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# A formal account of complex argumentation in a critical discussion

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**ABSTRACT:** In this paper, I present a dialogue game approach to the argumentation stage of a critical discussion. This formal perspective on the pragma-dialectical ideal model is meant to facilitate a contribution of pragma-dialectical theorising to the field of argumentation and computation. The dialogue game is based on the technical rules for a critical discussion that relate to the argumentation stage, and I will show how sequences of moves in the dialogue game relate to complex argumentation structures.

**KEY WORDS:** argumentation stage, argumentation structure, complex argumentation, computation, critical discussion, dialogue game, pragma-dialectics

## 1. INTRODUCTION

In this paper I present my current work in developing a formal perspective on the pragma-dialectical view of complex argumentation. This work constitutes a small part of a larger study for my doctoral dissertation. My overall goal in the dissertation is to connect the pragma-dialectical theory of argumentation to developments in the growing research field on the intersection of computer science and argumentation theory. In preparation of this intended connection a formal interpretation of (parts of) the pragma-dialectical theory is necessary as an intermediary.

In the next section (Section 2) I describe the motivation behind the project and the relevance of the 'process' and 'product' views of argumentation. In Section 3, I present a dialogue game based on the pragma-dialectical model of argumentative discussion. In Section 4, I relate specific sequences of moves in the dialogue game to the (complex) argumentation structures that can analytically be regarded as the product of argumentative discourse. Finally, Section 5 will conclude the paper with a short summary.

## 2. RELATING PRAGMA-DIALECTICS TO COMPUTATIONAL DEVELOPMENTS

The goal of my PhD research project is, as I mentioned in the introduction, to make a connection between the pragma-dialectical theory of argumentation (van Eemeren & Grootendorst, 1984; 2004) and computational approaches to argumentation (for a

recent overview of computational work on argumentation, see the edited volume by Rahwan and Simari (2009)). That this connection is yet undeveloped is surprising in some respects but not in others.

It is surprising in view of the potential mutual benefits of collaboration. The pragma-dialectical theory appears to capture characteristics of argumentation that are very useful for computational application. For example, the speech act based procedural discussion model developed by van Eemeren and Grootendorst (1984) can be used as a basis for a generic argumentation oriented communication protocol for artificial agents. Taking this discussion model as a starting point provides a foundation for the communication protocol that is tested on both instrumental validity – using the exclusion of fallacies as a criterion (van Eemeren & Grootendorst, 1992) – and conventional validity – empirically tested by van Eemeren, Garssen and Meuffels (2009). The integration of descriptive rhetorical aspects of argumentation into the existing normative dialectical model by van Eemeren (2010), can subsequently act as the basis for an extension of the communication protocol with a game theoretic layer of persuasive strategy. By making use of the empirical study of argumentative contexts by van Eemeren (2010) and others, the communication protocol can be made specific to the conventional preconditions associated with the intended domain of application.

Conversely, pragma-dialectical theorising could benefit from computational or formal reflections in at least two ways. The development of the pragma-dialectical theory was motivated in part by practical application, for example in education (van Eemeren, Garssen, & Rietstap, 2005) and advocacy (van Eemeren et al., 1991). With the ongoing computerisation of our society a new domain of application presents itself in computer implementations – e.g., online pre-trial legal dispute resolution, regulated mass debate on internet forums, the development and maintenance of argument repositories, software to support the analysis and evaluation of argumentative texts. Next to the opportunity to develop practical tools in the digital domain, a formal perspective on the pragma-dialectical theory can function as a laboratory setting to study the properties of, for example, the model of a critical discussion (a use of formal dialectical systems advocated by Hamblin, Krabbe and Walton, among others). The outcome of such studies could in turn lead to further precisation and development of the theory or model.

