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ARGUMENTATION SCHEMES

CAMBRIDGE

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This book provides a systematic analysis of many common argumentation schemes and a compendium of ninety-six schemes. The study of these schemes, or forms of argument that capture stereotypical patterns of human reasoning, is at the core of argumentation research. Surveying all aspects of argumentation schemes from the ground up, the book takes the reader from the elementary exposition in the first chapter to the current state of the art in the research efforts to formalize and classify the schemes, outlined in the last three chapters. It provides a systematic and comprehensive account, with notation suitable for computational applications that increasingly make use of argumentation schemes.

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For Karen, Cathy, Franco, and Mirna, with love.

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Introduction

Argumentation Schemes

The theory of argumentation is a rich interdisciplinary area of research spanning philosophy, communication studies, linguistics, computer science, and psychology. In the past few years, formal models of argumentation have been steadily gaining importance in artificial intelligence, where they have found a wide range of applications in specifying semantics for logic programs, generating natural language text, supporting legal reasoning, and facilitating multi-agent dialogue and negotiation on the Internet.[1] The most useful and widely used tool so far developed in argumentation theory is the set of argumentation schemes. Argumentation schemes are forms of argument (structures of inference) that represent structures of common types of arguments used in everyday discourse, as well as in special contexts like those of legal argumentation and scientific argumentation.[2] They include the deductive and inductive forms of argument that we are already so familiar with in logic. However, they also represent forms of argument that are neither deductive nor inductive, but that fall into a third category, sometimes called defeasible, presumptive, or abductive. Such an argument may not be very strong by itself, but may be strong enough to provide evidence to warrant rational acceptance of its conclusion, given that its premises are acceptable (Toulmin, 1958). Such an argument can rightly carry weight, or be a plausible basis

[1] Recent conferences and workshops dedicated to the theory of argumentation in artifical intelligence include the International Conference on Computational Models of Argument (COMMA 2006), the Computational Models of Natural Argument (CMNA) workshop series, and the Argumentation in Multi-Agent Systems (ArgMAS 04, 05, and 06) workshop series. In 2007, there has been a call for papers for a special issue of the IEEE journal *Intelligent Systems* on the topic of argumentation technology.

[2] Prakken (2005) has shown that because logic is too abstract to apply very effectively to legal argumentation, research in AI and law needs to be supplemented by an argumentation schemes approach.

for acceptance, on a balance of considerations in an investigation or discussion that is moving forward, as new evidence is being collected. The investigation can then move ahead, even under conditions of uncertainty and lack of knowledge, using the conclusion tentatively accepted.

To use a phrase from Anderson, Schum, and Twining (2005, p. 262), such presumptive arguments are necessary but dangerous. We need to use them as heuristics that provide rational grounds for accepting a conclusion tentatively even if it has not been conclusively proved, but we have to remain open-minded when we use such arguments, because they are fallible and inherently subject to default. A defeasible argument is one in which the conclusion can be accepted tentatively in relation to the evidence known so far in a case, but may need to be retracted as new evidence comes in. A typical case of a defeasible argument is one based on a generalization that is subject to qualifications. Should it come to be known that the present case is an exception to the generalization, the argument defaults, and its conclusion must be retracted. Defeasible arguments are especially prominent in legal and ethical reasoning, but they are everywhere, even in science, especially at the discovery stage of an investigation.

The recognition of the importance and legitimacy of defeasible argumentation has led to a recent paradigm shift in logic, artificial intelligence, and cognitive science. Common forms of defeasible arguments were long categorized as fallacious in logic textbooks. It is been only recently that, as these informal fallacies have been studied more intensively, more and more instances have been recognized where the forms of argument underlying them are reasonable, but inherently defeasible. For example, arguments based on expert opinion have long been categorized in logic textbooks under the heading of fallacious appeals to authority. However, it is clear that for practical purposes in everyday reasoning, and in many of our social and intellectual institutions, we could not get by without such arguments. Expert testimony, including ballistics evidence, DNA evidence, and many other forms of testimony by scientific experts, has become a dominant kind of evidence in the courts. It has become so dominant as evidence that it is on the verge of overwhelming our judicial system. Clearly, it is not helpful to condemn such evidence as inherently fallacious. Rather, the problem is to judge in specific cases when an argument from expert opinion can properly be judged to be strong, weak, or fallacious. Hence the importance of argumentation schemes has become readily apparent in recent years, as this

paradigm shift about rational argumentation has affected many fields, including law, cognitive science, artificial intelligence, logic, philosophy of science, and indeed any field where standards of rational argument are centrally important.

