

## ARGUMENTATION SCHEMES AND ENTHYMEMES

**ABSTRACT.** The aim of this investigation is to explore the role of argumentation schemes in enthymeme reconstruction. This aim is pursued by studying selected cases of incomplete arguments in natural language discourse to see what the requirements are for filling in the unstated premises and conclusions in some systematic and useful way. Some of these cases are best handled using deductive tools, while others respond best to an analysis based on defeasible argumentation schemes. The approach is also shown to work reasonably well for weak arguments, a class of arguments that has always been difficult to analyze without the principle of charity producing a straw man.

### 1. INTRODUCTION

In many logic textbooks so-called enthymemes, or arguments with missing (unstated) premises or conclusions, are treated using deductive logic (like syllogistic) to reconstruct the given argument. The ten case studies analyzed and discussed below show why this treatment, while it is useful in some cases, is inadequate to treat the broad range of typical kind of cases of enthymemes in natural language discourse in the best way. It is argued that these argument cases cannot best be reconstructed using only deductive forms of reasoning, or inductive forms of reasoning of the modern kind associated with statistical inference. These cases are shown to require a less strict standard of reasoning that is defeasible in nature. This third kind of argumentation has been much studied in artificial intelligence (AI), where it is called plausible reasoning, and is often associated with abduction (Josephson and Josephson 1994). It is shown through these case studies that the kind of structure needed to reconstruct the missing parts of an argument is the argumentation scheme (Hastings 1963; Perelman and Olbrechts-Tyteca 1969; Kienpointner 1987, 1992; Walton 1996; Garssen 2001). It is shown that the argumentation schemes most useful for analysis of many enthymemes are based on defeasible generalizations of a kind that are that are subject to exceptions.<sup>1</sup> This defeasibilistic view of enthymemes is not as new as it may sound to many readers. It can be shown to be very close to what may have been Aristotle's original doctrine of the enthymeme, according to the view of some commentators

(Burnyeat 1994). According to this original view an enthymeme is not an argument with a missing premise, but is a plausible argument based on a defeasible generalization, as opposed to a deductive argument based on a universal generalization of the type represented by the universal quantifier of deductive logic.

For purposes of finding missing premises in incomplete arguments expressed in texts of natural language discourse it would be a logician's dream to have an automated enthymeme machine. The machine would be a software entity that could be applied to incomplete arguments in any chunk of discourse comprised by a natural language text, like a newspaper editorial. Assuming that there is some way of identifying arguments with existing premises and (if stated) a conclusion, the function of an enthymeme machine is to pick out the unstated premises and conclusions in these existing arguments. The task is one of identifying the commitments that could be ascribed to an arguer as a basis for posing critical questions about the argument, based on the given text of discourse. But automation of an enthymeme machine, if reasonable reliability and domain independence are required, becomes extremely difficult if the machine must be presumed to have a capability of natural language understanding. There is a way around this problem however, by beginning with a technology that supports the user's ability to mark up an argument by identifying premises, conclusion and argumentation schemes. The Araucaria software (Reed and Rowe 2001) is a system that, given the user's markup of an argument in a given text of discourse, aids in determining implicit premises.<sup>2</sup> Thus the project of building an enthymeme machine becomes immediately approachable in a small way. Supplementing familiar argument forms of deductive logic with argumentation schemes, in the way proposed in this paper, provides a logical and philosophical basis for this new approach. The approach is shown to require two main components. One is the set of argumentation schemes and its apparatus. The other is the dialectical framework representing the different types of dialogue and features of dialogue. Most of the concern in this paper is with the first component. But at the end, a general discussion of the dialectical component is included.

## 2. PRELIMINARY DISCUSSION OF THE PROBLEM

The term 'enthymeme' has been taken, since the earliest commentators on Aristotle, to refer to an argument with premises (or a conclusion) that are not explicitly stated. That meaning may be historically wrong and misleading, but it is the one that has been presented as the official meaning of 'enthymeme' in logic textbooks for over two thousand years.<sup>3</sup> In

the official account, these missing statements are generally taken to be assumptions that are needed to make the argument valid. But attributing assumptions to an arguer is a process that is difficult to verify. It depends on interpreting what the arguer meant to say, as far as anyone can tell from the text of discourse attributed to her. A natural language text of discourse can be difficult to interpret. It can be vague or ambiguous. An arguer may be confused, and not know herself what she means. Or in other cases, she may try to hide her meaning by using deceptive tactics and fallacies. Another problem with enthymemes (Burke 1985; Gough and Tindale 1985; Hitchcock 1985) is that inserting assumptions into a text of discourse to make an argument in it valid may not represent what the arguer meant to say. Maybe the argument she intended to put forward is invalid. There is even the danger of the straw man fallacy. This fallacious tactic consists in 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, 85–86). Given these problems, many would despair of finding any objective method for dealing with enthymemes, and would declare that the matter is “subjective”. The idea of building a mechanistic or automated enthymeme machine appears to be hopeless. To help devise a tool that could be used to deal with the problem, Ennis (1982, 63–66) drew a distinction between needed and used assumptions in enthymemes. The needed assumptions are “propositions that are needed to support the conclusion, to make the argument a good one, to make a position rational, etc.” (Ennis 1982, 63). The used assumptions are the missing statements that are presumably meant to be included in the argument by its proponent. Ennis (1982, 64) takes the difference to be that that used assumptions are “unstated reasons”, while the needed assumptions are not. This distinction suggests that building an enthymeme machine for finding needed assumptions could be a good way of moving toward the harder project of building such a machine for finding used assumptions.<sup>4</sup> It may turn out then, in real cases, that the pragmatic component of the enthymeme machine is not so easily separable from the inferential component. A pragmatic tool often used to try to deal with enthymemes is the principle of charity, which offers a way of choosing between competing interpretations of an argument. This principle is usually taken to rule that one should choose the interpretation that makes the author of the argument appear more “sensible” rather than less sensible (Gough and Tindale 1985, 102). Another way of expressing the principle of charity is as the following general maxim of interpretation: “When interpreting a text, make the best possible sense of it.” (Johnson 2000, 127). But how could this criterion be made more precise as applied to incomplete arguments? One obvious way is to rephrase the principle so

that the criterion is the strength or weakness of the various interpretations as arguments. According to this criterion, the principle of charity rules that one should pick the interpretation that makes the argument stronger. But the standard objection to this version of the principle of charity is that it seems to require filling in missing assumptions until the “best possible” argument is produced (Gough and Tindale 1985, 102–103). The problem with this version of the principle is that the argument may be weak, and by making it stronger the interpreter of it may be distorting it. The principle of charity is too crude as a tool to help with determining missing premises (or conclusions), unless it can be made more precise in the right way. Thus pragmatic tools, although they can be of some help, do not seem to have been developed in quite the right way to work with cases of enthymemes.

Below, a number of cases are studied that bring out several aspects of incomplete arguments that have not been sufficiently appreciated in the past. What will be suggested by these cases is that there is a kind of formal or inferential criterion involved, but it is not always that of deductive validity. What is also shown is that dialectical factors are involved as well, and that these dialectical factors pertain to the context of dialogue in which an argument was used. They have to do with the purpose that an argument was supposedly used for, in a given conversational setting or type of dialogue. One such purpose might be to seek transfer of information between a questioner and a respondent. Formal dialectical systems representing information-seeking dialogue have been presented by Hintikka (1979, 1992, 1993, 1995). Another purpose might be to discuss an issue to bring out the strongest arguments on both sides. For example, suppose an arguer has the goal of persuading the reader to come to accept a particular proposition that he did not accept before by presenting arguments. This context of dialogue is that of a critical discussion. In such a case, the arguer will try to use premises that the audience accepts, or can be brought to accept, and that can be used to get the audience to come to accept the arguer’s conclusion (Van Eemeren and Grootendorst 1992). If this approach is right, then there will not only be a structural criterion that has to do with the form of the argument. There will also be a contextual criterion that has to do with how the argument was being used as part of some conversational exchange. In the discussion of the cases below, most attention is on the inferential component of the enthymeme machine. But in the last section, the general discussion of the problem of enthymemes includes consideration of the pragmatic component.

