Argumentation Schemes and Defeasible Inferences

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1 Introduction

Argumentation schemes are argument forms that represent inferential structures of arguments used in everyday discourse, and in special contexts like legal argumentation, scientific argumentation, and especially in AI. Deductive forms of inference like *modus ponens* and disjunctive syllogism are very familiar. But some of the most common and interesting argumentation schemes are neither deductive nor inductive, but defeasible and presumptive. You may not be familiar with these. To introduce them, some background may be useful.

Perelman and Olbrechts-Tyteca, in *The New Rhetoric* (1969) identified and defined many distinctive kinds of arguments used to convince a respondent on a provisional basis. Arthur Hastings' Ph.D. thesis (1963) made an even more systematic taxonomy by listing many of these schemes, along with useful examples of them. Hastings presented a form for each scheme, and a set of critical questions matching the form of argument. In each instance, Hastings presented one premise of the form (scheme) as a conditional or generalization expressed as a Toulmin warrant. These features turned out to be very significant in the subsequent development of argumentation schemes. Many argumentation schemes are mentioned or described in the work of van Eemeren and Grootendorst (1984; 1992). Kienpointner (1992) has developed a comprehensive account of argumentation schemes that includes deductive and inductive ones as well as presumptive ones. A list of presumptive argumentation schemes given in (Walton, 1996) is not complete, and the analysis of each scheme is still in rough form. But this list identifies many most common forms of defeasible argumentation. In some important respects, the treatment of schemes follows Hastings' style, especially in having with a set of critical questions matching each form. The latest development is that argumentation schemes are being handled and represented in Araucaria to help with argument diagramming.

But the history of the study of these presumptive argumentation schemes is ancient. Many of these forms of argument were identified and discussed by Aristotle in three of his books especially, *Topics*, *On Sophistical Refutations and Rhetoric*. Aristotle called these forms of argument "topics" (topoi) or places. Warnick (2000, pp. 120-128) drew up a detailed table comparing twenty-eight topics identified in Aristotle's *Rhetoric* to thirteen of the argumentation schemes in Perelman and Olbrechts-Tyteca. The traditional problem with topics is that it seemed hard for commentators to appreciate what role the topics were supposed to have. Perhaps because of the dominance of deductive logic, the role of the topics seemed obscure. What has been taken to be their most useful purpose is to help a speaker think up new arguments to support rhetorical presentation in a speech. In medieval logic, topics were also sometimes taken to be useful for the purpose of testing the inferential link between a set of premises and a conclusion. But this use never really caught on. The topics had some appeal in rhetoric from time to time, but were never much of a useful tool there. In logic, topics remained marginal.

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2 Examples of Schemes

For those who are not familiar with argumentation schemes it is good to examine a few examples. Argument from position to know is based on the assumption by one party that another party has information that the first party needs. For example someone lost in a foreign city asks a stranger where the Central Station is. The questioner needs this information, and does not have it. If the respondent gives and answer by citing a location, what reason does the questioner have to think that she can act on this information, or take it as true? The rationale is given by argument from position to know. The version of the argumentation scheme in (Walton, 1996, pp. 61-63) is given below.

Argument from Position to Know (Version I)

Major Premise: Source a is in a position to know about things in a certain subject domain S containing proposition A.
Minor Premise: a asserts that A (in Domain S) is true (false).
Conclusion: A is true (false).

When a proponent puts forward an argument in a dialogue and it meets the requirements indicated above, then it carries some weight as a presumption. But it is defeasible by questioning. Matching the argument from position to know are three critical questions (Walton, 1996, p. 62).

CQ1: Is a in a position to know whether A is true (false)?
CQ2: Is a an honest (trustworthy, reliable) source?
CQ3: Did a assert that A is true (false)?

When the proponent in a dialogue has put forward an argument from position to know, the respondent can ask any one of these three critical questions. Once the question has been asked the presumptive weight the argument had before is withdrawn. But if the proponent gives an acceptable answer to the question, the weight is restored.

Appeal expert opinion is a subtype of argument from position to know where one party has expert knowledge that the other wants to use. This scheme is represented in (Walton, 1997, p. 210) as follows.