There has emerged in recent years a considerable body of work on informal fallacies, collecting together a large corpus of examples, along with tools to identify, analyze, and evaluate the arguments in those examples. Clearly, this body of work provides a huge database, and repository of other materials, including many argumentation schemes, that are fundamental to any attempt to approach the project of providing a systematic overview of the current state of the art of research on argumentation schemes. The special advantage of the present book is that it builds on this previous research on fallacies, moving through the paradigm shift to the new idea of coping with the revolutionary notion that such "fallacies" are no longer fallacies.

Although this is the first book to bring together such a large number of schemes and to analyze and study them in such depth, even to the point of starting the project of classifying and formalizing schemes, prior works on schemes do exist. In a book on presumptive argumentation schemes by one of the authors (Walton, 1996), a list of twenty-six defeasible argumentation schemes was presented and analyzed. Among them are such common forms of argument as argument from sign, argument from example, argument from commitment, argument from position to know, argument from expert opinion, ad hominem argument, argument from analogy, argument from precedent, argument from gradualism, and several types of slippery slope argument. Each argument of this type is presented as providing only a defeasible support for its conclusion, subject to critical questioning in a context of dialogue. Matching each argumentation scheme is an appropriate set of critical questions. The method of studying defeasible argumentation schemes through the use of a set of matching critical questions can be credited to Hastings (1963). Arthur Hastings, in his innovative Ph.D. thesis at Northwestern University in 1963, set out a useful list of many of these schemes, with illustrative examples, and with a set of critical questions corresponding to each scheme. The method of evaluation of an argument fitting a scheme is that once the argument is put forward by a proponent, it may be defeated if the respondent asks an appropriate critical question that is not answered by the proponent. Hastings' approach seemed to have been ignored for many years, but as the field of argumentation studies

developed, other researchers began to adopt his approach. For example, Kienpointner (1992) and Grennan (1997) produced comprehensive lists of schemes, stressing deductive and inductive forms.

This book takes a much more comprehensive and in-depth approach than any previous treatment of schemes. In Chapter 9, a compendium of schemes has been produced that presents sixty-five schemes. They are presented in a form that can easily be used by all of those who are interested in schemes or are working on them. Nearly all of the schemes in the compendium have been collected from the already existing literature, although there are a few new ones. Here, for the first time, they are brought together in one place. Chapter 1 introduces the beginning reader to schemes, and describes the basic tools of argumentation research needed to formulate the schemes more precisely and to understand how they work. All concepts in Chapter 1 are explained from the ground up, so that the beginning reader can understand the chapters that follow. The reader can next, in Chapter 2, gain further insight into how schemes work and how they are to be analyzed by examining the treatment of one of the most fundamental schemes, that for argument from analogy. Argument from analogy is especially important in law, notably in our Anglo-American justice system, where court decisions are arrived at by comparing a given case with a previously decided one. Thus Chapter 2 also reveals the importance of this particular argumentation scheme and the wide-ranging nature of the application of defeasible argumentation schemes.

Chapter 2 begins with a typical example of a legal decision by the courts that is based on argument from analogy. When a trained dog sniffs luggage in a public place and signals to the police that it contains drugs, should this event be classified as a search? The question is decided by comparing the case, by analogy, to previous cases that have already been decided by the courts. Previously, the logical literature on argument from analogy has tended to classify this form of argument as either deductive or inductive. We propose a new way of classifying it by treating it as a defeasible argumentation scheme that can hold tentatively on the balance of considerations, thus influencing future decisions without finally closing the issue one way or the other. By using tools developed in argumentation theory and artificial intelligence, we show how argument from analogy, as used in legal reasoning in typical cases, is closely associated with other argumentation schemes. Especially prominent, as shown by our analysis of these cases, are the argumentation schemes for verbal classification and argument from precedent. We are thus able to show,

in a much deeper way than has been possible in the past, how argument from analogy, allied with these other argumentation schemes, provides new logical foundations for case-based reasoning in law.