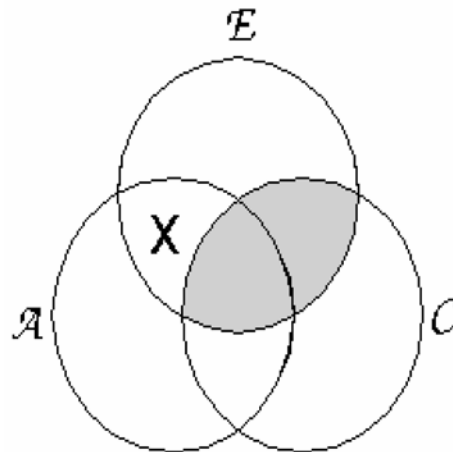


Figure 1. Venn diagram for the existential reconstruction.

### 3. A DEDUCTIVE CASE

This case is interesting because there are two ways of filling in the missing premise. Both ways produce a syllogism with a true premise. But the one way produces a valid syllogism while the other produces an invalid syllogism. The argument in question is: “No enthymemes are complete, therefore some arguments are not complete.” Let’s call this the syllogistic case, because it turns out to have the form of a syllogism. The first candidate for the missing premise is ‘Some arguments are enthymemes.’ This analysis yields the following syllogism.

No enthymemes are complete.  
 Some enthymemes are arguments.  
 Therefore some arguments are not complete.

This syllogism is valid, as shown by the Venn diagram below.

But it is also possible to reconstruct the argument syllogistically as follows.

No enthymemes are complete.  
 All enthymemes are arguments.  
 Therefore some arguments are not complete.

The missing assumption is the second premise, on this account. This syllogism can be tested for validity using the following Venn diagram.

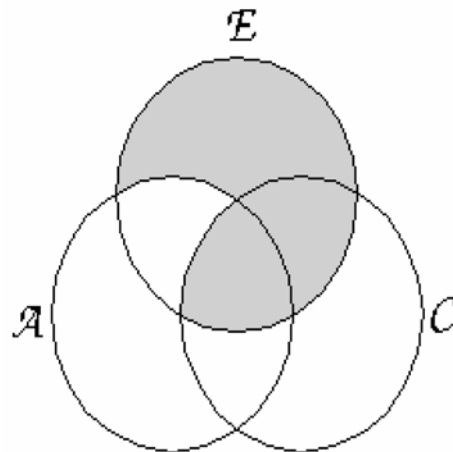


Figure 2. Venn diagram for the universal reconstruction.

On both analyses, the missing premise is a true statement. But only on the first analysis is the syllogism unconditionally valid. On the second analysis, the argument is valid if you assume that enthymemes exist. If you adopt existential import, and assume that 'All enthymemes are arguments' implies 'Some enthymemes are arguments', the argument comes out as valid. But otherwise it is not valid. The two premises are universal statements (without existential import) whereas the conclusion is a particular statement (with existential import). So although the argument is valid on the traditional Aristotelian interpretation, it is not valid on the modern Boolean interpretation.

This case seems like an easy one to resolve. The first analysis is arguably the right one, because it makes the argument come out valid without restrictions. Also, the first one seems more natural. Yet what is natural or not may be a subjective matter that is subject to dispute. So how can we say that the first one is right just because it makes the argument come out valid without adding assumptions about existential import that may be problematic? And should a missing part always be selected such that it makes the argument come out valid? If not, how can the first analysis be defended as the preferable one? After all, it may be argued, maybe the proponent of the argument really had the (invalid) second argument in mind. Some would invoke the principle of charity here, or some similar principle, arguing that the first analysis is better because it makes the argument come out stronger. But why, given two choices, should the one that makes the argument come out stronger be chosen? This question calls for some general principle that can be used to make judgments of which analysis to choose, if more than one is possible in a given case.

These issues apart, this case does have some clear lessons. It shows that, in some cases at least, deductive logic can be a useful tool in dealing with incomplete arguments. But as we will now go on to show by examining a range of other cases, deductive logic is not always the structural tool of choice for this purpose.

#### 4. LIMITATIONS OF DEDUCTIVE ANALYSIS

The following example looks initially like it should be deductive, but other interpretations need to be considered. This example, which we will call the frogs case, is from an exercise in the textbook (Hurley 2000, 292).

Any drastic decline in animal life is cause for alarm, and the current decline in frogs and toads is drastic.

In this case, what is needed to make the argument explicit is the conclusion, 'The current decline in frogs and toads is cause for alarm.' But there is also a missing premise needed to make the argument deductively valid. This premise needs to state that all frogs and toads are (forms of) animal life. In this case, the argument is plausibly cast as being deductively valid once the missing parts have been filled in.

What could be used to fill in the missing premise that frogs and toads are animals is the argumentation scheme for argument from verbal classification. The precise form of the argument from verbal classification given in (Walton 1996, 53–55) uses variable for individuals and properties as indicated below.

Individual  $a$  has property  $F$ .

For all  $x$ , if  $x$  has property  $F$ , then  $x$  can be classified as having property  $G$ .

Therefore  $a$  has property  $G$ .

The case shows that the argumentation scheme for argument from a verbal classification needs to be expanded to take into account cases of arguments based on subspecies relationships. In this case, it is not an individual frog or toad that is being classified, but frogs and toads generally. Still, one can see that the missing premise that needs to be filled in, in this case, is based on argumentation from verbal classification. The generalization in this case, 'All frogs and toads are (forms of) animal life.' is a strict or absolute one, of the kind modeled by the universal quantifier in deductive logic. These strict generalizations can be contrasted to the defeasible generalizations, the importance of which are shown in the next case.

The following example is quoted from the Sherlock Holmes story, 'The Adventure of Silver Blaze'. So we will call it the Silver Blaze case.

A dog was kept in the stable, and yet, though someone had been in and fetched out a horse, he had not barked enough to rouse the two lads in the loft. Obviously the midnight visitor was someone whom the dog knew well.<sup>5</sup>

The missing premise in this case seems to be the generalization, 'Dogs generally bark when a person enters an area (like a stall) unless the dog knows the person well.'<sup>6</sup> This generalization does not seem to be a strict (absolute) universally quantified statement. There are all kinds of possible exceptions. Some dogs will bark at any person who enters an area. Some dogs won't bark at any person who enters an area, or hardly any person. Some dogs are unpredictable. Or the dog in question could have been drugged. Despite such possible exceptions, the generalization does seem to hold as a reasonable warrant for an inference. But in this case, the argument does not seem to be deductively valid. The argument to the conclusion does carry some weight as evidence. It seems to be a conjecture, based on plausible reasoning. The defeasible generalization in this case can be contrasted with the strict (absolute) generalization 'All frogs and toads are (forms of) animal life.' in the frogs case. The word 'generally' is an indicator of this defeasibility pointing to the existence of potential exceptions. The strict generalization is falsified by a single counter-example. But when a contrary instance confronts a defeasible generalization in a given case, the generalization still holds (at a general level), even though it has defaulted in this particular case. For example, a dog that is too sick to bark falsifies the generalization, 'Dogs bark when a person enters an area', but it is an exception to the generalization, 'Dogs generally bark when a person enters an area'.