The absence of insights from pragma-dialectical theorising in the field of computer science is far less surprising when the nature of the respective academic fields is taken into account. The computational field is inherently formal in its orientation, while pragma-dialectics has ordinarily been presented in informal terms.<sup>1</sup> Bridging this conceptual gap is a precondition for the application of the pragma-dialectical theory in the computational field. The work presented in this paper constitutes one step in the development of such formal perspective. The step consists of two parts. First, I interpret the argumentation stage of the ideal model of a critical discussion as a dialogue game. Subsequently, I relate moves in this game to

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<sup>1</sup> Or at least in less formal terms. I will not reflect on the degrees to which pragma-dialectical theory – and the ideal model of a critical discussion in particular – can be regarded formal; for that I refer the reader to the observations by Krabbe (e.g., Krabbe, 2013b; Krabbe & Walton, 2011).

non-dialogical inferential structures. The choice for these two parts of the pragma-dialectical theory requires some explanation.

The *ideal model of a critical discussion* is at the heart of the pragma-dialectical theory. It is intended to capture the procedures and rules ideally followed by two agents in resolving a difference of opinion in a reasonable manner (van Eemeren & Grootendorst, 2004, pp. 57-62). To convince the interlocutor of said standpoint in a reasonable way, the disputed proposition will be argued for based on conceded starting points and the critical testing of any inferences alluded to in doing so. This view of argumentation as dialogue can be regarded as the prototypical manifestation of argumentation as 'process' in the pragma-dialectical theory. The conceptual distinction I use here follows the lines of the well-known process-product ambiguity of the term 'argumentation' (or 'argument', see, e.g., O'Keefe's (1977) description of respectively 'argument<sub>2</sub>' and 'argument<sub>1</sub>').

The prototypical manifestation of argumentation as 'product' in the pragma-dialectical theory is the *analytic overview*. This overview conventionally is the result of the reconstruction of a piece of argumentative discourse (van Eemeren & Grootendorst, 2004, pp. 118-122). One of the elements of the analytic overview is the inferential structure of the reasoning underlying the argumentation, called the argumentation structure. Snoeck Henkemans (1997), following the outline by van Eemeren and Grootendorst, shows how the different simple and complex structural compositions of argumentation come about as the result of argumentative responses to different kinds of criticisms in the argumentation stage of the discussion.

These two conceptually distinguished senses of 'argumentation' are not always both covered by computational approaches. Restoring the relation between process and product in a computational model would be fruitful for (at least) two reasons. Firstly, for the development of software tools to support (or even partly automate) the reconstruction of argumentative discourse a model is needed of argumentative communication as well as the inferential structures underpinning it. Secondly, much computational work on argumentation can be characterised to involve either communication protocols or inferential reasoning. The regulation of argumentative behaviour that protocols offer for inter-agent dialogue relates to the process of argumentation. The modelling of inferential reasoning, on the other hand, is related to the product, where argumentative principles are used to shape intra-agent reasoning or decision-making. Connecting these two approaches in a theoretically justified way within one computational system is a challenge (Reed, 2010). Nonetheless, a combination of the two perspectives would bring us closer to a proper computational model of human argumentative practice and closer to practical software applications.

In this respect, the argument interchange format proposed by Chesñevar et al. (2007) is an interesting development. One of their goals is to facilitate the interaction between systems modelling communication and reasoning in one graph-based computational representation. In my dissertation I describe the ideal model of a critical discussion and elements of the analytic overview in terms of the argument interchange format. In a theoretically motivated way, this gives substance to the relation between the process and product of argumentation in the argument

interchange format. But before any such work can proceed, (the relevant parts of) the pragma-dialectical theory have to be formalised.

### 3. THE ARGUMENTATION STAGE AS A DIALOGUE GAME

In this section I give a formal interpretation of the argumentation stage of the ideal model of a critical discussion in terms of a dialogue game. This perspective is very similar to recent work by Krabbe (2013a; 2013b). Despite the similarities in our respective formalisations of critical discussion, the results will differ because the developments are independent and we are likely to make different design choices.

