumentatie bevordert, is een preliminaire formalisering deels vertaald in termen van het computationele Argument Interchange Format. Deze exploratieve vertal-

ing geeft een goede indicatie van de beoogde verbinding en vergemakkelijkt de vergelijking met bestaande computationele argumentatiemodellen.

Het bereiken van de synthetische doelstelling van het onderzoek is gerealiseerd door de ontwikkeling van een dialoogspel dat een formalisering vormt van het pragmadialectische ideaalmodel. Het dialoogspel is stapsgewijs ontwikkeld, beginnend met een vereenvoudigd dialoogspel dat vervolgens uitgebreid kan worden om zo een steeds completere formalisering op te bouwen. Met iedere uitbreiding wordt de formele benadering dichter bij de volledige reikwijdte van het pragmadialectische ideaalmodel gebracht.

Om dienst te doen als het uitgangspunt van de stapsgewijze ontwikkeling is een basaal dialoogspel voor kritische discussie, CRIT$_1$, gedefinieerd. Het dialoogspel is op verschillende manieren vereenvoudigd ten opzichte van het ideaalmodel, wat een formalisering oplevert van een zeer beperkte interpretatie daarvan. Slechts enkele karakteristieken van het veelzijdige ideaalmodel worden in CRIT$_1$ in ogenschouw genomen. De specifieke karakteristieken zijn gekozen omdat ze de kern van een kritische discussie vormen.

Van de vier discussiefasen van het ideaalmodel wordt in CRIT$_1$ alleen de argumentatiefase in ogenschouw genomen, terwijl er voorlopig nog geabstraheerd wordt van de confrontatiefase, de openingsfase en de afsluitingsfase. Om de samenhang van het model te waarborgen worden bepaalde resultaten van de drie overige discussiefasen in de spelregels van CRIT$_1$ voorondersteld. Ten gevolge van de vereenvoudigende vooronderstellingen blijven de discussiemogelijkheden in CRIT$_1$ beperkt tot het oplossen van een meningsverschil over één positief standpunt dat in twijfel getrokken is, door middel van het naar voren brengen van één argument gebaseerd op een propositie-logische gevolgtrekking.

De spelregels van CRIT$_1$ zijn gebaseerd op de vijftien pragmadialectische procedureregels voor het redelijk oplossen van meningsverschillen. Deze vijftien regels voor kritische discussie zijn typerend voor de dialectische dimensie van het pragmadialectische discussiemodel. De pragmatische dimensie (het taalhandelingsperspectief), de logische dimensie (de redeneringen en argumentatieschema's) en de retorische dimensie (het strategisch manoeuvreren in geïnstitutionaliseerde contexten) worden in het basale dialoogspel buiten beschouwing gelaten.

Als onderdeel van dit proefschrift zijn er twee uitbreidingen van het dialoogspel ontwikkeld. Allereerst zijn in CRIT$_2$ de afsluitingsfase en de pragmatische dimensie van kritische discussie aan het dialoogspel toegevoegd. Het inpassen van de afsluitingsfase is gerealiseerd door de spelregels zo uit te breiden dat de spelers expliciet kunnen vaststellen wat, op basis van de naar voren gebrachte argumentatie, de uitkomst van de discussie is. De uitbreiding van het dialoogspel met de pragmatische dimensie is gerealiseerd door het taalhandelingsperspectief van kritische discussie te gebruiken als grondslag voor de herdefiniëring van de spelregels voor zetten en gebondenheden. De spelregels voor zetten in het dialoogspel zijn aangepast in lijn met de taalhandelingen die instrumenteel zijn voor het oplossen van een verschil van mening (en de

distributie daarvan over de verschillende discussiefasen van het ideaalmodel). Vervolgens zijn de gebondenheidsregels aangepast om de geslaagdheidsvoorwaarden die horen bij de desbetreffende taalhandelingen te weerspiegelen. Door het doen van een zet in CRIT_2 committeert een speler zich aan de geslaagdheidsvoorwaarden die horen bij de taalhandeling die ten grondslag ligt aan de zet.