The argument in this case could be nicely analyzed as an abductive inference, as follows. The known facts are that the intruder entered the stall and the dog didn't bark. But this situation seems unusual, and calls out for an explanation. For don't dogs normally bark when a person enters an area where the dog is kept and takes something away? Then why didn't it happen in this case? The best explanation would seem to be that the dog knew the person who entered the stall. For generally, if a dog knows the person, it won't bark. Thus the best explanation of the given data, including what happened and what didn't happen, is that the dog knew the person who entered the stall and took the horse. The line of argument in this case, so analyzed, involves the *argumentum ad ignorantiam*, the so-called argument from ignorance, or lack of-evidence argument. Sherlock



Holmes called the case “the curious incident of the dog in the nighttime.” To the riposte, “The dog did nothing in the night-time.” Holmes answered, “That was the curious incident.”<sup>7</sup> Although Holmes was known to describe the reasoning used in his detective work as deductive, in this case it is a clear example of the use of plausible, or abductive reasoning. On the argumentation scheme for the argument from ignorance, see (Walton 1996, chapter 4). This scheme is associated with the inferential rule of the Closed World Assumption in AI. Reiter (1980, 69) calls the Closed World Assumption the rule that if all the positive information in a data base is listed, the negative information is represented by default. For example, (Reiter 1980, 69), considers a question-answering system associated with an airline flight schedule. The user asks the question, “Does Air Canada flight 113 connect Vancouver with New York?” If there is such a flight listed in the data base, the system responds “yes”. But if there is no such flight listed in the data base, such a system will typically respond “no”. In other words (Reiter 1980, 69), “Failure to find a proof has sanctioned an inference.” The system has assumed that if there were such a flight, it would be listed in the data base. In other words, the system has adopted the closed world assumption. Or to put it another way, the system has used the argument from ignorance as the basis for its response.

Is the argument from ignorance fallacious in this case or reasonable? The use of the term “obviously” in the conclusion indicates a kind of confidence that is typical of Holmes’ “deductions”, but that is not reasonably justified by the argument. Holmes seems to be leaping a bit too quickly to a conclusion that could be wrong. The use of the word “obviously” is textual evidence for evaluating the argument from ignorance as fallacious (with apologies to Sherlock Holmes fans).<sup>8</sup> On the other hand, such an argument does carry some weight as supporting the conclusion, giving a reason to accept it as one small argument within the mass of relevant evidence in the case.

The Silver Blaze case is quite a nice example of an incomplete argument with a defeasible generalization as the missing assumption. It has some interesting lessons with regard to the argument from ignorance, or lack-of-evidence argument, as it is sometimes called. The frogs case is more complex. It contains a missing premise and a missing conclusion. The missing premise is a strict universal generalization, and the argumentation scheme that underlies it seems to be deductive rather than presumptive or plausibilistic in nature.

## 5. USE OF ARGUMENTATION SCHEMES IN ANALYSIS

The previous section has shown that schemes can play role even where some superficial deductive structure is apparently applicable. In other cases, schemes play a more dominant role. Hurley (2000, 289) defines an enthymeme as “an argument that is expressible as a categorical syllogism but that is missing a premise or a conclusion”, and offers the following example. Let’s call it the corporate income tax case.

The corporate income tax should be abolished; it encourages waste and high prices.

The missing premise is said to be the statement, “Whatever encourages waste and high prices should be abolished.” (p. 289). To make the argument into a categorical syllogism, this statement has to be taken to express a universal generalization, like ‘All things (or perhaps practices) that encourage waste and high prices are things (practices) that should be abolished.’ One might wonder in this case whether the missing statement should be taken to express a strictly universal generalization. Perhaps it means something more like, ‘In general, if a practice encourages waste and high prices, then that is a reason to abolish it.’ This version of the statement is defeasible, because it is compatible with there being reasons for not abolishing the practice. It could be called a defeasible generalization or non-strict generalization. So analyzed, the argument in the corporate income tax case falls into the category of enthymeme in the original Aristotelian sense of the term cited by Burnyeat.

Another observation about this case is that the argument seems to depend on two additional missing premises. One is a statement that could be expressed as follows: a practice that encourages waste and high prices is, all other things being equal, a bad practice. The other is the statement, ‘If something is a bad practice, it ought to be abolished.’ A structure that is helpful in guiding an argument analyst on how to fill in these missing premises is the argumentation scheme for the argument from negative consequences (Walton 1996, 76).

Premise: if action *A* is brought about, bad consequences will occur.

Conclusion: therefore *A* should not be brought about.

This argumentation scheme can be used to give a reason to support the claim that an action should not be carried out, the reason being that

bad consequences will occur. As described above, there is another argumentation scheme for what is called argument from classification. Using argument from classification, you could classify “waste” and “high prices” as being, generally speaking, bad things. Then using argument from classification and argument for negative consequences, you could identify two generalizations that could function as unstated premises in the argument in the corporate income tax case. Argument from Negative Consequences  
Premise: Any practice that has bad consequences should (other things being equal) be discontinued.

Argument from Classification Premise: Waste and high prices are (generally) bad things.

This way of reconstructing the argument is quite attractive, because the argumentation schemes can be used to identify the generalizations that naturally fit as the missing premises. Although we can dispute about what the missing premises really are, and exactly what form they should take, the analysis using argumentation schemes is a good fit. It is even less problematic than the analysis of the syllogistic case. This analysis employed deductive logic, while the analysis of the corporate income tax case used argumentation schemes.

The question of how the argumentation in the corporate income tax case should be diagrammed is interesting, because it raises the issue of how an argumentation scheme should be represented on an argument diagram. Consider the following representation.

- (1) The corporate income tax should be abolished.
- (2) The corporate income tax has bad consequences.
- (3) The corporate income tax encourages waste and high prices.
- (4) Waste and high prices are bad consequences.

The 2–1 part in the shaded area is an instantiation of the argument from consequences scheme in which the premise (2) is defeasible. The shaded area thus represents the structure of the argumentation scheme for argument from consequences as diagrammed by Araucaria.

The argument in the following case, like that in the in the corporate income tax case, is better analyzed as being a defeasible inference based on a presumptive argumentation scheme. Many enthymemes have to do with practical reasoning. Consider the following example, which we will call the self-hypnosis case, from Pinto, Blair and Parr (1993, p. 143).

Everyone should learn self-hypnosis because it’s one of the best ways to reduce stress.

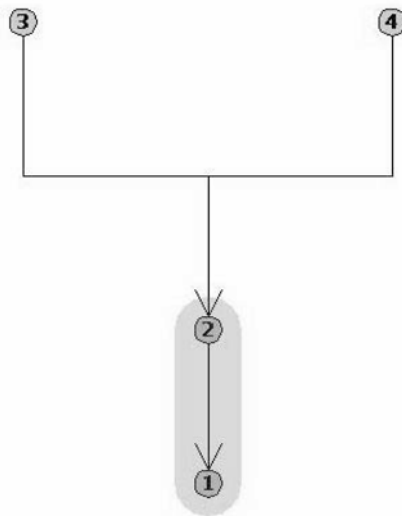


Figure 3. Diagramming an argumentation scheme.