A formal interpretation, as I intend it here, provides an opaque overview of the allowed (or sometimes obligatory) moves at every turn of the dialogue game, in fully disambiguated terms and on an a priori basis. The dialogue game is presented in the form of a directed-graph and defines all those (and only those) moves that the two players of the game may (or have to) make in order to play by the rules. As such, this graph of argumentative moves is closely related to the notions of 'topical potential' as described by van Eemeren (2010) and 'dialectical profiles' (van Eemeren, Houtlosser, & Snoeck Henkemans, 2007).

Every node of the graph represents a possible move in the game. The directed edges connecting the nodes represent the possible transitions from one move to the next (in the direction of the arrow). Some transitions have one or more special conditions that are a prerequisite for making that move. A uniform definition of the pairs of moves will be pursued at another occasion, when I will define the dialogue game in a rule-based manner in addition to the current graph-based definition. For my current purposes, the graph presentation will suffice to demonstrate the moves discussants can make and, in Section 4, the complex argumentation structures these embody.

The dialogue game is based on the rules for a critical discussion, in particular on those rules that relate directly to the argumentation stage. When I mention a rule in this paper, I am referring to the 15 rules as specified by van Eemeren and Grootendorst (2004, pp. 135-157). These "technical" rules should not be confused with the code of conduct for reasonable discussants consisting of 10 more practically oriented commandments (van Eemeren & Grootendorst, 1992, pp. 208-209). The argumentation stage is just one of the four stages of the ideal model of a critical discussion. Because I currently only model this stage of the discussion, all of the following results of the other stages are taken for granted.

In the *confrontation stage*, discussants have acknowledged that they have an explicit well-defined difference of opinion. To simplify matters, I will assume that i) the difference of opinion pertains to a single proposition, ii) one of the discussion parties assumes a positive standpoint towards this proposition and will later take on the burden of proof to argue for it, and iii) the other discussion party has no standpoint of his own but resorts to casting doubt (also with respect to any consecutive sub-standpoints). These assumptions result in a consistently non-mixed discussion about a single positive standpoint. In the *opening stage* the discussants will have agreed upon a set of common (material and procedural) starting points and agree to enter the argumentation stage. In the *argumentation stage*, which is the

focus of this paper, the discussant defending the standpoint presents argumentation and the acceptability thereof is critically tested on both propositional content and justificatory force. Finally, a conclusion is reached by determining the outcome of the discussion in the *concluding stage*.

The graph-form definition in Figure 1 is intended to give a formal interpretation of the argumentation stage of a critical discussion as a dialogue game. As is to be expected, this dialogue game does not fully cover all properties of the original ideal model. It would be very surprising indeed if all properties of the informal model could be preserved in a formal interpretation. But, through gradual improvement, I hope to approach the informal model as closely as possible.<sup>2</sup> A notable simplification at this moment is the purely dialectical character of the dialogue game– i.e. the focus on the procedural regimentation of argumentative moves. While the original ideal model of a critical discussion is pragmatic besides dialectical, I currently only take an abstracted view of a discussion progressing like a game without going into the details of how these discussion moves are manifested in terms of illocutionary acts. One of the consequences of this is that the request and performance of usage declaratives to clarify the intended meaning of an argumentative contribution as allowed by the 15th rule is no longer pertinent because all moves are fully explicit and transparent.

The dialogue game of Figure 1 is played between two players. One has taken on the role of *protagonist* (marked "Prot" in Figure 1) in the opening stage and provides argumentation ("Arg") in favour of the disputed standpoint ("Stp"). The other will critically test the acceptability of the argumentation in her role as *antagonist* ("Ant") of the standpoint. The game is started at the dotted arrow at the top of the diagram. The first move has to be made by the protagonist and consists of advancing a first argument in defence of the main standpoint. This method of defending a standpoint is in line with rule 6a which regulates the right of the protagonist to defend the standpoint by advancing argumentation. By advancing a particular argument, the protagonist is committed to the acceptability of its propositional content, as well as to the justificatory principle underpinning the relevance and sufficiency of the argument in defence of the standpoint (van Eemeren & Grootendorst, 1984, p. 44; p. 72). These commitments are an indication of the possible critical responses that can be expected.

