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## CORRESPONDENCE BETWEEN THE PRAGMA-DIALECTICAL DISCUSSION MODEL AND THE ARGUMENT INTERCHANGE FORMAT

**Abstract:** The pragma-dialectical ideal model of a critical discussion takes a normative approach to argumentative discourse. The model defines the four stages of a critical discussion, conditions on speech acts and their distribution over the stages, and a set of 15 procedural rules regimenting the moves discussants may make. These problem-valid rules are instrumental towards the reasonable resolution of the difference of opinion. We take the model of a critical discussion as constituting a basis for a dialogue protocol allowing agents to play out a dialectical game in order to test the tenability of one agent's standpoint. The Argument Interchange Format (AIF) allows such a dialogue protocol to be translated in terms of its core ontology. The core ontology provides a directed graph data structure in which descriptions of argumentative discourse and arguments can be represented. The AIF can function as interlingua allowing various frameworks and theories of argumentation to interact in theoretically unbiased terms. Establishing a correspondence between pragma-dialectical notions and the AIF would provide the latter with a normative natural language discussion model. Furthermore viewing the pragma-dialectical theory from a formalised perspective indicates possible areas of concern which need to be addressed before the theory could get involved further in the field emerging on the intersection between argumentation theory and artificial intelligence.

**Keywords:** Argument Interchange Format, critical discussion, dialogue protocols, Pragma-Dialectics

### 1. Argumentation and theory

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) 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, being the field within linguistics in which meaning is regarded as inherently context-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) Lately the conventional validity – whether the restrictions in the normative model match accepted conventions in actual use – of the theory 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)

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 this 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.<sup>1</sup> 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 on the coherence and consistency of the pro-

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<sup>1</sup> The *standard* pragma-dialectical model refers to the theory before its rhetorical extension in terms of strategic manoeuvring. See (van Eemeren and Grootendorst 2004) for the standard model and (van Eemeren 2010) for the extended.

cedure 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.<sup>2</sup> 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 (2009) 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?” (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.

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 possibly simplifying the theory at 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 and the analysis of argumentative discourse through the use of linguistic indicators and dialectical profiles. (See respectively van Eemeren 2010, and van Eemeren

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<sup>2</sup> 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.

*et al.* 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 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 paragraphs 2 and 3. Then we will present a preliminary correspondence between the two in paragraph 4. Paragraph 5 will conclude this paper with an outline of our endeavours so far and of the opportunities it opens up for future research.

## 2. The pragma-dialectical approach to argumentation

### 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 a normative 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.<sup>3</sup> 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 material and procedural points of agreement, indicating what common ground there is. The dialectical rules ensure a methodical resolution-oriented

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<sup>3</sup> 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.

discussion procedure based on these conceded premises – *ex concessis* – by prescribing dialectical obligations and rights to the discussants. The sections that follow will explain the stages (2.2), the speech act distribution (2.3) and the 15 rules (2.4) of a critical discussion.

## **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 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 disagrees with. This disagreement is expressed by casting doubt on the standpoint. The disagreeing 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 disagreement about several separate but related standpoints at the same time. In such case 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.<sup>4</sup> The other party will cast doubt on the standpoint and, as antagonist, will critically challenge the argumentation.<sup>5</sup>

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

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<sup>4</sup> 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 would suit their particular situation.

<sup>5</sup> In the sections involving the pragma-dialectical theory the term “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 (and not including) a standpoint. It also is the term that names the complex speech act covering the assertives performed in discourse in support of the standpoint expressed.

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 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.<sup>6</sup> Such would take another critical discussion.

### 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 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 *et al.* 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.<sup>7</sup>

### 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 15 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

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<sup>6</sup> Testifying to the *critical rationalist* principles of the theory.

<sup>7</sup> The tables in (van Eemeren *et al.* 2007, p. 16) and (van Eemeren and Grootendorst 1984, p. 105) show the speech acts relevant for critical discussion and their distribution over the discussion stages and between the discussion parties.

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.<sup>8</sup> We will quickly go through the rules and will reproduce some from (van Eemeren and Grootendorst 2004) if they are of particular interest to our current project.<sup>9</sup> The first of the 15 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 a standpoint to prompt the discussant who 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 he 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 certain shared premises and discussion rules; the discussant remains obligated to defend the standpoint as long as he does not retract it and as long as he has not successfully defended it against this particular discussant on the basis of the particular agreed premises and discussion rules.*

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 again during the current discussion. If a discussant wants to discuss the status of one of

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<sup>8</sup> For more on fallacies as violations of the rules of a critical discussion, see (van Eemeren and Grootendorst 1992) and (van Eemeren *et al.* 2002).