This argument rests on the implicit assumption that reducing stress is a worthwhile goal for everyone. Then the stated premise is that self-hypnosis is a means to reduce stress – one of the best ways. The conclusion, as stated, is that everyone should learn self-hypnosis. In this case, the argument is not deductively valid. But once the nonexplicit assumption is inserted as a premise, the argument does have a recognizable form.

The argumentation scheme for practical reasoning (Walton 1996, 11) is based on a form of argument that has two premises. The first premise states that an agent has a goal. The second states that the agent reasonably judges that carrying out a particular action is a means to achieve this goal. The conclusion is the statement that the agent arrives at the conclusion that he or she should carry out this particular action. Matching the argumentation scheme for practical reasoning are five appropriate critical questions that can be asked (Walton 1996, 11).

1. Is it realistically possible to achieve the goal?
2. Are there positive or negative consequences of either of the courses of action that should be taken into account?
3. Are there other means of carrying out the goal that should be considered?
4. Which is the best of the various means available?
5. Are there other goals (possibly even conflicting with the goal at issue) that should be considered?

The argument having the form of argumentation from consequences can carry some weight as a plausible argument in a given case. But if an appropriate critical question is asked, that weight is temporarily suspended until the question has been successfully answered. Thus arguments of this form are defeasible. In the self-hypnosis case, the missing premise is the statement 'Reducing stress is a worthwhile goal for everyone.' This statement looks like a strict universal generalization, but is it? Statements about goals are generally defeasible (including the one in this very sentence). It can be argued, in this case, that reducing stress is not a worthwhile goal for absolutely everyone, but is a worthwhile goal for most of us, these days, who live such stressful lives. At any rate, this case suggests that goal-directed practical reasoning is a form of argumentation underlying many cases of enthymemes.

#### 6. USE OF SCHEMES IN ANALYZING WEAK ARGUMENTS

The following example is taken from a letter to *Chatelaine* magazine, May, 1982. We will call it the abortion case. It represents the kind of case in which, once the implicit assumption is identified, it is highly questionable whether it is justified.

When a murderer is found guilty, he is punished regardless of his reasons for killing. Similarly, anyone partaking in an abortion is guilty of having deprived an individual of her or his right to life.

The implicit conclusion is the statement that anyone partaking in an abortion should be punished. Why? It seems that this statement is supported by the drawing of an analogy between the case of one person murdering another person and the case of someone partaking in an abortion. Since both kinds of cases are alleged to be similar, it is alleged that what is true of one should also be true of the other. The argumentation scheme for argument from analogy is given in (Walton 1996, 77–80). The argument is based on the assumption that since a murderer is punished, then by analogy, an abortion partaker should also be punished. In this case the argumentation scheme for argument from analogy can be used to show the argument is based on an implicit generalization that the two kinds of cases of murder and abortion are similar. Such a generalization is defeasible, for any two such real cases will also fail to be similar in some respects.

A good question that may be asked about incomplete arguments is whether they always have to come out as valid (or structurally correct,

by some standard) once the missing parts are filled in. Another question is whether the missing premises or conclusion are statements that have to be true, or at least plausible. The following case, an interesting one to consider, suggests an answer to this question. This case, which we will call the attendance case, is in the form of a dialogue, as quoted from Farrell (2000, 98):

*Student:* You have no right to flunk me.

*Professor:* Why?

*Student:* I came to every class.

The implicit assumption of the student's argument seems to be the following premise: all students who comes to every class should pass the course. Another premise that is explicitly stated is that this student (the one speaker in the dialogue) came to every class. The implied conclusion is that this student should pass the course. Presumably then, this conclusion is used as part of another argument with the conclusion that the professor had no right to fail this student. In this case, the missing premise, 'All students who come to every class should pass the course.' is (presumably) false. For presumably, attendance by itself is not sufficient for a passing grade.

In this type of case, there is a missing premise that is assumed by the argument, but the most natural candidate for the missing premise seems to be a statement that is false, or at least highly questionable. If this kind of reconstruction of such arguments is right, then it follows that, in some cases, filling in the missing premises (or conclusions) results in a bad argument. It results in an argument with a premise that is false, or at least implausible. It would seem to follow then that not all missing premises (or conclusions) have to be true or plausible propositions. Some incomplete arguments, when completed, come out as bad arguments. Cases like this one are interesting, because they suggest that filling in missing assumptions in incomplete arguments seems to have a critical component. If the student was asked whether she really meant to state the missing premise cited above, she might react defensively, and might not want to admit it, even though her argument does not seem to make much sense otherwise. So in this case, it might be too strong to assert that her original incomplete argument is identical to the completed version. A better approach might be as follows. A critic might pose critical questions in a dialogue by asking the student if that is what she really meant to argue. The critical discussion could then continue from there. At any rate, the issue of whether filling in incomplete arguments presupposes some sort of context of a critical discussion is considered in the section on dialectical aspects of enthymemes.

One can normally find another context of dialogue that supports a reasonable interpretation. For example, suppose that an instructor had mentioned to his student at the beginning of the school term that there is a strong statistical correlation between attending every lecture and getting an A grade. In this context, a student might construct an argument like, "A high proportion of students that attend every class pass the course; I attended every class; therefore I should pass the course."

The attendance case is curious. Normal practice in reconstructing arguments would be to try to base the argument on a missing assumption that is true or at least plausible, as indicated in the paragraph above. But in this case, the natural candidate for the missing premise is a statement that is false, or at least highly questionable. Is it a counter-example to this normal practice? It seems that it is not. As stated above, given a choice of missing assumptions that would make a given argument structurally correct, the rule is to select the more plausible one over the less plausible one. In the attendance case, the reason 'I came to class.' is connected in the dialogue to the conclusion, 'You had no right to flunk me.' in a way that indicates that the assumption the inference rests on is the generalization, 'All students who come to every class should pass the course.' But there could be a choice between a more plausible and a less plausible missing premise. A more plausible (or less implausible) choice would be, 'Generally, all other factors being equal, if a student comes to every class then he or she should pass the course.' But this statement does not look very plausible either. It looks like the only way to link the two premises of the argument together inferentially, and come up with a valid (or structurally correct) argument, is to choose a false or implausible generalization as the missing premise. Thus the attendance case throws some light on how to build the enthymeme machine. It suggests that the best choice for the missing premise does not always have to be a statement that is true, or even very plausible. It can be a statement that is questionable. The function of the enthymeme machine, in such a case, would not be to determine finally that such and such statement is the missing premise, closing all further discussion. Instead, it would be to prompt the asking of a critical question, like "This statement or that statement is what is required in order to complete your argument, so which one do you accept, or do you reject both of them as representing your argument?" In effect, the attendance case requires a dialogue approach rather than an absolute judgment or one-shot outcome.

The phone book case illustrates an enthymeme that may not, when filled out, produce an argument that is a good one.

Bob Sturges can't have a telephone, because his name isn't listed in the phone book.

The missing premise in this case seems to be the statement, 'If your name is not listed in the phone book then you don't have a telephone.' This assumption is false, as a matter of common knowledge, because it is possible to have an unlisted number.<sup>9</sup> If the missing assumption is inserted, the resulting argument is valid, but has a false premise. On the other hand, you could interpret the missing premise as a conditional that is not strict, but is a defeasible rule of thumb. Suppose we interpret the missing premise as saying that it's a pretty good guess, although it could be wrong, that if somebody is not listed, that he or she does not have a telephone. This interpretation makes the premise come out as rough but somewhat plausible, rather than false. But the argument is no longer valid. Instead it is a plausible argument that could carry some weight, but is defeasible.