Chapters 3, 4, and 5 describe many of the most common and important defeasible argumentation schemes, providing many examples to show how they work in everyday argumentation. Chapters 6 and 7 study two concepts that are not only fundamental to understanding how schemes work, but that also show how important schemes are as building blocks of the most common kinds of arguments. Chapter 6 shows how schemes can be used to help identify premises or conclusions that are implicitly assumed, but that have not been explicitly stated as part of an argument. Chapter 7 is about the notion of argument rebuttal. In other words, it is all about how one argument confronts and attacks, and possibly even defeats, another argument by adducing reasons that show that the other argument is not tenable. Some argumentation schemes have the specific purpose of functioning as rebuttals to other arguments. Although the notion of argument rebuttal is fundamental to the study of all rational argumentation, there are many controversies and disagreements about how it should precisely be defined, and the notion has never been clarified fully throughout the long history of the subject.

As we show in Chapter 8, the study of schemes has a long history going back to Aristotle's topics – common types of argument, often called commonplaces, that Aristotle saw as fundamental building blocks in a branch of logic he called dialectic. Aristotle also developed formal logic through his theory of the syllogism, and that approach to logic came to dominate the whole field, and indeed the intellectual scene generally, through the Middle Ages. As deductive logic became formalized in the twentieth century, the study of dialectic continued to be ignored. Although informal fallacies, as noted earlier, continued to be treated in the logic textbooks, the study of topics remained in a somewhat confused state, never gaining wide acceptance as a tool for the analysis of rational argumentation. Many had hoped that topics could be used as a tool for the discovery of new arguments, a technique for argument invention. This would be an extremely useful tool in many fields, but only with the advent of this book has it become a practical possibility.

The problem so far in modern argumentation studies is that the schemes have been developed in a rough-and-ready way. They have been meant to be practical tools to help students learn skills of argumentation and critical thinking by recognizing common forms of argument and by being able to criticize them by asking standard critical questions that

probe the weak points of an argument. Such a practical tool has proved to be extremely useful, but if schemes are to be exploited by more exact fields like logic and artificial intelligence, they need to be defined and analyzed in a more precise and systematic manner. Indeed, as we show in Chapter 10, a systematic method of classifying schemes is a top priority, and the current work in artificial intelligence is developing methods for the formalization of schemes. These efforts, culminating in this book, represent the frontiers of the new research on schemes, aiming at the goal of developing tools for argument search in natural texts and for argument invention.

This volume surveys all aspects of argumentation schemes from the ground up, taking the reader from the elementary exposition of the first chapter to the latest state of the art in the research efforts to formalize and classify the schemes as outlined in the last three chapters. In Chapter 8, the history of schemes is surveyed, so that the reader can grasp how, even though their study was very much in the background for two millennia, there was active work on them during both the ancient and medieval periods. In Chapters 2 through 5 we pick out what we take to be the most important and common schemes, and analyze and discuss these schemes up to the present point of research on them. In Chapters 6 and 7 we discuss two underlying concepts, those of enthymeme and rebuttal, that are fundamentally important in helping us to understand the common structure that the schemes share and the promise that they hold as argumentation tools. Thus the whole book gives a panoramic survey of the state of the art of current research on schemes, from the ancient roots of the subject to recent research developments. It is a necessary tool for anyone interested in argumentation schemes, in the many fields that use them, and in the many other fields that will.

1

Basic Tools in the State of the Art

This chapter introduces the reader to argumentation schemes and explains, through the use of some examples, why they are important. Another aim of the chapter is to briefly review the literature on argumentation schemes, including the key works by Hastings, Walton, and Kienpointner, and to set it in a broader context, bringing out some characteristics of defeasible reasoning and argument evaluation that are fundamental to the study of schemes. Another is to introduce the beginning reader to some basic tools, like argument diagramming, that utilize schemes and need to be integrated with them. In this chapter we will introduce the reader to an automated system of argument diagramming called Araucaria. This technique is a box-and-arrow representation of the premises and conclusions of an argument, showing how one argument can be chained together with others to form a sequence of reasoning. This tool will be used in subsequent chapters, and so we need to introduce the reader to it now. One of our goals in the book is to show how argumentation schemes are in the process of being modeled by argument technology in the field of artificial intelligence (AI). However, we will reserve our fullest account of these developments for the last chapter of the book, even though, from time to time, we will mention aspects of them that impinge on our fundamental understanding of argumentation schemes as forms of reasoning.