According to rule 13b&c the discussants take turns in making discussion moves, so it is now the antagonist's turn to respond. She has three options: cast doubt on the acceptability of the argument's propositional content, cast doubt on the justificatory force linking the argument to the standpoint, or accept the argument. When the antagonist criticises the propositional content or the justificatory force, this does not change her commitments. As laid down in rules 6b and 10, the antagonist has the right to challenge both propositional content and justificatory force, regardless of the order she does this in. On the other hand, once she accepts the argument, there is no way back for the antagonist: accepting an

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<sup>2</sup> This incremental approach is also the reason why I keep referring to the dialogue game as "the dialogue game of Figure 1" instead of giving it a proper name which might mistakenly be understood to indicate the finality of the proposal.

argument (as both propositionally acceptable and sufficient to justify the disputed standpoint) does commit her to the consequence of having to withdraw her doubt of the standpoint in the concluding stage (in line with rule 14b).

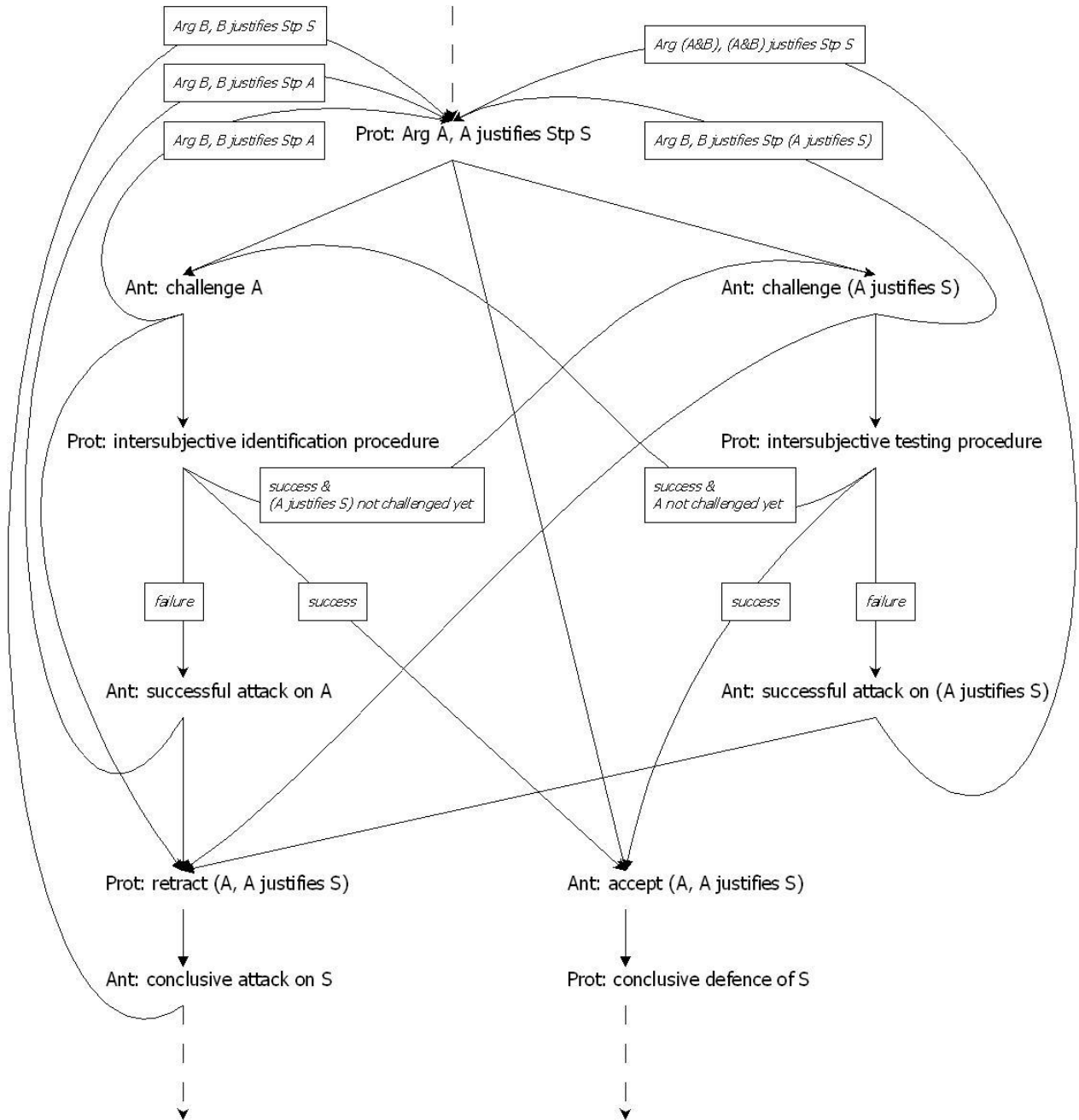


Figure 1. A procedural dialogue game interpretation of the argumentation stage of a critical discussion.

Assuming the antagonist has chosen to criticise the acceptability of the propositional content of the argument (on the left side in Figure 1), then the protagonist has three options. First, he can retract his argument, a right that rule 12 awards him throughout the discussion. I will describe the consequence of retracting argumentation later. Second, he can support the proposition by justifying it with a second argument (based on rules 7a and 11). This is visualised with the arrow back to the first move of the dialogue game, this time with a new argument in defence of the contested proposition as (sub-)standpoint. In this way the dialogue game can be recursively instantiated and progress to deeper levels of argumentative support, which again are open to critical testing. The third response the protagonist can give to a challenge of the propositional content of the argument, is invoking the intersubjective identification procedure (according to rule 7a). In this procedure the discussants consult their list of common starting points agreed upon in the opening stage of the discussion, and check whether