<sup>9</sup> The rules as presented here are very similar to those in (van Eemeren and Grootendorst 2004) but are revised slightly in some occasions. Of course the rules of a critical discussion still apply equally to male and female discussants, but in the interest of brevity we use male pronouns to refer to both protagonists and antagonists.



the agreed upon rules this happens outside of the current discussion, giving rise to a meta-discussion.<sup>10</sup>

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 this standpoint, and in which case the protagonist has successfully defended the standpoint and in which case the antagonist has successfully attacked it; the rules in which this is laid down apply throughout the duration of the discussion, and may not be called into question during the discussion itself by either of the parties.*

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 negation of the commissive and a directive to request new argumentation on the basis of the unacceptability of the propositional content or of 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 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 encyclopedia – 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

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<sup>10</sup> Which should not be confused with a sub-discussion. We will encounter the latter in the argumentation stage, while the meta-discussion (also called meta-dialogue by some authors) is used to determine the common commitments of the discussants in the opening stage.

use of the system of logic agreed upon as 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 will 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:<sup>11</sup>

- 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 a complex speech act of 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.*

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 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 acts of argumentation performed by the protagonist in support of this standpoint.

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<sup>11</sup> By having a disjunctive form in part *b*, this rule forces the choice we make later in our dialogue protocol when it comes to not regarding argumentation which failed the intersubjective inference procedure as salvageable by employing the intersubjective explicitisation procedure first and then subsequently checking its tenability through the testing procedure.

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 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 none of the discussants has to change their commitment to the standpoint, such a termination can not 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 15 rules of a critical discussion as well as our present introduction of the pragma-dialectical theory. In paragraph 4 we will establish some basic correspondences between the pragma-dialectical theory we have just seen and the Argument Interchange Format which will be introduced in paragraph 3.

### **3. The Argument Interchange Format**

Argumentation theory is a large and diverse field stretching from analytical philosophy to communication theory and social psychology. The computational investigation of the space 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.<sup>12</sup> 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, see Prakken 2010), visual languages (e.g. Araucaria's AML format for diagrams, see Reed and Rowe 2004) or natural language (e.g. as used in the pragma-dialectical approach, see van Eemeren and Grootendorst 2004).

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<sup>12</sup> 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.

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  $n^2$  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.

### 3.1. The AIF 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 in (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 *et al.* 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*) and 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 argumentation schemes, such as the schemes for Causal Argument or for Argument from Sign in (Walton *et al.* 2008) or the pragma-dialectical argument schemes based on analogy, sign or cause (see van Eemeren and Grootendorst 1992).<sup>13</sup> There are various ways to represent the schemes in the Forms Ontology. Rahwan *et al.* (2007), for example, define them as graphs of so-called form-nodes (F-nodes) whilst Rahwan *et al.* (2010) define schemes as combinations of classes of statements in Description Logic. In this paper, we will represent individual schemes as a list of features, viz.

<i>Scheme name</i>	<b>Analogy</b>	<b>Modus Ponens</b>
<i>Scheme type</i>	defeasible inference scheme	deductive inference scheme
<i>Premises</i>	$A$ is true (false) for $C1$ $C1$ is similar to $C2$	$\varphi$ $\varphi \Rightarrow \psi$
<i>Conclusion</i>	$A$ is true (false) for $C2$	$\psi$
<i>Presumption</i>	The similarity between $C1$ and $C2$ is relevant to the comparison	none
<i>Exception</i>	$A$ is false (true) for another $C3$ similar to $C1$	none

**Table 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  $C1$ ?’).

The Forms Ontology and the Upper Ontology are intimately connected because specific applications of schemes (denoted by RA-, CA- and

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<sup>13</sup> 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.

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 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.

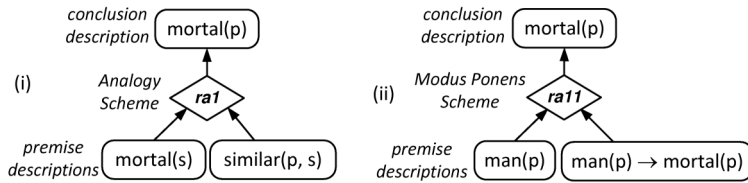


Figure 1. Argument graphs in the language of the AIF ontology

### 3.2. Dialogue in the AIF

The basic AIF ontology, as described in (Chesñevar *et al.* 2007; Rahwan *et al.* 2007), does not include ways of representing argument<sub>2</sub>, that is, dialogical argument.<sup>14</sup> 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<sub>2</sub> 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<sub>2</sub> and argument<sub>1</sub>. 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.