Appeal to Expert Opinion (Version I)

Major Premise: Source E is an expert in subject domain S containing proposition A.
Minor Premise: E asserts that proposition A (in domain S) is true (false).

Conclusion: A may plausibly be taken to be true (false).

Appeal to expert opinion is a defeasible form of argument that should not be taken as beyond challenge. There is a natural tendency to respect an expert, and thus we find it hard to question the word of an expert. Still, appeal to expert opinion is best seen as subject to critical questioning. Six basic critical questions are proposed in (Walton, 1997, p. 223).

1. *Expertise Question:* How credible is E as an expert source?
2. *Field Question:* Is E an expert in the field that A is in?
3. *Opinion Question:* What did E assert that implies A?
4. *Trustworthiness Question:* Is E personally reliable as a source?
5. *Consistency Question:* Is A consistent with what other experts assert?
6. *Backup Evidence Question:* Is A's assertion based on evidence?

The two devices of the scheme and the critical questions work together. The scheme is used to identify the premises and conclusion. The critical questions are used to evaluate the argument by probing into its potentially weak points.

Many argumentation schemes are associated with traditional informal fallacies. Appeal to popular opinion is a separate scheme from argument from argument from position to know, but is often connected with it. But in many cases the two are connected. An example would be, "Everybody in Lyon says that the Metro is a good way to get around." This argument is an appeal to popular opinion but its worth is bolstered by the intertwined argument that people who live in Lyon are (presumably) in a position to know about such things.

Argumentum ad hominem, or use of personal attack to criticize somebody's argument, has several interconnected argumentation schemes associated with it. The circumstantial *ad hominem* is a subtype of argument from commitment. In law, circumstantial *ad hominem* arguments are used to raise doubt about the credibility of the witness by attacking his testimony as inconsistent. Several argumentation schemes have to do with meanings of words and phrases. One is argument from classification. Legal arguments are often about how something like a contract can be classified. Other schemes are based on definitions. One is to attack an argument from definition claiming that the definition is too vague.

The sunk costs argument, or argument from waste, as Perelman and Olbrechts-Tyteca called it, runs as follows. I have already sunk such an effort into trying to attain this goal, it would be wasteful for me to stop now. The sunk costs argument also seems to be a species of argument from commitment, as recognized by the growing literature on the notion of precommitment in the literature on decision making in economics and banking. Generally, the presumptive schemes represent types of argument that would be widely seen in AI as abductive. The scheme most closely related to abduction, however, is argument from sign.

As noted above, the schemes as formulated in (Walton, 1996) are in a rough form designed to be useful. They need more work to adopt some standard notation to put them in a consistent structure that could be useful for formalization and computing. For example, consider the two schemes above. They can be reformulated in a way that makes the structure of the inference in them more explicit. Consider argument from position to know first.

Argument from Position to Know(Version II)

Major Premise: Source a is in a position to know about things in a certain subject domain S containing proposition A.
Minor Premise: a asserts that A (in Domain S) is true (false).
Conditional Premise: If source a is in a position to know about things in a certain subject domain S containing proposition A, and a asserts that A is true (false), then A is true (false).
Conclusion: A is true (false).

In version II, the conditional premise plays a role comparable to the general premise in Hastings' formulation of schemes. In this formulation, as noted above, the premise was expressed as a Toulmin warrant. It is a defeasible rule that can default in the face of exceptions to the rule in a given case.

A reformulation of the appeal to expert opinion along the same Hastings-style lines is set out below.

Appeal to Expert Opinion (Version II)

Major Premise: Source E is an expert in subject domain S containing proposition A.
Minor Premise: E asserts that proposition A (in domain S) is true (false).
Conditional Premise: If source E is an expert in a subject domain S containing proposition A, and E asserts that proposition A is true (false), then A may plausibly be taken to be true (false).
Conclusion: A may plausibly be taken to be true (false).

Versions I and II of these schemes are not that different. Version II is a more explicit account of the structure of the inference that makes the warrant that the argument is based on more visible. But version II leads to a certain controversy that now needs to be discussed.