In de tweede uitbreiding, CRIT_3, komen de complexe argumentatiestructuren die ontstaan als er meer dan één argument naar voren gebracht wordt tijdens een discussie aan bod. Afhankelijk van het soort van kritiek waarop het toegevoegde argument een respons is, leidt dit tot verschillende argumentatiestructuren. De argumentatiestructuur kan zo meervoudig, nevenschikkend of onderschikkend worden. Om deze types complexe argumentatiestructuren die binnen de pragmadialectische theorie onderscheiden worden in het dialoogspel op te kunnen bouwen, zijn de opeenvolgingsregels zo uitgebreid dat de zet waarmee een argument naar voren wordt gebracht meer dan eens per spel gedaan kan worden.

Summary

A dialogue game for critical discussion

Groundwork in the formalisation and computerisation of the pragma-dialectical model of argumentation

Over the past twenty years, the use of computational methods in the study of argumentation has been steadily increasing. Full automation of the analysis of argumentation – however appealing – is not yet possible in light of the current state of the field of 'computational argumentation theory'. Smaller software tools, however, which assist human analysts in their tasks, are becoming increasingly available. To give two examples of such smaller software tools; diagramming software helps to visualise argumentation structures in a uniform output format, and argument mining techniques make it possible to carry out quantitative research on large corpora of argumentative texts. Because each theory of argumentation comes with its own conceptual framework, underlying philosophy, and models, software designed to be used with one theoretical approach will not be fully compatible with another theoretical approach.

The rationale behind the study reported in this dissertation is that a formal preparation of the pragma-dialectical theory of argumentation would facilitate the development of computer tools to support the analysis of argumentative discourse. The pragma-dialectical method of analysing argumentation is widely used and based on a theory of argumentation that has been refined over the past four decennia. Although software tools are steadily making their way into the argumentation scholar's toolbox, no such tools have yet been developed catering specifically to the pragma-dialectical theory.

Central to the pragma-dialectical method of analysis is the ideal model of a critical discussion. This model is employed as a heuristic instrument to reconstruct the relevant parts of the text that is being analysed. Because of its central position, the ideal model of a critical discussion is the focal point of the preparatory foundation for developing software tools to support a pragma-dialectical analysis of argumentative discourse. This leads to two aims of the current study. The first aim is explorative and concerns the method that is used to prepare the formal

foundation. The second aim is synthetic and concerns the actual development of this foundation.

Making preparations for the development of analytical software tools based on the pragma-dialectical method means taking a step in the development from a philosophical ideal to a software application. The software applies a computational model of argumentation, which is an implementation of a formal model of argumentation. In turn, the formal model is an approximation of a theoretical model. Finally, the theoretical model is based on a philosophical ideal. On the scale indicated by these observations, the pragma-dialectical ideal model is situated between the theoretical model and the formal model. Through the formalisation carried out as part of realising the second aim of this dissertation, the model is brought one step further into the direction of computational implementation and application.

The pragma-dialectical model is already formal in two senses. First, the model is not just focussed on the outcome of an argumentative discussion, but procedural. Second, instead of providing a description of actual argumentative practice, the model normatively defines an ideal procedure for the reasonable resolution of a difference of opinion. A third sense of formal is added to the formalisation of the model in this dissertation, by providing a definition of the linguistic forms that can be used in the model and the way in which these can be combined.

The formalisation aimed for is realised by defining a dialogue game for critical discussion. In a dialogue game, verbal interaction is modelled in terms of a game played by two (or more) interlocutors. In the dialogue game, the interlocutors make communicative moves in order to reach some interactional goal. The dialogue game for critical discussion is defined by means of five categories of rules. First, the commencement rules define the initial state of the game. Second, the move rules define the moves that can be made during the game. Third, the commitment rules define the commitments that are brought about as a result of moves made. Fourth, the sequence rules define for each move under which circumstances it may be made. Fifth, the termination rule defines when the game ends and what the conditions for winning and losing are.

To examine whether such an approach to the formalisation of the pragma-dialectical ideal model actually facilitates the intended connection to the computational modelling of argumentation, a preliminary formalisation is partially translated into the computational Argument Interchange Format. This translation is indicative of the intended connection and facilitates the comparison to existing computational models.