<sup>14</sup> Here, we refer to O’Keefe’s (1977) two characterizations of the term “argument”: argument<sub>1</sub> and argument<sub>2</sub>. Argument<sub>1</sub> refers to an argument as a static object (the pragma-dialectical notion of *argumentation*) and is described by sentences such as “he prepared an argument”. Argument<sub>2</sub> refers to a dialogue (the pragma-dialectical notion of *critical discussion*) and is described by sentences such as “they had an argument”.

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 something that happened in 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<sub>1</sub> (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).

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 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 2 shows the ontological structure of locutions and transitions.

For examples of locutions and transition schemes, consider Table 2 and 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



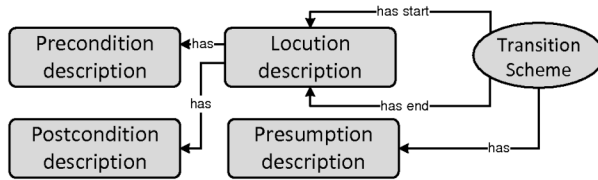


Figure 2: Transition schemes and locutions

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.

<i>Locution name</i>	<b>Challenge</b>	<b>Resolve</b>
<i>Format</i>	Why P?	Resolve whether P
<i>Precondition description</i>	P is not in speaker’s commitment	none
<i>Postcondition description</i>	P is in hearer’s commitment Why P? is in speaker’s commitment	none

Table 2: Two locutions from Mackenzie’s DC protocol

<i>Scheme name</i>	<b>Challenge – Resolve</b>
<i>Start Locution Description</i>	Why P?
<i>End Locution Description</i>	Resolve whether ‘if Q then P’
<i>Presumption Description</i>	P is an immediate consequence of Q Q is a conjunction of statements to all of which the hearer is committed

Table 3: A transition in Mackenzie’s DC protocol

One interesting question is how exactly L-nodes are connected to I-nodes in argument<sub>1</sub>. 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) and later 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<sub>2</sub>) and I-nodes (“elements” of argument<sub>1</sub>). 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.

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 unfulfillment 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 argumentation 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 unfulfillment. 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 on attacks on the successful application of illocutionary force.

### **3.3. Calculated properties in the AIF**

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<sub>1</sub> structures this is a relatively small problem, but 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 exi-

stence or non-existence of particular claims, the current status of claims and commitments.

## 4. Critical discussion in the AIF

Having introduced the pragma-dialectical model of a critical discussion in paragraph 2 and the AIF in paragraph 3, we turn our attention to the correspondence between the two in paragraph 4. We will begin by relating the core concepts of the pragma-dialectical model to the building blocks of the AIF ontology. After which 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 and we will highlight some of the most noteworthy and interesting locution pairs found within the protocol.

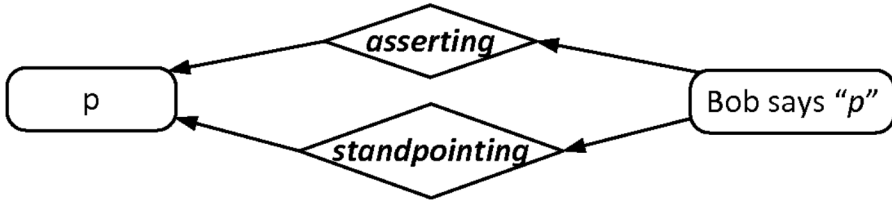
### 4.1. Pragma-dialectical notions in AIF terms

Evaluating argumentative discourse in accordance with the standard pragma-dialectical model of a critical discussion requires the constructing of an analytic overview. (van Eemeren and Grootendorst 2004, pp. 118–122) This overview covers all analytically relevant, argumentative elements of the discourse. Sections 4.1.1 to 4.1.6 correlate these core elements of pragma-dialectical analysis to the core ontology of the AIF.

#### 4.1.1. 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 clumsily), ‘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 stand-

pointing. 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, below.