It could be noted that the form of the argument in this case is also that of argument from ignorance. As described in the Silver Blaze case, such arguments can have a deductive form if the requirement of epistemic closure is met, licensing the closed world assumption, that is, if the knowledge base is complete, and no relevant facts are assumed to be missing (Walton 1996, 112). But more typically they are arguments used in cases where knowledge is incomplete. In such cases, even when they are reasonable, they tend to be plausible kinds of argument to tentatively move ahead with as a basis for action or further investigation.

#### 7. LIMITATIONS OF SCHEMES

The following two cases show that schemes do not offer a panacea for argument analysis. The first is adapted from an example from Peirce.<sup>10</sup> The argument in the fossilized fish case is the following:

"Fossilized remains of fish were found on Mount Lemmon;  
therefore, Mount Lemmon was under water at one time."

There seem to several implicit assumptions in this argument. One is that Mount Lemmon is not presently under water. But there are three others.

1. If fossilized remains of fish were found on Mount Lemmon, then were fish at Mount Lemmon at one time.
2. Fish can only survive in water.
3. If there were fish at Mount Lemmon at one time, then Mount Lemmon was under water at that time.

How the argument works can be analyzed as follows. The given premise, along with missing premise 1, implies by *modus ponens* that there were



fish at Mount Lemmon at one time. This statement, along with missing premise 3 implies the conclusion of the given argument. 2 functions as support for 3. 2 could perhaps be rephrased as 'All places that fish survive are places that are under water.' So construed, 2 deductively implies 3. But does the argument have to be reconstructed in a way that makes the warrant it is based on an absolute generalization or conditional? Maybe not. Perhaps the missing premise could be expressed using the following generalization: "Anywhere fossilized remains of fish were found is a place that was under water at one time." This generalization could be seen as one that is subject to exceptions, depending on what kind of explanations of the fossilized remains as data are possible or plausible. Peirce used this very case (or one like it) to illustrate abductive inference. Along Peircean lines, the argument can be reconstructed as an instance of inference to the best explanation. The given datum is the finding of fossilized remains of fish at Mount Lemmon. But then as Peirce might ask, how could such a finding be explained? A possible explanation is that fish were there in their natural state in the region of Mount Lemmon at one time. That hypothesis would explain how the fossils got there. But how could it be that fish survived in that location considering the additional fact there is no body of water near Mount Lemmon at the present time? For fish can only survive (under natural conditions) in water. A plausible explanation would be that Mount Lemmon was under water at one time, when the fish were there. Of course there could be other explanations. The fish could have been transported there, for example. Or they could have been blown there by hurricane, or by some other major disturbance. But it could be that the best explanation is that Mount Lemmon was under water at one time.

What the fossilized fish case shows is that there seem to be two ways of reconstructing this kind of argument. One way is the usual method of enthymemes or incomplete arguments. This way is to fill in the missing premises in the usual way, and then show how the conclusion follows by a chain of reasoning from the given premises along with the missing premises. The other way is the method of abduction. This way is to reconstruct the argument as an instance of inference to the best explanation. According to this method, you start from the given data, and then construct a hypothesis that seems to best explain the data. Then, from that hypothesis, you may construct a further hypotheses needed to explain the initial hypothesis. Using this method, you get a chain of inferences to the best explanation from the given data. These two ways seem to be equivalent. In practice, they pretty much seem to amount to the same general method. A chain of inferences is used to fill in the gaps to fill in the line the reasoning between the given premises and the conclusion to be proved.

One interesting aspect of this case is that it looks as if the first reconstruction, using the method of enthymemes, is based on deductive argument. The reason is that *modus ponens* is used to derive the conclusions needed in the chain of reasoning. Yet the abductive reconstruction uses inference to the best explanation, which is not a deductive form of argument. The resolution of the puzzle of a deductive form being used in non-deductive reasoning comes through the realization that premises 1 and 3 in the fossilized fish case are really not the kinds of conditional that support *modus ponens* inferences of the deductively valid sort. They are defeasible conditionals, of the sort often called “defeasible rules” in AI (Verheij 1996). They are not universally true, but hold only with a kind of generality that is subject to default. They represent hypotheses that are plausible, but that can be defeated by new incoming information describing particular findings of the given case. It would not be too surprising to find a case like the fossilized fish case treated in logic textbooks as being an enthymeme that can be filled in using rules of deductive logic. But a more careful analysis of the case should reveal that the argument is abductive.

The last case is one of a series of cases studied in (Walton 2001). These are cases of enthymemes based on a kind of missing assumption that is often characterized by the phrase “common knowledge”. In connection with enthymemes, a number of definitions of this phrase have been given. According to Govier (1992, 120), an implicit premise in an argument is based on common knowledge if it states something known by virtually everyone, depending on audience, context, time and place. As examples Govier (1992, 120) cited the statements “Human beings have hearts.” and “Many millions of civilians have been killed in twentieth-century wars.” Freeman has what appears to be a less strict and more variable definition of ‘common knowledge’ that is more accommodating to defeasible statements. Freeman (1995, 269) stipulated that to claim a statement is common knowledge is to claim that many, most or all people accept that claim. But Freeman (p. 269) added the warning, “popularity is never sufficient to warrant acceptance”, based on the danger posed by the *argumentum ad populum* or appeal to popular opinion, known to be fallacious in some instances. Freeman described common knowledge as a form of presumption, rather than knowledge, based on the shared “lived experience” of a speaker and hearer (p. 272). In their account of the kind of common knowledge characteristic of enthymemes, Jackson and Jacobs (1980, 263) emphasized Gricean postulates based on rules of conversation that allow participants to participate collaboratively in a dialogue by making assumptions about what the other party can reasonably be expected to know. The literature in

AI on scripts and plan recognition (Carberry 1990) is full of examples of this kind of assumption-making.

A glance through the logic textbooks reveals many examples of arguments with missing premises based on assumptions that come under the heading of common knowledge. One common type of example comes from everyday human experience of the way things can be generally expected to go in common situations that both speaker and hearer can be assumed to be stereotypically familiar with. The next case, also cited in (Walton 2001) is a textbook exercise from (Copi 1986, 246). Let's call it the textbook case.

“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.” (W. Ron Jones, *Changing Education*, Vol. 5, No. 4, Winter-Spring 1974)

The three non-explicit assumptions in this case cited in the analysis presented in (Walton, 2001) are the following statements.

1. Anything that is a universal guide to learning of great worth and importance would be regarded as highly valuable.
2. Anything that is regarded as highly valuable, and would not be too difficult to steal, would likely be stolen.
3. These textbooks would not be too difficult to steal.

The gist of the argument in this case can now be reconstructed by the following expansion of what the writer is presumably telling us. Since no one ever stole a textbook, in the writer's experience, the assumption that these textbooks are regarded as highly valuable is refuted. This assumption is shown to be false. From that conclusion, another is then suggested. This conclusion is that these textbooks are not the universal guide to learning of great worth and importance they are taken to be.

Statements 1, 2 and 3 are based on what is called common knowledge. They are assumptions about the way things generally work, about familiar human institutions and values, and about the way we can normally expect most people to generally react. For example, statement 3 is based on common knowledge about how textbooks are used in schools. In this typical situation, the textbooks have to be distributed to the students. But we know the way this procedure normally works in the public schools, the need for distribution makes them easy to steal. The reader is assumed to be familiar with how textbooks are normally used in the schools, and with theft as a common occurrence in that setting that is hard to prevent. In the

literature on planning in AI (Carberry 1990), these assumptions would be classified as domain-dependent knowledge, and are notoriously difficult to capture in a principled way (Lenat 1995). But they are not based on specialized expert knowledge. They represent common knowledge about the way things can normally be expected to work in a typical situation known to both the speaker and hearer in a conversation.