3 *Modus Ponens* and Schemes

The more explicit presentation of the presumptive argumentation schemes, revealing the warrant, often seems to come very close to assuming that inferences have the *modus ponens* form. But this seems inconsistent, because we all know that MP is deductively valid, and yet these presumptive schemes are not supposed to represent deductively valid forms of argument. Blair (1999, p. 341), as quoted in the sentence below, detected an inconsistency in the treatment of schemes in (Walton, 1996).

"(S)everal of the formulations of argumentation schemes (in Walton, 1996) represent valid argument forms, whereas Walton is quite explicit throughout the book that presumptive arguments are not deductive entailments."

As an example, Blair (p. 341) cited the argumentation scheme for appeal to popular opinion as formulated by Walton.

Appeal to Popular Opinion If a large majority (everyone, nearly everyone, etc.) accept A as true, then there exists a (defeasible) presumption in favor of A.

A large majority accept A as true.
Therefore, there exists a presumption in favor of A.

Blair found a contradiction here. He wrote (p. 341), "this scheme has the form of *modus ponens*." And then he wrote, "yet Walton says that this kind of argumentation is deductively invalid!" These comments suggest that there is much to be puzzled about with the account of argumentation schemes ventured in (Walton, 1996). We

all know that *modus ponens* is a deductively valid form of argument, and thus that all arguments having the *modus ponens* form are deductively valid. So if presumptive argumentation schemes can be cast in the *modus ponens* form, the outcome seems to be a bad sort of contradiction that needs to be resolved. How can this problem be dealt with?

The problem can be addressed by drawing a distinction between two types of inference after a fashion proposed by Verheij (2000, p. 5).

Modus Ponens

Premises:

As a rule, if P then Q
P

Conclusion:

Q

Modus Non Excipiens

Premises:

As a rule, if P then Q
P
It is not the case that there is an exception to the rule that if P then Q

Conclusion:

Q

As far as terminology is concerned, we would like to call *modus non excipiens* defeasible *modus ponens*. The strict form can then just be called *modus ponens*. Or if the contrast needs to be emphasized, it could be called deductive *modus ponens* or strict *modus ponens*. This distinction, whatever terms you use to draw it, seems to address Blair's problem. But it poses another one. How can one tell in a given case whether a *modus ponens* argument is better formalized using the one form or the other? Verheij (2000, p. 5) proposed policies to enable us to distinguish between cases. But we won't pause on this more practical aspect of the problem. Each case needs to be dealt with individually to examine the claim presumably made by an arguer. Even if this practical problem can be solved, Blair's problem resurfaces in another guise by raising a general theoretical problem. It is a controversial issue that goes to the heart of applied logic.

The reason this issue is so controversial is that logic textbooks have become accustomed to telling students that all arguments having the *modus form* are deductively valid. This statement can be misleading however. It seems to suggest that even arguments of defeasible *modus ponens* form have to be deductively valid. It seems to make deductive logic all-encompassing. It the supposed applicability of deductive logic to arguments that, many of us would say, it doesn't properly apply to. This expansionist approach is evident in many of the standard logic textbooks. For example, in the very widely used textbook Introduction to Logic (Copi and Cohen, 1998, p. 363) the reader is told that the following argument has the *modus ponens* form, and is therefore deductively valid.

If he has a good lawyer then he will be acquitted.
He has a good lawyer.
Therefore he will be acquitted.

Copi and Cohen (p. 363) tell their readers that the first premise should be translated into symbolic form using the material conditional, and that the argument can then be proved to be valid using propositional logic. But is it deductively valid? The problem is that it could be true that you could have a good lawyer, but it could also be true that the other side has a better one. At this point Blair's problem resurfaces as the firestorm of controversy begins (to mix two metaphors). The deductivist camp will maintain that if you mean the first premise to be really true, then the argument can be seen as deductively valid. The problem with this approach is that deductive logic has been expanded so widely that seeing the above argument as having any inferential link or warrant is excluded. In particular this expansionist approach excludes the possibility of seeing the argument as having the defeasible *modus ponens* form. And so it excludes the possibility of using defeasible *modus ponens* as a resource for the study of argumentation schemes.