**Figure 3.** Standpointing as illocutionary force

Whilst Figure 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, *viz.* (in our example): *Bob’s point of view in respect of the expressed opinion p is that this expressed opinion p is (not) the case* (1984: 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 supervenience, 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 connection from one illocutionary scheme to 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 Section 4.3). And finally, it is possible to expand the analysis presented in Figure 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 argumentation schemes capture presumptions and constitutive requirements on inferences. In addition to Searle-like 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 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.

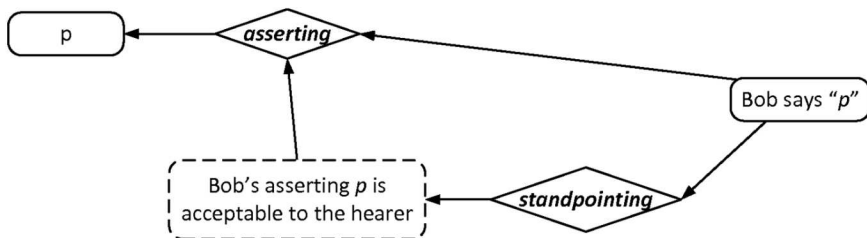


Figure 4. Standpointing with acceptability of sentence level assertion

Figure 4 is a significantly more complex interpretation, so for the sake of clarity in what follows, we retain the analysis in Figure 3, because nothing is lost in our investigation if we do so.

#### 4.1.2. 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 about 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.

#### **4.1.3. 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 pragma-dialectical theory do not include derivations or applications of inferences, or instances of conflict relations, and so do not include complexes of I-nodes and S-nodes). In pragma-dialectical theory, starting points may also include rules of inference, which correspond to components of the Forms ontology (referred to as F-nodes in (Rahwan *et al.* 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 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.

#### 4.1.4. Argumentation

The concept of ‘an argumentation’ in pragma-dialectical theory corresponds fairly closely to O’Keefe’s (1977) characterisation of argument<sub>1</sub>. 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<sub>1</sub>. 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.

#### 4.1.5. 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 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 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 subordinative argumentation structure.

#### **4.1.6. Argument schemes and critical questions**

Argument schemes in 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 in (van Eemeren *et al* 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 schemesets already characterised, including those based on Walton *et al.*'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 *et al.* (2007) offer some examples of these patterns.

Critical questions form a key part of the machinery of argumentation schemes, and the dual  $\text{argument}_1/\text{argument}_2$  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  $\text{argument}_1$  character, in that they structure the connections between  $\text{argument}_1$  components. On the other hand, critical questions are inherently  $\text{argument}_2$  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.

#### 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 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 section 2.4 pragma-dialectical theory does provide insight into these procedures and 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. Another 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 agree which of the two discussion 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.<sup>15</sup> At present this fork in

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<sup>15</sup> Remember that a standpoint can only be constructively defended. Cf. (van Eemeren and Grootendorst 2004, p. 141) for the problem of *order* (not *choice*) in a mixed or multiple difference of opinion.

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 would 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 nonetheless 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 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 in (van Eemeren and Grootendorst 2004, p. 157).)

Each node in Figure 5 represents a locution performed as indicated by parties 1 or 2 or by 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.<sup>16</sup> 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 the discussion party 1 has the possibility to not advance any argumentation and retract his prior standpoint (eg. 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 there never was a critical discussion to begin with: the standpoint's merits were never put to the test.

A possible difficulty in the procedure represented in the protocol is the move from the antagonists's challenge to either the intersubjective inference or the explicitation procedure. As it stands the first route has to be taken iff the argumentation was both fully externalised and dependent on logical validity in its potential transfer of the acceptability of the premises employed

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<sup>16</sup> With the current exclusion of the usage declarations allowed by rule 15 in an attempt to maintain a more-or-less comprehensive chart.