the proposition can be identified. If the proposition the argument relies on turns out not to be part of the common starting points, the antagonist claims to have successfully attacked the argumentation (as an outcome of rule 7b). The protagonist may respond to this by either retracting this argument, or by providing a new argument in support of the proposition (again, 7a).

If the intersubjective identification procedure yields a positive result, the antagonist has to either accept the argumentation because it was successfully defended or concede the acceptability of the propositional content of the argument while proceeding to challenge its justificatory force. This last move may only be made if the justificatory force of this particular argument had not yet been challenged before. Rule 13a prohibits the repetition of argumentative moves in one discussion. If this would be allowed, the discussion runs the risk of never coming to an end because the antagonist could just repeat challenging the propositional content and the justificatory force one after the other without ever incurring further commitments.

The right side of Figure 1 contains the moves relating to the antagonist's challenge of the justificatory force of the argumentation advanced by the protagonist. Challenging the justificatory force can follow either in direct response to an advanced argument, or after a successful intersubjective identification procedure when the justificatory force had not been challenged yet. In response to criticism regarding the justificatory link from the argument to the standpoint, the protagonist again has three options: retracting his argumentation (rule 12), provide argumentative support for the link, or invoke the intersubjective testing procedure (both as a result of rule 8a). Arguing for the justificatory link is visualised in Figure 1 by the arrow going back up to the first move of the dialogue game, under the special condition that a new argument is advanced, this time in defence of the justificatory link as (sub-)standpoint.

When the intersubjective testing procedure is called upon to determine the sufficiency of the argument in justifying the standpoint, the discussants together check the validity of the inference from the proposition in the argument to the proposition in the standpoint. If the inference is based on a defeasible argument scheme, the discussants go through the critical questions associated with the scheme to determine whether the inference is acceptable.