Another aim of this chapter is to introduce the reader to the problem posed by the fact that many of the most important kinds of schemes are defeasible in nature, meaning that even after the argument has been accepted, it might later be defeated as new evidence enters into consideration. This factor of defeasibility raises the problem of how schemes are rationally binding. In deductive logic, if someone to whom an argument is directed accepts the premises of the argument, and the argument is

deductively valid, that person must accept the conclusion. If he does not, he is in a position of inconsistency, a position that is logically untenable. However, defeasible schemes are not binding in this way, because it is open to the person to whom the argument is directed to ask critical questions about it before having to accept a conclusion. This feature, the attaching of critical questions to a scheme, turns out to be problematic in several respects. First of all, it challenges the traditional notion of argument cogency, whereby a cogent argument provides a sufficient reason to accept the conclusion. Second, it presents a problem in applying standard tools and techniques, like box-and-arrow diagrams, that model arguments as sets of propositions, called premises and conclusions, and inferential links between sets of them. It is not easy to see how critical questions can be analyzed as tools for argument evaluation within such a propositional model.

Schemes have recently been attracting more and more attention from those who are interested in exploiting the rich interdisciplinary area between argumentation and AI (Reed and Norman, 2003; Verheij, 2003). Of course, AI has long been interested in nondeductive forms of reasoning (for a good general review of the area, see Prakken and Vreeswijk, 2002). But schemes, as construed by argumentation theory, seem to provide a somewhat more fine-grained analysis than is typical within AI. One example lies in the granularity of classification of types: Kienpointner introduces over a dozen, Walton almost thirty, and Grennan over fifty, but none can claim exhaustivity. By comparison, AI systems are more typically built with a small handful. Pollock's (1995) OSCAR, for example, identifies fewer than ten – with an uneven amount of work spread between them. This profligacy in philosophical classification might be argued to be as much a problem as an advantage – explored further in Chapter 10 – but it serves to demonstrate that more detail is in some way being adduced. It is the contention of this book that those refined structures of reasoning yield nicely to a computational interpretation and can be implemented to useful effect. Eventually, in Chapter 12, we will examine recent developments in computing that have the aim of formalizing schemes and building working systems for analyzing, evaluating, and constructing arguments using schemes.

1. INTRODUCING ARGUMENTATION SCHEMES

Perelman and Olbrechts-Tyteca, in *The New Rhetoric* (1969), in addition to the other authors mentioned in the Introduction, identified many of

these defeasible types of arguments used to carry evidential weight in a dialogue, in a somewhat different style from that of Arthur Hastings' Ph.D. thesis (1963), where a more systematic analysis of many of the most common of these presumptive schemes is presented. The scheme itself, in Hastings' treatment, is specified by stating the form of premises and conclusion in each argument type. Hastings expresses one special premise in each scheme as a Toulmin warrant, which could be seen as a generalization or rule, linking the other premise or premises to the conclusion. Such a warrant is typically a defeasible generalization that is subject to qualifications, on the Toulim model. Along with each scheme, Hastings attaches a corresponding set of critical questions. These features set the basic pattern for argumentation schemes in the literature that followed.

Some argumentation schemes were used by van Eemeren and Grootendorst (1984; 1992) in their work on critical discussion and fallacies. Kienpointner (1992) developed a comprehensive listing of argumentation schemes that includes deductive and inductive forms in addition to presumptive ones. Walton (1996) identified some twenty-six (depending on how you count them) argumentation schemes for common types of presumptive reasoning. Following Hastings' format, a set of critical questions attached to each scheme is the device for criticizing any argument fitting the structure of the scheme. The asking of a question, along with the response to it, implies a kind of dialogue structure in which two parties interact with each other. If an argument put forward by a proponent meets the requirements of a scheme, and the premises are acceptable to the respondent, then the respondent is obliged to accept the conclusion. But such an acceptance – or commitment, as it is often called – is provisional in the dialogue. If the respondent asks one of the critical questions matching the scheme and the proponent fails to offer an adequate answer, the argument defaults. Thus we see that defeasibility is linked to a dialogue structure in which a burden can shift back and forth. The original weight of an argument, before it defaulted and had to be retracted, is restored only when the proponent gives a successful answer to the question.