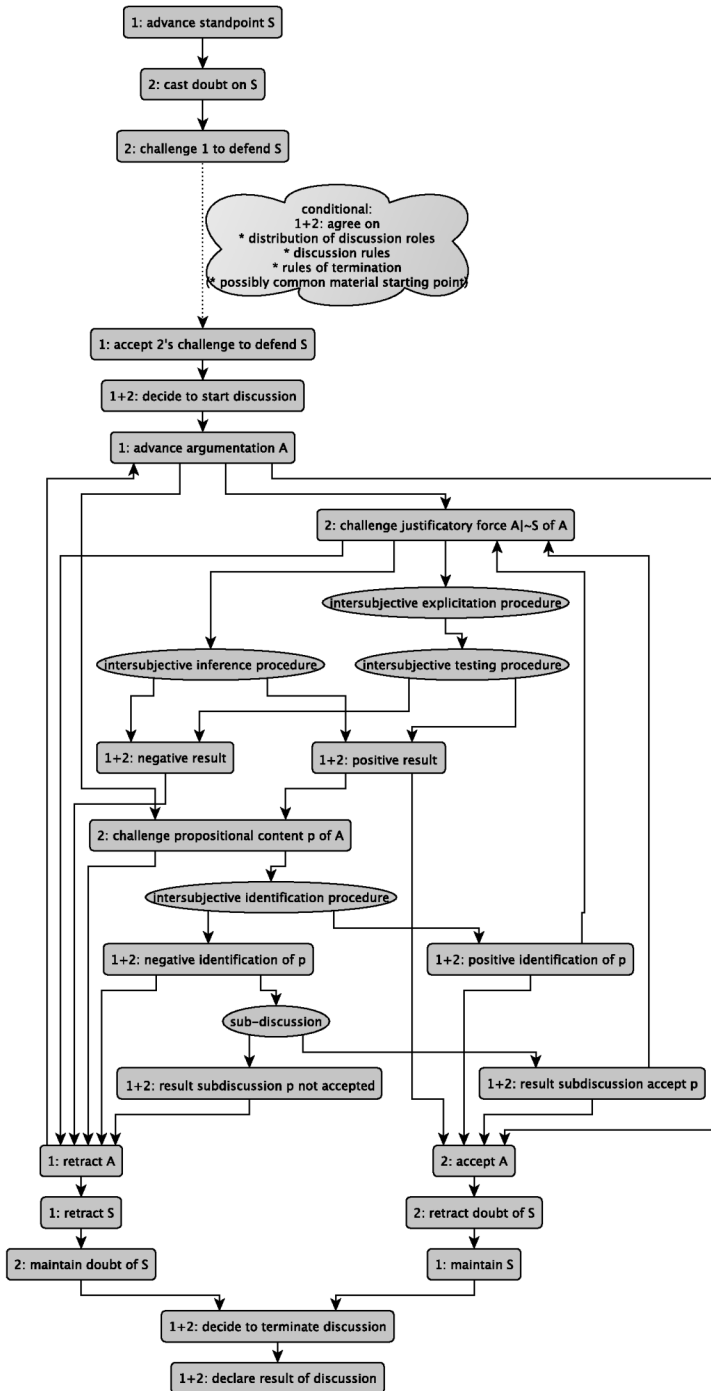


Figure 5. The (simplified) dialogue protocol of a critical discussion as flow-chart

to the standpoint. This approach appears to be in line with (van Eemeren and Grootendorst 2004, pp. 148–50). 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 therefore 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 pragmatic optimum – dressing the bare-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.

### **4.3 The protocol and locution-pairs in the AIF**

By regarding the pragma-dialectical discussion procedure as a dialogue protocol Figure 5 shows that locutions come in pairs where the first might be followed up by one specific or possibly of choice of several successor locutions. Some of the pairs are of more interest than others and by means of 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 4. In our characterisation of the locutions, we present them in a “semi-formal” way. In Table 4,  $p_i$  stands for the party (or player if we see the discussion as a dialogue game) that advances the locution.

<i>Locution name</i>	<b>Advance standpoint</b>	<b>Cast doubt on standpoint</b>
<i>Format</i>	$p_i$ : standpoint $S$	$p_i$ : doubt $S$
<i>Precondition description</i>	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
<i>Postcond. description</i>	$p_i$ is committed to (defend) $S$	none

**Table 4**

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 (cf. van Eemeren and Grootendorst 2004, p. 191, commandment 2).<sup>17</sup> 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 4 leads us to the first pair of locutions in a discussion that can be modelled as such a scheme in AIF+, viz. Table 5.

<i>Scheme name</i>	<b>Advance Standpoint</b> $\rightarrow$ <b>Cast doubt on standpoint</b>
<i>Format</i>	$p_i$ : standpoint $S \rightarrow p_j$ : doubt $S$
<i>Presump. description</i>	$p_i \neq p_j$

**Table 5**

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  $S$  (cf. van Eemeren and Grootendorst 1992, p. 124–31). The transitional scheme adds to this the presumption that the doubt is cast by

<sup>17</sup> Precondition (b) will be discussed below.

a different discussion party 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, viz. Table 6.