The synthetic aim of the study is realised by developing a dialogue game that is a formalisation of the pragma-dialectical ideal model. The dialogue game is developed incrementally, starting with an elementary game that can be extended to build up an increasingly complex formalisation. With each increment, the formal approximation is brought closer to the full scope of the pragma-dialectical ideal model.

To serve as the starting point for the incremental development, a basic dialogue game for critical discussion, CRIT$_1$, is defined. The dialogue game is simplified in various ways, thus constituting a formalisation of a restricted interpretation of the ideal model. Only certain features of the multifaceted ideal model are accounted for in CRIT$_1$. These features are chosen because they represent the core of critical discussion.

Of the four discussion stages of the ideal model, the quintessential argumentation stage is accounted for in CRIT$_1$, while the confrontation stage, the opening stage and the concluding stage are temporarily abstracted from. To maintain a comprehensive model, particular outcomes of the three remaining discussion stages are assumed in the rules of CRIT$_1$. As a result of these simplifying assumptions, CRIT$_1$ is restricted to a discussion aimed at resolving a difference of opinion about one positive standpoint which is met with doubt, through the advancement of one argument relying on a propositional logical inference.

The rules of CRIT$_1$ are based on the pragma-dialectical set of fifteen procedural rules for a reasonable resolution of a difference of opinion. These fifteen rules for critical discussion exemplify the dialectical dimension of the pragma-dialectical discussion model. The pragmatic dimension (speech act perspective), logical dimension (reasoning and argument schemes) and rhetorical dimension (strategic manoeuvring in institutional contexts) are abstracted from in the basic dialogue game.

As part of the dissertation, two extensions of the dialogue game are developed. First, in CRIT$_2$, the concluding stage and the pragmatic dimension are accounted for. The accommodation of the concluding stage is realised by extending the rules of the dialogue game to allow the players to explicitly establish the outcome of the discussion based on the advanced argumentation. To account for the pragmatic dimension, the speech act perspective of critical discussion is used as a basis for the redefinition of the rules for moves and commitments. The rules for moves in the dialogue game are changed to deal with the speech acts that are instrumental in the resolution of a difference of opinion (in accordance with the distribution of speech acts over the discussion stages of the ideal model). In addition, the commitment rules are changed to reflect the felicity conditions that are associated with the speech acts concerned. By making a move in CRIT$_2$, a player becomes committed to the fulfilment of the felicity conditions of the speech act the move corresponds with.

The second extension, CRIT$_3$, addresses the complex argumentation structures that come about when more than one argument is advanced during a discussion. Depending on the kind of criticism the additional argument is a response to, this leads to different argumentation structures. Depending on the kind of move that is responded to, the resulting argumentation structure is multiple, cumulative or subordinative – the types of complex argumentation structures distinguished within the pragma-dialectical theory. The sequence rules of the dialogue game are extended to allow the move with which an argument is advanced to be made more than once per game.

A dialogue game for critical discussion

Groundwork in the formalisation and computerisation of the pragma-dialectical model of argumentation

Over the past twenty years, the use of computational methods in the study of argumentation has been steadily increasing. Although full automation is not yet possible, smaller software tools that support scholars in their argumentative tasks are becoming widely available. Software is employed, for example, to visualise diagrams of argumentation structures, or to mine argumentative content from large text corpora. Such software implements notions and models specific to an underlying theory. This generally limits the compatibility of the software to that specific theoretical approach.

While the pragma-dialectical theory of argumentation is one of the leading approaches in argumentation studies, no software has yet been developed specifically catered to it. A reason for this may be found in the lack of a formalisation of (parts of) the theory. The current study serves as a foundation for the formalisation and subsequent computational development of pragma-dialectics.

A dialogue game is proposed as a formalisation of the ideal model of a critical discussion, which is at the core of the pragma-dialectical methods of analysing and evaluating argumentative discourse. The resulting dialogue game for critical discussion is an interpretation of the ideal model in terms of two interlocutors playing a game to reasonably resolve a difference of opinion. The dialogue game represents essential parts of the model, such as the distinction between different discussion stages, the role of speech acts, and the structure of argumentation. The formalisation as a dialogue game provides a starting point for the development of software based on the pragma-dialectical theory.

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