An argumentation scheme that can be used as our first example is that for argument from sign. Let's take a case in which Helen and Bob are hiking along a trail in Banff, and Bob points out some tracks along the path, saying, "These look like bear tracks, so a bear must have passed along this trail." In the argumentation scheme that follows, taken from Walton (1996, p. 49), one premise is seen to function as a generalization.

Argument from Sign

Minor Premise: Given data represented as statement *A* is true in this situation.
Major (Generalization) Premise: Statement *B* is generally indicated as true when its sign, *A*, is true, in this kind of situation.
Conclusion: Therefore, *B* is true in this situation.

The major premise is a conditional stating that if *A* is true, then generally, but subject to exceptions, *B* is also true. This generalization is defeasible. The tracks could have been planted on the trail by tricksters. But in the absence of evidence of some trickery, it is reasonable to provisionally draw the conclusion that a bear passed along the trail. Argument from sign is closely related to abductive inference, or inference to the best explanation, since the best explanation of the existence of the observed tracks is the hypothesis that a bear walked along the trail producing the tracks. There could be other explanations, but in the absence of additional evidence, the bear hypothesis could be plausible as a basis for drawing a provisional conclusion.

Argumentation schemes include deductive forms of reasoning like *modus ponens*, and inductive forms like arguing from a collected set of data to a statistical conclusion drawn from the data. But they also include forms of reasoning that are often necessary, but are more tentative in nature and need to be judged circumspectly by reserving some doubts. Such reasoning is presumptive and defeasible. This kind of reasoning is only plausible and is often resorted to in conditions of uncertainty and lack of knowledge. Presumptive reasoning supports inference under conditions of incompleteness by allowing unknown data to be presumed. Defeasible reasoning, as mentioned earlier, is of a sort in which the conclusion can be withdrawn or modified if known (but uncertain) data turn out to be flawed (Fox and Das, 2000). Walton (1996, p. 81) employs the following example:

> A Ph.D. student, Susan, has spent more than five years trying to finish her thesis, but there are problems. Her advisers keep leaving town, and delays are continued. She contemplates going to law school, where you can get a degree in a definite period. But then she thinks: "Well, I have put so much work into this thing. It would be a pity to give up now."

This is not just an instance of a presumptive, defeasible argument, but an instantiation of a particular pattern of reasoning, a particular scheme – in this case, what is called the *argument from waste* by Perelman and Olbrechts-Tyteca (1969), but what is more usually called the *argument*

from sunk costs. By taking this classificatory step, it becomes possible to probe in a straightforward, deterministic way for missing premises, and to consider a set of predetermined critical questions in carrying out an analysis and evaluation of the argument.

Argumentation schemes have recently been attracting increasing interest for several reasons. The first is their contribution to fallacy theory. As Walton has pointed out in a series of monographs, arguments that fit into traditional categories of fallacies seem, under the right circumstances, to be appropriate, acceptable, and persuasive. Walton (1996) posits that schemes offer one way of tackling this apparent contradiction. Argumentation schemes are also very attractive on pedagogical grounds. Schemes can be used as a way of providing students with additional structure and analytic tools with which to analyze natural arguments and to evaluate them critically.

Schemes also hold great potential for tackling a variety of problems in artificial intelligence (AI). The real world represents an immense challenge to artificial agents. Even if we focus only upon reasoning capabilities, and leave to one side the physical aspects of interacting with the world, an agent must deal with two fundamental problems: uncertainty and incompleteness. Not only will an agent not know everything, it cannot even be sure of the things that it does know – and this demands a complete shift from more traditional approaches to software design. Recent work (see Carbogim et al., 2000; Reed, 1997; and Walton, 2000 for reviews) has shown that argumentation offers a powerful means of tackling these problems by moving away from purely deductive, monotonic approaches to reasoning and toward presumptive, defeasible techniques. Typically, however, such reasoning systems will have to interact not only with the world, but also with humans. This places further demands on these systems: not only must this reasoning be carried out, it must also be presented, perhaps dialogically, in a form that is appropriate for human consumption. Once again, it has been demonstrated that dialogue-based theories of argumentation offer flexible, realistic, and, crucially, implementable techniques (Grasso et al., 2000; Reed, 1998).