The textbook case shows even more clearly how incomplete arguments can rest on what is called common knowledge shared by the proponent of the argument and the intended recipient. Thus the study of this case has indicated the limits of argumentation schemes as a tool for the identification of implicit premises in incomplete arguments. This limitation has already been remarked upon by Gerritsen (2001). She observed (p. 73) that the identification of an argumentation scheme in an argument gives only a general clue to the unexpressed premise, "while the problems of identifying unexpressed premises are often about details and peculiarities." For example, the abortion case rests on an argument from analogy, and the identification of the argumentation scheme of argument from analogy is a general clue that helps to identify the unexpressed premise. But the textbook case shows very clearly how identification of argumentation schemes is not sufficient to fill in all the details and peculiarities needed to identify the unexpressed premises.

## 8. DISCUSSION OF CASES

The cases fall roughly into a pattern suggesting two types. In the one type, a strict (absolute) universal generalization appears to be the missing assumption needed to complete the argument. Deductive logic can be used to furnish the right kind of structure needed to make the argument valid. In the other type of case, a non-strict (defeasible) generalization appears to be the missing assumption needed to complete the argument. Plugging in a strict generalization in these cases would produce a false, or easily refutable premise (or conclusion, as the case may be). Such a reconstruction would therefore not fit with optimal methods for dealing with enthymemes. It would violate the negative principle that you shouldn't reconstruct an argument in such a way as to impute a false or implausible unstated assumption to it, if there is a more plausible (or true) statement that would also fit into the slot for the missing assumption.

What the cases can plausibly be taken to indicate is that deductive logic alone is not sufficient as the structural tool of inference needed to aid in the filling in of incomplete arguments. It is shown that deductive logic is the right tool in some cases. But the weaker standards of appraisal are

more appropriate in others, as shown by Ennis (2001). In many of these other cases, and these kinds of cases seem to be very common in natural language argumentation, presumptive argumentation schemes are the right tools for the job. This in itself is an important finding, given the traditional tendency in logic to advocate deductive logic as the right tool for enthymemes, even applying it to cases where argumentation schemes are clearly more appropriate, and would do a much better job of locating the missing assumptions. In general, different standards or structural models of rational argument need to be applied to different cases. In some cases, for example where the generalization that is the warrant of the inference is strict, deductive logic is the right standard. In other cases, though none are included in the case studies above, inductive logic of the modern statistical kind could be the right standard. But in many cases, presumptive argumentation schemes are the right kinds of structures needed. In these cases, the standard of argument is neither deductive nor inductive, but falls into a third category. It could be called the category of plausible arguments, based on argumentation schemes and defeasible generalizations. Some of the cases involve an argument would nowadays often be classified as abductive. This is not to belittle the problem of classification. There are substantial practical challenges in carrying this out.<sup>11</sup> Following Mann (1987), we suggest a pragmatic approach based on plausibility judgments. When analyzing a given text of discourse, there may be more than way of reasonably interpreting the text, and the job of the analyst may be to consider alternative interpretations as hypotheses.

Groarke has argued (1999, 2001) that argumentation schemes can be captured in a deductivist framework, with deductive logic propagating a level of certainty or presumption from the premises to the conclusion. He gives the following example:

Jones is a politician, so he is not to be trusted.

He suggests that the missing premise is the generalization, “No politicians can be trusted”. He suggests that there are other possible premises that would result in deductive validity (e.g. “If Jones is a politician then he is not to be trusted”, which could work in the rather peculiar context in which Jones has been claiming not to be a politician), but that the “No politicians ...” premise is more likely:

“In the absence of some explicit indication that this idiosyncratic assumption is the basis of the conclusion, it is reasonable to assume that it is the latter generalization about politicians which drives the inference. It can therefore be designated the pragmatic optimum.” (p. 6)

We are concerned here about how this designation is to be made in practice – and, perhaps, automatically. The answer lies in the guidance afforded by the structure of argumentation schemes – if we have a scheme of a particular type in play, then we know what missing premises are to be expected.

There is also a potential problem with the deductivisation of schemes. There seem to be two approaches to analysing Groarke's example. First, Groarke's own:

- (1) Jones is a politician
- (2) No politicians can be trusted
- (3) Jones is not to be trusted

This is a clear, deductive argument. Groarke would argue that (2) is only plausible (whereas (1) is certain) and that therefore this plausibility is transferred to the conclusion, (3). The result is that the conclusion is plausible. An alternative reading is

- (1) Jones is a politician
- (2) Usually, politicians cannot be trusted
- (3) Jones is not to be trusted

This is based some on sort of scheme (perhaps the circumstantial *ad hominem*, or a specialisation of it) that says

- (1) Person X is an A
- (2) As usually have some feature F
- (3) X has feature F

and, as an inbuilt part of the scheme (or rather, as a feature of the scheme), the conclusion is only plausible; only defeasible. So, with the argumentation scheme approach, we have the same conclusion, again marked as plausible. The only difference between the Groarke approach and the scheme approach is that in the former the implicit premise is a universal generalization that is only plausible, rather than certain, and in the latter, the implicit premise is a nondeductive, nonuniversal generalisation that admits exceptions. We argue that it is a generalisation that admits exceptions, rather than a universal generalisation that might be wrong, that is driving such argumentation. For, a single exception to a universal generalisation would demonstrate it to be wrong, and yet intuition leads us to view an exception to a generalisation as just that – an exception to a generalisation that still holds. We conclude from this example, therefore, that although deductive logic has a role to play, it can function best when complemented by an approach based on non-deductive argumentation schemes.

The case studies, as analyzed and discussed above, bring out the importance of argumentation schemes as a supplement to deductive logic. But they do not, even so, provide anything like a complete solution to the problem of incomplete arguments. They do move the discussion of the problem along, however. What is made clear is that a formal, inferential component is a necessary part of the construction of an enthymeme machine, and that argumentation schemes should be an important part of that component. To conclude, it is well to comment on some of the general issues concerning enthymemes that still remain to be dealt with. It is useful to see that a contextual component needs to be used alongside the formal inferential component, in order to construct the enthymeme machine.

#### 9. THE ATTRIBUTION PROBLEM

The most general issue in dealing with incomplete arguments is how a statement can be attributed to an arguer as part of her argument if she never went on record as making that exact statement explicitly. It could be called the problem of attribution. The problem of attribution is one of interpreting a claim supposedly made, based on a quotation, or given text of discourse, recording what the arguer actually said or wrote. Some would say that you can never attribute a claim to someone unless they actually made that exact claim. For after all, it may be said, you can never really look into the other person's mind, and see what they meant, or intended to say. All attributions, other than exact quotes of claims made, as many would say, are "subjective". There is something to this line of argument. It is often made by students who are reluctant to take on the task of analysis of argumentation in a text of discourse because they fear that the whole project is dangerously "subjective". Many philosophers, especially of the postmodernist stripe, have voiced the same objection. It has to be admitted that there is something to this objection, and it should be taken seriously.