Before continuing the walk-through of Figure 1, I have to explain that the dialogue game is simplified in this instance in comparison to the ideal model of a critical discussion. The ideal model contains a total of four intersubjective procedures. The identification procedure functions as a defence to acceptability criticism. The testing procedure is intended to test whether an argument scheme is considered admissible and correctly applied. This testing can only follow the intersubjective explicitisation procedure in which any implicit part of the argumentation (commonly the justificatory principle) is made explicit. For the checking of argumentation purely based on (classic) logical validity, the intersubjective inference procedure is used. In the current instantiation of the dialogue game, the latter two intersubjective procedures are absent. This is an intentional decision to maintain a more transparent dialogue game, at the cost of being less representative. Players of the dialogue game are assumed to only use fully explicit argumentation that relies on argument schemes expressing defeasible inferences as justificatory principle.

The intersubjective testing procedure initiated by the protagonist in defence of the justificatory force of his argumentation can result in a success or a failure. If the testing procedure is successful, the antagonist has to either accept the argument or challenge its propositional content, under the condition that this has not been done yet. If the testing procedure failed, this means the argument on its own is not sufficient to properly justify the standpoint. In line with rule 8b, the antagonist then claims to have successfully attacked the justificatory force of the argument. The protagonist has to respond by either retracting this line of argumentation or supporting the justificatory force by adding an argument that rectifies the issues on which the argument failed in the intersubjective testing procedure.

Working towards the outcome of the argumentation stage, the dialogue game of Figure 1 includes the moves of claiming successful and conclusive attacks and defences by the players. These moves are not ordinarily part of the argumentation stage of the ideal model of a critical discussion. Nonetheless I have included these moves on the basis of rules 7, 8 and 9 which describe the conditions under which attacks and defences succeed and fail. The reason for the inclusion is to make the dialogue game respect the turn-taking requirement of rules 13b&c. The moves of claiming a conclusive attack of defence also play an instrumental role in the progression from the argumentation stage to the subsequent concluding stage, which is not explicitly regulated in the ideal model.

The end of the dialogue game is constituted by the two dotted arrows at the bottom in Figure 1. These two routes allow the discussants to progress from the argumentation stage to the concluding stage. When the protagonist has retracted his argumentation as a result of criticism (left route), the antagonist can claim to have conclusively attacked the standpoint. This move is in accordance with rule 9b, which states that if the protagonist has had to retract his argumentation based on a successful attack on its propositional content or justificatory force, then the standpoint has been conclusively attacked. The protagonist's response can either be to advance a new line of argumentation, or to resign his defence and commit to a withdrawal of the standpoint in the concluding stage that follows.

The other way (right route) to exit the dialogue game of the argumentation stage occurs when the antagonist accepts the argumentation, after which the protagonist may claim to have conclusively defended the standpoint in line with rule 9a. As mentioned before, this entry point into the concluding stage commits the discussants to the withdrawal of the doubt originally cast in the confrontation stage of the discussion. At this point the dialogue game of Figure 1 stops and the concluding stage would start. When discussing, in the next section, the complex argumentation structures this dialogue game can give rise to, it becomes clear that the absence of the concluding stage creates a problem for the resolution of the dialogue game.

#### 4. COMPLEX ARGUMENTATION IN THE DIALOGUE GAME

If the ideal model of a critical discussion is an instance of the view of argumentation as a process, and the analytic overview – and with it the representation of argumentation structures – of argumentation as a product, then the connection between process and product is inherently part of the pragma-dialectical theory. With respect to argumentation structures, Snoeck Henkemans (1997) has given a dialogical interpretation based on the various ways a discussion can proceed in the argumentation stage of a critical discussion. She describes how particular (argumentative) reactions by the protagonist in response to different kinds of criticism by the antagonist lead to complex structures of often interconnecting arguments.

Following van Eemeren and Grootendorst's (1984, p. 93) outline, the main structures Snoeck Henkemans distinguishes are single, multiple, coordinately compound and subordinately compound argumentation. In this section of the paper I explain how these four different compositions of argumentation structure relate to the dialogue game of Figure 1. In particular, I show how sequences of moves in the dialogue game result in the different structures.