Argumentation schemes are the forms of argument (structures of inference) that enable one to identify and evaluate common types of argumentation in everyday discourse. Walton (1996) identifies twenty-five argumentation schemes for presumptive reasoning. Matching each argumentation scheme, a set of critical questions is given. The two elements together, the argumentation scheme and the matching critical questions, are used to evaluate a given argument in a particular case, in relation

to a context of dialogue in which the argument occurred. An argument used in a given case is evaluated by judging the weight of evidence on both sides at the point in the case where the argument was used. If all the premises are supported by some weight of evidence, then that weight of acceptability is shifted toward the conclusion, subject to rebuttal by the asking of appropriate critical questions.

In deductive logic, we are used to working with forms of argument. Deductively valid forms of argument like *modus ponens* and disjunctive syllogism are used as formal structures to analyze and evaluate arguments. In a comparable way, inductive forms of argumentation of various sorts can be used to model probabilistic argumentation. The new tool we need is a set of argumentation schemes (forms of argument) that can be used to model many kinds of plausibilistic (abductive, presumptive, defeasible) types of argument. But the modeling with respect to this third type of argument needs to be pragmatic in nature. The argument serves a probative function whereby probative weight is transferred from the premises to the conclusion. Probative weight is defeasible. Its function is to tilt a balance of considerations on an ultimate issue in a dialogue to one side or the other. An argumentation scheme is evaluated in a given case by light of appropriate critical questions in a dialogue. This approach sounds new and unusual to those traditionalists trained in deductive logic. But its utility is immediately apparent from a computational viewpoint, especially in relation to recent work on defeasible reasoning in AI.

The list of presumptive argumentation schemes given by Walton (1996) is not complete, but it identifies many of the most common forms of defeasible argumentation that should be the focus of research. Perelman and Olbrechts-Tyteca (1958) identified many distinctive kinds of arguments used to convince a respondent on a provisional basis. Arthur Hastings' Ph.D. thesis (1963) presented an even more systematic taxonomy by listing some of these schemes, along with useful examples of them. Recently, Kienpointner (1992) has produced an even more comprehensive outline of many argumentation schemes, stressing deductive and inductive forms. Among the presumptive argumentation schemes presented and analyzed by Walton (1996) are such familiar types of argumentation as argument from sign, argument from example, argument from commitment, argument from position to know, argument from expert opinion, argument from analogy, argument from precedent, argument from gradualism, and the slippery slope argument. Helpful examples of each type of argumentation are given and discussed. In other

recent writings on argumentation (e.g., van Eemeren and Grootendorst, 1992), there is a good deal of stress laid on how important argumentation schemes are in any attempt to evaluate common arguments in everyday reasoning as correct or fallacious, acceptable or questionable. The existing formulations of the argumentation schemes are not very precise or systematic, perhaps because they have arisen out of practical concerns in dealing with real cases. New work is needed to refine, classify, and formalize these schemes. To provide a more detailed introduction to what argumentation schemes are and how they work, two examples will be presented. One is called argument from position to know, and the other is called argument from expert opinion.

2. ARGUMENT FROM POSITION TO KNOW AND EXPERT OPINION

The argument from position to know is a type of argument based on the presumption by a proponent that a respondent is privy to some information or knowledge that can be extracted from him (her, it) by questioning. The classic example is the dialogue in which someone lost in a foreign city asks a stranger where the Central Station (or some other building or institution) is located. The questioner presumes, perhaps wrongly, that the person queried is familiar with the town. The following form of argument from position to know is that given by Walton (1996, p. 61).

Argument from Position to Know

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).

Matching the argument from position to know, as indicated by Walton (1996), are the following three critical questions.

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)?

As indicated earlier, argument from position to know shifts a probative weight from the premises to the conclusion, thus tilting the balance of considerations in a dialogue toward one side. But this outcome is

only tentative, depending on what happens next in the dialogue. If an appropriate critical question is posed by the respondent, the probative weight shifts the balance of considerations to the other side. Only if the question is answered satisfactorily is the probative weight shifted back again.

Argument from expert opinion is a subtype of the more general argumentation scheme for argument from position to know, of a kind often used in an information-seeking dialogue. The special kind of information seeking in appeal to expert opinion arises from a situation where one party to the dialogue has information that the other lacks. The one party is an expert. The other is not. The expert has knowledge that the non expert wants to use in order to determine how to proceed with a problem or choice of actions. Argument from expert opinion is represented by the following argumentation scheme in the analysis given by Walton (1997, p. 210).