The topic of a recent discussion with Bart Verheij was the argument, 'John is a thief; therefore John is punishable.'<sup>12</sup> Verheij took the position that this argument is a different argument from the following valid argument: 'If John is a thief he is punishable; John is a thief; therefore John is punishable.'<sup>13</sup> The point of view typically expressed on incomplete arguments (enthymemes) in the logic textbooks is that the second argument is an analysis or reconstruction of the first one. In other words, the assumption is that the two arguments are equivalent, in some sense, or that at least the second one represents the argument underlying the first. But Verheij took the point of view that the two arguments are not equivalent to each other. As conceded above, there is something to be said for this

point of view, and there could be various reasons for maintaining it. One of these reasons frequently surfaces when you try to teach students how to analyze arguments by filling in missing premises. Students can be highly skeptical when asked to fill in missing premises (and) conclusions in texts of discourse they are analyzing. Some students ask how you can attribute a statement to someone if they didn't explicitly say it? After all, isn't placing such an interpretation potentially unfair, if the proponent of the argument might not agree with it? How can you tell what such a person was really thinking anyhow? Such doubts are legitimate. In order to respond to them appropriately, the defender of the doctrine of enthymemes is rightly put in the position of having to show why it should be intellectually acceptable for a critic to put in missing premises in an argument analysis.

This dispute about enthymemes is not new. But Burnyeat (1994) has brought out a number of interesting historical points relating to enthymemes arising from the texts of Aristotle and other Greek philosophers. One interesting point (1994, 46) concerns two views that were expressed by ancient philosophers. Antipater of Tarsus, head of the Stoic school about 159–130 B.C., defended one-premised arguments like "If you breathe, you are alive." (Kneale and Kneale 1962, 163). But this posed a problem in relation to Stoic logic, because the five basic types of arguments recognized by the Stoics all have two premises. It also posed a problem for the Aristotelian commentator Alexander of Aphrodisias, because an Aristotelian syllogism must have two premises. To justify syllogistic logic, Alexander argued that the kind of argument cited by Antipater must be incomplete. To fill it out you must add a missing premise, like 'All who breathe are alive.'<sup>14</sup> There is also another example that Burnyeat (1994, 46) ascribes to Antipater: "This man deserves punishment, for he is a traitor." The issue is whether this argument has as a missing or unstated assumption the premise, 'All traitors deserve punishment.' It would seem that there are two viewpoints on this issue. According to the standard view of the enthymeme found in the logic textbooks, and as well, according to Alexander of Aphrodisias, the two arguments are equivalent. Or at least the second one represents a more explicit version of the first. According to Verheij and Antipater, as well as many skeptical students of argumentation, the two arguments are not equivalent. One should be seen as quite different from the other.

Arguments can be given on both sides of this issue. But the case studies above, along with the Araucaria system of marking up an argument, suggest a way of approaching the attribution problem. That way involves seeing the new argument reconstructed from an incomplete argument as being closely related to, but different from the original argument. As



Burnyeat (1994) showed, there is considerable persuasive evidence that Aristotle's notion of enthymeme has been systematically misinterpreted by commentators, and by mainstream logic, for over two thousand years of western tradition. The version of Aristotle that Burnyeat brings out shows Aristotle viewing an enthymeme as essentially a type of argument based on a defeasible argumentation scheme.

Araucaria is equipped with a set of argumentation schemes. When a user constructs an argument diagram, she can identify the scheme that fits a given set of premises and conclusion she has identified as an argument in a given text. Araucaria can then fit the scheme to the specified parts of the argument, and identify the missing premises required by that scheme. This part of the process is straightforward, but other issues need to be resolved. One issue is the identification of additional nonexplicit premises. This task seems best accomplished through the use of critical questions. Each argumentation scheme has a matching set of critical questions. The best approach is to use the critical questions corresponding to a scheme, and available in Araucaria, to extend the process of identifying additional nonexplicit premises. But critical questions can have critical subquestions. For example, appeal to expert opinion has six basic critical questions (Walton 1997, 223). But it also has critical subquestions under each of these main critical questions. Thus there is a practical problem posed of how long the process the process of identifying nonexplicit assumptions should go on. It may not be useful to list all critical questions for all schemes. And thus it may be best to make the assumption that normally the main critical questions are only invoked when identifying nonexplicit premises.

A further problem is that schemes are related to each other. In many cases, some schemes are subsumed under others. For example, the scheme for appeal to expert opinion is treated in (Walton 1996) and (Walton 1997) as a subtype of argument from position to know. Another issue is whether deductive and inductive forms of argument can be included along with defeasible argumentation schemes, as part of the sets of structures used the system to mark up arguments. The best approach to these issues is to classify the schemes into a taxonomic hierarchy with a three-fold root representing reasoning types – deductive, inductive and plausible. Thus as things turn out, this approach to enthymemes does take some steps toward the solution to the problem of attribution in incomplete arguments. According to this approach, the system can use argumentation schemes and critical questions to identify nonexplicit premises in an incomplete argument identified by a user in a given text of discourse. But so far, most of the attention has been directed to the inferential component, relating to the use of arguments forms. The textbook case in particular suggests that

there are also important assumptions about common knowledge. We now turn to a discussion of an additional component of enthymemes relating to the context of dialogue in a given case.

#### 10. THE DIALECTICAL COMPONENT OF THE ENTHYMEME MACHINE

The case study discussions above showed that, in addition to the inferential component, there is another factor necessary for the reconstruction of incomplete arguments. In addition to generating an argument that is structurally correct by some standard of inference, the machine should give preference to missing premise (or conclusion) candidates that are true, represent common knowledge, or at least that are plausible, in context. The principle of charity tells the machine to pick missing parts that make the argument strongest. But as indicated in the case studies, this approach isn't always right. The distinction between used and needed premises also seemed like a helpful tool. But in fact what the machine needs to do, as indicated by the cases above, is to combine both aspects. To solve the attribution problem, some new approach is needed.

This new approach takes a line of reasoning that supports a version of Alexander's and Verheij's point of view. According to this point of view, the reconstructed argument and the original incomplete argument are not exactly identical. Yet it can be argued that they are closely related in a pragmatic way. It can be argued that when a critic analyzes an argument in a given text of discourse, she can only analyze it by bringing out the implicit assumptions in the arguments. To do this, she should see herself as engaging in a critical discussion with the proponent of the given argument. A critical discussion type of dialogue can only be maximally successful if the strongest possible arguments on both sides are brought forward. How should missing premises or conclusions be inserted by the enthymeme machine in the context of such a critical discussion? In a typical critical discussion each party has a thesis to defend, and the thesis of the one party is opposed to the thesis of the other party (Van Eemeren and Grootendorst 1992). To make the critical discussion successful, each party should put forward the strongest and most convincing arguments possible to support his or her thesis. This aspect seems to support the principle of charity. What makes an argument strong? The reply suggested above is that the critic needs to put in the assumptions required to make an argument come out valid, or at least structurally correct according to whatever the accepted standards are, makes the argument stronger. After all, if the argument really depends on this assumption, and it is not stated as part of the argument, the other side in the critical discussion could ask critical questions about

this gap. Asking such critical questions would reveal a weakness in the argument, showing a missing premise in it. Therefore, from a viewpoint of having a good critical discussion, putting in such a missing premise can be justified. In a sense, Gilbert's (1991) dialogic algorithm for refining the Principle of Charity to get at exactly what implicit premise the protagonist is working from, provides a generic set of critical questions, or rather, a single generic critical question aimed at refining universal generalizations. This would form one part of the critical questioning that probes the inferential link in the argument.