For those in the computing field, who are used to dealing with defeasible inferences, Blair's problem is easily circumvented. All we need to do is to recognize the distinction between strict and defeasible *modus ponens* and then classify the lawyers argument from Copi and Cohen as having the defeasible form. But those used to deductive logic as presented in the standard textbooks may not give up so easily. One of the issues which brings the two camps closer together is the need to diagram such arguments. Diagramming is of interest both to those in argumentation as a tool in the analytical toolbox, and to computer scientists as a precursor to implementable formalisation.

As explicit *modus ponens* arguments are so rare in everyday conversation (we return to this below), it is not often that one encounters diagrams of such arguments. Given that the conventional, deductive form of *modus ponens* relies on both its two premises, one appropriate diagram would be a linked structure as follows:

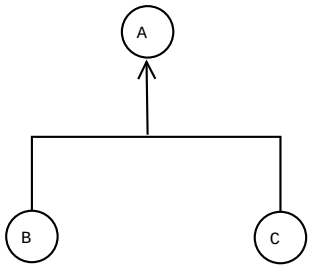

Figure 1. Linked structure diagram

Which maps on to the deductive *modus ponens* with A representing the conclusion Q, B representing the major premise *If P then Q*, and C the minor premise P. Of course, the diagram works equally well as an analysis of the Copi and Cohen argument:

A. He will be acquitted

B. He has a good lawyer

C. If he has a good lawyer then he will be acquitted

So, the apparent similarity in form is mirrored by similarity in diagramming. Yet, if the forms of *modus ponens* and *modus non excipiens* are to be distinguished, then the diagrammatic analysis too should be able to handle the difference.

The approach proposed and implemented in the Araucaria system (Reed and Rowe, 2001) is to mark instantiations of schemes explicitly. If we want to distinguish *modus ponens* and *modus non excipiens* by seeing the latter as a scheme, or if we want to indicate that the Copi and Cohen argument is an instantiation of a particular scheme, the diagram in Figure 2 would be appropriate.

Thus, the part of an argument covered by, or encapsulated in, an argumentation scheme is demarcated by a coloured area - which may

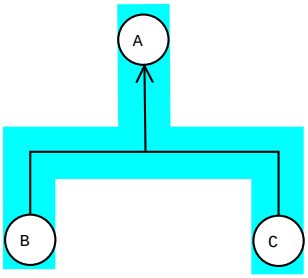

Figure 2. Argument scheme diagram

then be labelled.

This approach has the benefit of providing a common diagramming technique for both deductivists and those advocating a somewhat smaller remit for deductive logic. In this approach to diagramming, the rich variety of real arguments can be catered for without needing a resolution to that discussion, and, further, it provides a starting point for formlisation of argument structure within computer science. At the moment, the structures in Figures 1 and 2 are constructed within the Araucaria software, and saved using an Argument Markup Language (AML), based upon the industry standard XML approach. There are a range of benefits associated with using XML, but perhaps the most important here is that as an open standard, it supports a wide variety of different techniques for accessing and manipulating the data. Some of these techniques have applications, such as computer supported collaborative work and multi-agent systems communication, which lie squarely within computer science and for which closely defined, formal descriptions of argument are crucial.

4 The Completeness Problem for Argumentation Schemes

What could be called the completeness problem for argumentation schemes is expressed in the following question. When all the appropriate critical questions matching a scheme been answered satisfactorily, must the respondent then accept the argument? Or can he continue to ask critical questions? Or the question can put another way. When is a presumptive argument complete, meaning that if the respondent commits to the premises he must also commit to the conclusion? These questions ask how argumentation schemes are binding so to speak. Arguments based on presumptive schemes are not binding in the same way that a deductively valid is, or even in the same way that an inductively strong argument is. The respondent is only bound to tentatively accept the conclusion of a argument fitting a presumptive scheme, given that he accepts the premises of such an argument. Such arguments are plausible but inherently weak. Only when taken along with other arguments in a mass of evidence do they shift a balance of considerations.