<i>Scheme name</i>	<b>Cast doubt on standpoint</b> → <b>Challenge to defend</b>
<i>Format</i>	$p_i$ : doubt $S$ → $p_i$ : challenge_defend $S$

**Table 6**

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) seems to indicate that *first* the challenge is accepted and *then* the limits are set, pragma-dialectical rules 3 and 5 above (taken from (van Eemeren and Grootendorst 2004)) 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 part in Figure 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 7). A further presumption is that the challenger is a different person from the one who accepts.

<i>Scheme name</i>	<b>Challenge to defend</b> → <b>Accept challenge to defend</b>
<i>Format</i>	$p_i$ : challenge_defend $S$ → $p_j$ : accept_challenge_defend $S$
<i>Presump. description</i>	<ul style="list-style-type: none"> <li>– <math>p_i \neq p_j</math></li> <li>– agreement on discussion roles and rules, starting points and termination criteria</li> </ul>

**Table 7**

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 5) and after this locution, there is only one possibility, namely for the party defending the standpoint to *advance an argumentation* in favour of it (Table 8).

<i>Scheme name</i>	<b>Advance standpoint &amp; Decide to start <math>\rightarrow</math> Advance argumentation</b>
<i>Format</i>	$p_i$ : standpoint $S$ and $p_i, p_j$ : decide_start $\rightarrow p_i$ : argue A
<i>Presump. description</i>	<ul style="list-style-type: none"> <li>- <math>p_i \neq p_j</math></li> <li>- if <math>S = (+/p)</math>, then <math>A \vdash p</math></li> <li>- if <math>S = (-/p)</math>, then <math>A \vdash \neg p</math></li> </ul> <p>here, <math>\vdash</math> means so much as “p follows from A” under the agreed rules.</p>

**Table 8**

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* viz. Table 9.

<i>Scheme name</i>	<b>Advance standpoint &amp; Retract argumentation <math>\rightarrow</math> Advance argumentation</b>
<i>Format</i>	$p_i$ : standpoint $S$ and $p_i$ retract A $\rightarrow p_i$ : argue B
<i>Presump. description</i>	<ul style="list-style-type: none"> <li>- if <math>S = (+/p)</math>, then <math>B \vdash p</math></li> <li>- if <math>S = (-/p)</math>, then <math>B \vdash \neg p</math></li> </ul>

**Table 9**

The presumptions of this scheme are slightly different because the utterer of the *retract* and *advance* locutions is the same person.

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 9 (e.g.  $B \neq A$ ), 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.

<i>Locution name</i>	<b>Advance argumentation</b>
<i>Format</i>	$p_i$ : argue A
<i>Precond. description</i>	A has not been advanced in this discussion before.
<i>Postcond. description</i>	$p_i$ is committed to (defend) A

**Table 10**

After an argumentation has been advanced, the antagonist can either accept the argumentation or challenge the argumentation in various ways (Figure 5). Hence, there are a number of transition schemes from *advance argumentation* to the various challenges, Table 11 and 12.

<i>Scheme name</i>	<b>Advance argumentation <math>\rightarrow</math> Challenge propositional content</b>
<i>Format</i>	$p_i$ : argue A $\rightarrow$ $p_j$ : challenge p
<i>Presumption description</i>	– $p_i \neq p_j$ – p is in A

**Table 11**

<i>Scheme name</i>	<b>Advance standpoint &amp; advance argumentation <math>\rightarrow</math> Challenge justificatory force</b>
<i>Format</i>	$p_i$ : standpoint $S$ and $p_i$ : argue A $\rightarrow$ $p_j$ : challenge A $\vdash S$
<i>Presump. description</i>	$p_i \neq p_j$

**Table 12**

As discussed in section 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 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  $p \rightarrow$  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 and for any argument can only be questioned once. Again, this can only be modelled as preconditions on the *challenge* locutions: each *challenge* locution has as 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 and their full specification in terms of presumptions and the locutions' individual pre- and post-conditions 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.

## 5. Conclusion

Perhaps somewhat surprisingly, 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 are becoming possible in a more detailed and thorough way than has previously been possible. This paper has taken some initial steps to show how those 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<sub>1</sub> structures that are created, navigated and manipulated by those locutions and transitions. This connection is coherent in both computational AIF terms and also in pragma-dialectical terms. What has been achieved here 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 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 explore computationally more recent advances in pragma-dialectical theory such as strategic manoeuvring (van Eemeren 2010). But this paper already demonstrates the potential and the value – for both artificial intelligence and philosophy – of building a computational understanding of the pragma-dialectical approach.

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