*Single argumentation* is the elementary case from which all complex argumentation structures are composed. Single argumentation consists of one argument in defence of a standpoint. In the dialogue game of Figure 1, this occurs when during a game the protagonist's move [Arg A, A justifies Stp S] is made exactly once. This means that either the antagonist accepted the argument outright, or did so as a result of successfully going through one or both of the intersubjective procedures. The resulting structure of the argumentation would be represented in an analytic overview as a material premise 1.1 expressing the propositional content of the argumentation, linked to the defended standpoint 1 through a linking premise 1.1' which expresses the inferential principle underpinning the justificatory force of the argumentation.

1	S
1.1	A
1.1'	A justifies S

*Multiple argumentation* essentially consists of a number of independent lines of single argumentation for one and the same standpoint. In the dialogue game this only happens as a result of the protagonist's retraction of his commitment to a first argument followed by a new independent line of argumentation in reaction to the antagonist's claim of having conclusively attacked the standpoint. In such case the protagonist concedes the unacceptability or insufficiency of the first argument, but thinks he might remedy the situation by advancing a completely new argument in defence of the original standpoint.

This sequence of moves begins with the protagonist's [Arg A, A justifies Stp S], proceeding after some intermediate moves with [retract A, A justifies S], in order to follow up on the antagonist's [conclusive attack on S] with the move [Arg B, B justifies Stp S]. The representation of the structure this sequence of moves results in is as follows.

1	S
1.1	A
1.1'	A justifies S
1.2	B
1.2'	B justifies S

Analogous to multiple argumentation, a compound argumentation structure also encompasses more than one argument. What distinguishes compound argumentation from multiple argumentation is that in the latter the lines of argumentation are independent from each other, while in compound argumentation the arguments are mutually interdependent: arguments only support the standpoint together with the other arguments that are part of the compound structure. Compound argumentation is subdivided further into two kinds. In a coordinate structure two arguments have to be taken together to lend sufficient support in order to defend a standpoint. In a subordinate structure one argument supports a second argument which in turn supports a standpoint.

Coordinately compound argumentation is described by Snoeck Henkemans (1997) to occur in two versions. The two versions are distinguished on the basis of the kind of criticism the arguments are meant to overcome: cumulative coordinate argumentation if (merely) doubt is raised about the sufficiency of the argument, and complementary coordinate argumentation if a concrete counter-argument is put forward.<sup>3</sup> In this paper, I only take cumulative coordinate argumentation into account. I do not include the complementary version because the counter-argument it is a reaction to results in a mixed sub-dispute while the assumption for the dialogue game of Figure 1 is that the dispute is *consistently* non-mixed. At a later occasion, mixed disputes shall have to be addressed as well, which would facilitate the incorporation of complementary coordinative argumentation and argumentative refutations.

In the dialogue game of Figure 1, *cumulative argumentation* can occur when the antagonist has criticised the justificatory force of argument A for standpoint S

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<sup>3</sup> Pinto and Blair (1989, p. 221) discuss the notion of complementary premises in a different way.

and the intersubjective testing procedure has failed. When the protagonist in response to this chooses not to retract his argumentation, he has to argue that when A is supplemented with another argument B, the two together lend sufficient support to the standpoint. The protagonist then makes a move [Arg (A&B), (A&B) justifies Stp S].

- 1            S
- 1.1a        A
- 1.1b        B
- 1.1a/b'     (A&B) justifies S

The second kind of compound argumentation is *subordinate argumentation*. Subordinately compound argumentation can be found in three places in Figure 1. It is the result of the argumentative support of the propositional content of an argument or of (the relevance of) its justificatory force in response to criticism by the antagonist. After the antagonist's initial challenge, the protagonist can immediately advance supporting argumentation. In the case of criticism directed at the propositional content, a subordinate argument can also be advanced in response to a failed intersubjective identification procedure.