It would be tempting to jump to the following hypothesis. Once all the critical questions matching a scheme have been satisfactorily answered, the argumentation is complete. But there is a problem with this hypothesis. It has been shown some schemes can have critical subquestions under each critical question. For example, the following three critical subquestions have been cited (Walton, 1997, p. 217) as coming under the trustworthiness critical question of the appeal to expert opinion.

Subquestion 1: Is E biased?
Subquestion 2: Is E honest?
Subquestion 3: Is E conscientious?

Bias, meaning failure represent both sides of an issue in a balanced way, is an important factor in evaluating appeal to expert opinion. Honesty is a matter of telling the truth, as the expert sees it. Conscientiousness is different from honesty, and refers to care in collecting sufficient information. Thus here we have three critical subquestions nested under the more general trustworthiness critical question matching version I of the appeal to expert opinion argumentation scheme above.

Suppose a respondent in a given case has asked all six of the basic critical questions corresponding to version I of the appeal to expert opinion scheme and the proponent has answered all of them adequately? Is the respondent now obliged to accept the appeal to expert opinion or can he continue to raise questions about it? We won't try to solve the completeness problem here, but will only suggest that a solution requires recognition of different levels on which critical questioning can take place in a dialogue. At one level, basic critical questions can be asked. At another level, critical subquestions of the basic questions can also be asked. Some authors, such as Gilbert (1991) suggest that this questioning can go on almost indefinitely. Presumptive arguments should always be regarded as open to critical questioning in a dialogue until the dialogue reaches the closing stage. Closure to asking of critical questions thus depends on the stage a dialogue is in.

5 Enthymemes

Invoking the authority of Aristotle, logic has traditonally used the term 'enthymeme' to mean an argument with missing (unstated) premises (or a conclusion). More and more evidence is showing that this meaning of 'enthymeme' is based on a misinterpretation of Aristotle's writings, beginning with the earliest commentators. Burnyeat (1994) has shown that Alexander of Aphrodisias may have been the first to put forward what became traditional view of enthymeme for two millenia. According to Burnyeat, what Aristotle really meant by 'enthymeme' is the plausibilistic type of arguments with a major premise expressing a generalizations that is not absolutely universal, but is defeasible. Such an argument may look like a syllogism with a premise containing what we now call a universal quantifier. But this appearance is misleading. This premise contains a generalization holds only "for the most part", to use Burnyeat's translation of Aristotle's expression. This new interpretation of Aristotle's writings on the enthymeme is quite exciting for those of us studying argumentation schemes. It suggests that the real Aristotelian enthymeme is the defeasible (presumptive) argumentation scheme of the kind described above.

Whatever you call it though, the problem of figuring out how to fill in missing premises or conclusions in a text of discourse is still there. It could be called the problem of incomplete arguments, or the problem of arguments with missing parts. It may seem a simple problem at first, but the many difficulties inherent in it have been shown. Such arguments are expressed in natural language, and a natural language text of discourse can be highly problematic to make sense of. Inserting premises that make an argument valid may misrepresent what the arguer meant to say (Burke, 1985; Gough and Tindale, 1985; Hitchcock, 1985). There is the ever-present danger of the straw man fallacy. This fallacy is the device of exaggerating or distorting an interpretation of an argument in order to make it look

more extreme than it is, thereby making it easier to attack or refute it (Scriven, 1976, pp. 85-86). Examining these problems, it may appear the dream of creating an enthymeme machine, a mechanical device that automatically inserts missing premises or conclusions into an argument, is unachievable. Certainly creating such machine is a lot harder than it looks, given the difficulties in dealing with natural language argumentation.

An example taken from an exercise in Copi and Cohen (1994, p. 296) will illustrate some aspects of the problem. The reader is instructed to formulate the missing but understood premise or conclusion in the following enthyememes. One of these enthmemes is quoted below.

> Although these textbooks purport to be a universal guide to learning of great worth and importance - there is a single clue that points to another direction. In the six years I taught in city and country schools, no one ever stole a textbook.