But it was shown in the case studies that the inferential component is not enough. The enthymeme machine should select out missing assumptions that are true, or at least seem to be true, or that represent common knowledge or the arguer's position as indicated by the discourse. Often, such missing assumptions are statements that would generally appear to be acceptable as "common knowledge" to the audience, or statements that seem to be based on the arguer's position (commitments), as far as the text and context of discourse indicates. This observation suggests that dialectical criteria are important for constructing the enthymeme machine, for example in cases where the context of the given argument is that of a critical discussion. In a critical discussion, the arguer's goal is to convince the audience (other party) that her (the arguer's) thesis is true (Van Eemeren and Grootendorst 1992). For this purpose, the arguer ideally needs not only strong arguments (structurally), but arguments based on premises that the audience will accept, or can be led to accept. She also needs arguments that will support her own position, and especially her thesis to be proved. Here then is the pragmatic component. Incomplete arguments should be filled in with missing assumptions that are (a) plausible to the intended audience or recipient of the argument, and (b) that appear to fit in with the position advocated by the arguer, as far as the evidence of the text indicates (Gilbert 1991). Here then is an approach to solving the attribution problem. In addition to the argumentation scheme component, a dialectical component needs to represent other relevant factors of the text and context of dialogue in a given case.

But some other clarifications and qualifications need to be added. The inserted premise must be marked clearly as an assumption put in by the critic, and distinguished from other statements explicitly stated as premises or conclusions. Such a marker should indicate that the inserted statement is merely a hypothesis inserted by the analyst.<sup>15</sup> As long as that requirement is met, and provided there is evidence that the inserted statement does seem to represent what we take to be the arguer's position (commitments), putting in missing premises can be pragmatically justified. This way of

building an enthymeme machine fits with the view of Antipater and Verheij. The two arguments about John being a thief, according to that view, are not equivalent (the same argument). One is a kind of artificial construct made up from the other, plus contextual information about the type of dialogue the arguments are supposedly embedded in. In some cases, you could justify replacing the one by the other. But the two arguments are not equivalent in the sense that they are substitutable for each other in all contexts of argumentation. The justification for replacing the one for the other depends on the purpose of the talk exchange. And yet there is another sense in which the two arguments are, if not equivalent in a context free way, at least equivalent in a more limited sense. In this sense, the one can be substituted in for the other in the right context, and under the right conditions, for a purpose.

Speaking of the logician's dream of constructing an enthymeme machine, one might ask what its anticipated uses are. Of course, the traditional need for such a machine is evident in existing methods used in applied logic and critical thinking, where the concept of the enthymeme is already an important and well-established part of the curriculum. But there are other significant uses as well. One is in the development of critical thinking tutorial software for educational applications. A software system that helps a user to identify implicit premises machine by using argumentation schemes, and possibly other dialectical clues, could be useful in guiding a user to probe logical gaps in an argument and ask appropriate critical questions. The user numbers the component statements in an argument, and identifies an argumentation scheme, or type of argument, linking the given premises to the conclusion. The machine then applies the scheme and inserts a missing assumption that completes the argument. The machine then engages in a critical dialogue with the user. For example, it might give hints by asking the user about other possible choices. A second use is in the field of communication, especially in rhetoric, where the analysis of incompletely expressed arguments is centrally important. A third application is to computing, and especially to multi-agent systems, where software agents often communicate using argumentation (Reed 1998). Agents often communicate by asking questions of other agents, and by acting on the basis of practical arguments and directives expressed by another agent. In this application, as well as in the first two, filling in the missing parts of an incomplete argument is an important preliminary to efficient communication and carrying out of practical tasks based on information and directives expressed either in natural language or the artificially constructed discourse of computer languages. An enthymeme machine would be a valuable tool for carrying out such tasks in an automated and efficient way. A fourth

use is in legal argumentation, where many typical kinds of legal arguments can be analyzed as based on assumptions in the form of unstated premises or conclusions. An enthymeme machine would be a valuable tool that could be used in many computer systems of the kind being now being developed in artificial intelligence and law (Prakken 2002). Araucaria is a tool for supporting a human analyst that goes some way to meeting the challenges of enthymemes. It is a useful and valuable first step. But much work remains to be done in tackling the difficult task of truly automating the process of enthymeme reconstruction.

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#### NOTES

<sup>1</sup> A defeasible generalization, in contrast to an absolute universal generalization, is one that is subject to exceptions and that is defeated (defaults) in a case where one of the exceptions occurs. Defeasible generalizations often contain expressions, like the word 'generally' that indicate that the generalization has exceptions. In some instances, exceptions are explicitly stated in the generalization. For example, one might say, "Birds fly, except for penguins".

<sup>2</sup> Araucaria is based on an argument markup language (AML) defined in an XML document type definition (DTD). It can be obtained from the Araucaria homepage: <http://araucaria.computing.dundee.ac.uk/>

<sup>3</sup> Burnyeat (1994) shows that Alexander of Aphrodisias may have started the traditional view that the Aristotelian enthymeme is a syllogism with an unstated premise, and that this traditional view does not really represent what Aristotle meant by *enthymema*. What Aristotle really referred to, according to another interpretation, were eikotic or plausibilistic arguments that are syllogistic-like but based on generalizations that are not universal, but hold only for the most part. If this alternative interpretation of Aristotle is correct, strictly speaking, we should discontinue using the term 'enthymeme' to refer to arguments with missing premises (or conclusions). Instead we should use the expression 'incomplete argument'. I would prefer this latter expression, but tradition, especially one so well-entrenched as this one, is hard to change. If Burnyeat's analysis is correct, the term 'enthymeme' should properly be used in its original Aristotelian sense to refer to the defeasible (presumptive) argumentation schemes of the kind cited in (Walton 1996).

<sup>4</sup> At least, it would suggest that from a monological point of view. Once the dialectical point of view is considered, more resources are available, as demonstrated by Gilbert's (1991) 'Enthymeme Buster' algorithm.

<sup>5</sup> Sir Arthur Conan Doyle, 'Silver Blaze', in *The Complete Sherlock Holmes: The A. Conan Doyle Memorial Edition*, vol. 1, Garden City, New York, Doubleday, Doran & Co. Inc., 1932, p. 27.

<sup>6</sup> The missing premise in case 4 depends on what is often called "common knowledge". This notion and its importance for enthymemes are discussed below.

<sup>7</sup> *Ibid.*, p. 23.

<sup>8</sup> Some interesting questions are raised here about the use of discourse markers as evidence to determine argument structure. See Snoeck Henkemans (2001). It seems unlikely that such indicators alone are sufficiently frequent to provide a basis for giving a conclusive determination of the argument structure.

<sup>9</sup> Once again, the notion of common knowledge comes into play here.

<sup>10</sup> Peirce (1965, p. 375), in his paper, 'Deduction, Induction and Hypothesis', originally published in 1878, cited this example in the following words. "Fossils are found; say, remains like those of fishes, but far in the interior of the country. To explain the phenomenon, we suppose the sea once washed over this land."

<sup>11</sup> Some argue that there is no reasonable way to classify reasonable arguments at all (Hitchcock 1981; Ennis 2001).

<sup>12</sup> This discussion took place in several e-mail exchanges on the subject of defeasible reasoning in November, 2000.

<sup>13</sup> See the analysis of defeasible legal reasoning in (Verheij 1999).

<sup>14</sup> A modern candidate for a counter- example to this generalization would be the case of a brain-dead patient whose breathing is artificially sustained by a respirator.

<sup>15</sup> *Araucaria* explicitly marks implicit premises. The AML tag marking a proposition has an attribute *missing* that is set to *No*, in the case of original components of the argument, or *Yes*, for analyst-added parts.

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