The main difference between the two forms of subordinate argumentation is the sub-standpoint that is defended. In the case of a response to a challenge with respect to the acceptability of the propositional content of the original argument (see left side in Figure 1), the sub-standpoint is made up of the original argument's propositional content. A second argument B is put forward in defence of the propositional content of argument A, which in turn is an argument for the original standpoint S. The corresponding moves in the dialogue game of Figure 1 start with the protagonist's [Arg A, A justifies Stp S], the antagonist's criticism of the propositional content [challenge A], then potentially an intersubjective identification procedure, and finally the protagonist's move [Arg B, B justifies Stp A].

- 1.1            A
- 1.1.1        B
- 1.1.1'       B justifies A

If a subordinate argument is advanced to support the justificatory force, the resulting structure is the same but the sub-standpoint now consists of the inferential link between the original argument and the main standpoint. This happens in the dialogue game when after the protagonist's [Arg A, A justifies Stp S] the antagonist responds with [challenge (A justifies S)] (right side in Figure 1), which in turn is followed up by the protagonist by arguing [Arg B, B justifies Stp (A justifies S)].

- 1.1'            A justifies S
- 1.1'.1        B
- 1.1'.1'       B justifies (A justifies S)

It is important to notice that, in contrast to multiple argumentation, in the case of compound argumentation (both coordinate and subordinate structures) the protagonist does not retract any existing argumentation but adds to it. Once a protagonist adds to existing argumentation, for example by responding to a challenge of an argument's propositional content with a subordinate argument, the original argument is still 'in play'. This causes a problem for the resolution of the dialogue game of Figure 1. As I explained in Section 3, rule 10 of the ideal model of a critical discussion awards the antagonist the unconditional right to criticise an argument on both its propositional content and its justificatory force at any moment in the discussion, provided she has not done so yet for this particular argument. The antagonist should therefore still have the opportunity to challenge all aspects of earlier arguments not challenged yet after the acceptability of the new argument has been determined, but this is not possible in the dialogue game of Figure 1.

In a recursive way the resolution of the larger discussion should be decomposed into the resolution of its argumentative building blocks while keeping open the opportunity for the antagonist to be maximally critical at every step of the way. But, because the concluding stage, in which the discussants have to withdraw or accept standpoints and doubt, is not part of the dialogue game, the acceptability of the coordinate and subordinate arguments is not established and 'backtracking' to an unexploited opportunity for criticism is not possible in the dialogue game. This *prima facie* shortcoming of the dialogue game of Figure 1 then turns out not really to be a problem of the dialogue game itself but rather a result of the absence of the concluding stage. Hence, care should be taken that this is remedied once a formal interpretation of the concluding stage is added into the dialogue game.

## 5. CONCLUSION

In this paper I have done three things. First, I gave a brief introduction to the research project I am working on and the motivation behind it. The objective of the overall project is to prepare the pragma-dialectical theory of argumentation for contributions to the research field of argumentation and computation.

Next, I presented a formal interpretation of the argumentation stage of the ideal model of a critical discussion. This took the form of a dialogue game, which I presented in terms of a directed-graph defining all the potential sequences of moves allowed within the game.

In the last part of the paper, I characterised the different complex argumentation structures in terms of sequences of moves in the dialogue game. It turns out that the dialogue game does not resolve once one of the recursive routes in the graph is taken. This can be remedied by incorporating the concluding stage.

The dialogue game I presented in this paper in no way represents a final outcome of my study. Rather it should be seen as one intermediate step in the iterative development of a formal interpretation of the ideal model of a critical discussion. On the basis of the current dialogue game, I can include further discussion stages, give a more accurate representation of the original rules and incorporate speech acts. Future developments can also concern argumentative refutation or the relation between compound argumentation, the intersubjective

procedures and the critical questions of defeasible argument schemes. A sufficiently complete and accurate formal interpretation will clear the way for a subsequent specification in terms of the argument interchange format.

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