The missing premise seems to be the statement, 'If people thought that these textbooks were a universal guide to learning of great worth and importance, they would steal them if given an opportunity. But the observation stated is that people do not tend to steal these textbooks when given an opportunity. The conclusion is that people do not think that these textbooks are a universal guide to learning of great worth and importance. This example brings out the point that an enthymeme can have an implicit premise that is a defeasible type of conditional. It is a type of conditional that is not absolute or strict. It would not support a deductively valid *modus ponens* argument. It presents us with a defeasible *modus ponens* argument. Of course there are enthymemes that can be reconstructed as *modus ponens* arguments or as syllogisms. But surely there are just as many, or perhaps even more, that can be better reconstructed as defeasible arguments.

REFERENCES

[1] Aristotle, *Topics*, trans. E. S. Forster, Loeb Classical Library, Cambridge, Mass., Harvard University Press, 1939.

[2] Aristotle, *On Sophistical Refutations*, trans. E. S. Forster, Loeb Classical Library, Cambridge, Mass., Harvard University Press, 1928. 11

[3] Aristotle, *The Art of Rhetoric*, trans. John Henry Freese, Loeb Classical Library, Cambridge, Mass., Harvard University Press, 1937.

[4] J. Anthony Blair, 'Review of (Walton, 1996)', *Argumentation*, 13, 1999, 338-343.

[5] Michael Burke, 'Unstated Premises', *Informal Logic*, 7, 1985, 107-118.

[6] Myles F. Burnyeat, 'Enthymeme: Aristotle on the Logic of Persuasion', *Aristotle's Rhetoric: Philosophical Essays*, ed. David J. Furley and Alexander Nehemas, Princeton, N. J., Princeton University Press, 1994, pp. 3-55.

[7] Irving M. Copi and Carl Cohen, *Introduction to Logic*, 10th ed., Upper Saddle River, Prentice Hall, 1998. Also cited is the 9th edition of 1994.

[8] Michael Gilbert, 'The Enthymeme Buster', *Informal Logic* 13(3), 1991, 159-166.

[9] James Gough and Christopher Tindale, 'Hidden or Missing Premises', *Informal Logic*, 7, 1985, 99-106.

[10] Arthur C. Hastings, *A Reformulation of the Modes of Reasoning in Argumentation*, Evanston, Illinois, Ph.D. Dissertation, 1963.

[11] David Hitchcock, 'Enthymematic Arguments', *Informal Logic*, 7, 1985, 83-97.

[12] Manfred Kienpointner, *Alltagslogik : Struktur und Funktion von Argumentationsmustern*, Stuttgart, Fromman-Holzboog, 1992.

[13] Chaim Perelman and Lucie Olbrechts-Tyteca, *The New Rhetoric*, Notre Dame, University of Notre Dame Press, 1969.

[14] Chris Reed and Glenn Rowe, *Araucaria: Software for Puzzles in Argument Diagramming and XML*, Technical Report, Dept. of Applied Computing, University of Dundee, 2001.

[15] Frans H. van Eemeren and Rob Grootendorst, *Speech Acts in Argumentative Discussions*, Dordrecht, Foris, 1984.

[16] Frans H. van Eemeren and Rob Grootendorst, *Argumentation, Communication and Fallacies*, Hillsdale, N. J. Erlbaum, 1992.

[17] Bart Verheij, 'Logic, Context and Valid Inference Or: Can There be a Logic of Law', 2000. Available on `bart.verheij@metajur.unimaas.nl`, `http://www.metajur.unimaas.nl/~bart/`

[18] Douglas Walton, *Argumentation Schemes for Presumptive Reasoning*, Mahwah, N. J., Erlbaum, 1996.

[19] Douglas Walton, *Appeal to Expert Opinion*, University Park, Penn State Press, 1997.

[20] Barbara Warnick, 'Two Systems of Invention: The Topics in the Rhetoric and The New Rhetoric', *Rereading Aristotle's Rhetoric*, ed. Alan G. Gross and Arthur E. Walzer, Carbondale, Southern Illinois University Press, 2000, 107-129.