Argument from Expert Opinion

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).

As Walton (1997) makes clear, appeal to expert opinion should, in most typical cases at any rate, be seen as a defeasible form of argument. It is rarely wise to treat an expert as omniscient. However, there is quite a natural tendency to respect experts and to defer to them. Thus, for most of us, it is not easy to question the opinion of an expert. It verges on the impolite, and is best done in a careful way. But experts are often wrong, for many reasons. As a practical matter – for example, in matters of health and finance – you can do much better if you are prepared to critically question the advice of an expert in the right way. Thus, in principle, appeal to expert opinion as a form of argument is best seen as defeasible and as open to critical questioning. Appeal to expert opinion is a fallible form of argument that often carries probative weight. But, as the logic textbooks have rightly emphasized in the past, there is a tendency to defer to experts, sometimes too easily, and this tendency gives rise to fallacious appeals to expert opinion. Pressing ahead too aggressively, or "browbeating" the respondent, is associated with many cases of fallacious appeal to expert opinion. The sophistical tactic often used is for the

proponent to try to trade on the respondent's respect for expert opinion by suppressing the respondent's legitimate critical questions in the dialogue.

Here are the six basic critical questions matching the appeal to expert opinion, as indicated by 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 *E*'s assertion based on evidence?

Someone attempting to analyze or critically evaluate a given argument can use the two devices of the argumentation scheme and the matching critical questions. The scheme identifies the form of the argument and its premises. Once the premises have been identified, they can then be questioned to see if there is support for them. The critical questions indicate other ways in which the argument can be questioned or criticized by indicating key assumptions that the worth of the argument depends on. The asking of a critical question throws doubt on the structural link between the premises and the conclusion.

The idea behind using critical questions to evaluate appeals to expert opinion is dialectical. The assumption is that the issue to be settled by argumentation in a dialogue hangs on a balance of considerations. Appeal to expert opinion can carry a small weight of presumption in the dialogue, even if by itself it is only a weak argument. If the given argument meets the requirements of the argumentation scheme and the premises are plausible (carry some weight as presumptions), that can give the conclusion some weight as a plausible assumption to go ahead with. But suppose the respondent asks one of the appropriate critical questions just indicated. The burden of proof shifts back to the proponent's side, defeating the argument temporarily until the critical question has been answered successfully.

3. CRITICAL QUESTIONS

One of the features of argumentation schemes that is key to evaluating whether an argument fitting a scheme should be judged strong or weak is the list of associated critical questions – questions that can be

asked (or assumptions that are held) by which a nondeductive argument based on a scheme might be judged to be (or presented as being) good or fallacious. The critical questions form a vital part of the definition of a scheme, and are one of the benefits of adopting a scheme-based approach. One crucial aspect, then, of developing applications of argumentation schemes – computational or otherwise – is to capture these critical questions in an appropriate way. The pattern of most argumentation schemes is similar to *modus ponens*, typically with something defeasible acting as the major premise (Walton, 2002b). In a standard diagramming approach, a *modus ponens* argument would be analysed as having a single conclusion supported by two linked premises. That the premises are linked rather than convergent might be demonstrated using Freeman's (1991) approach of considering a reconstructed dialogue in which an imaginary interlocutor asks a specific question after the presentation of the minor premise. So, in the following example,

(Ex1) *This computer does have an accumulator. It is built on the von Neumann architecture.*

the interlocutor might ask, "Why is that [the second sentence] relevant?," eliciting the major premise that *having a von Neumann architecture implies having an accumulator.* (In a real dialogue, of course, a question such as "Why is that relevant?" is more likely to elicit, through Gricean maxims, not just the linked major premise, but also further arguments in support of that premise.) It is Freeman's question of relevance, rather than of ground adequacy ("Can you give me another reason?"), that moves the argument from one premise to the other in this case, suggesting that they are linked.

Viewing *modus ponens* as an example of a linked argument structure, it is possible to see argumentation schemes in the same way: a conclusion supported by two, or sometimes more, linked premises. Crucially, many of these premises are often left implicit. In a *modus ponens* argument, it is the usual practice to leave implicit the major premise – so usual, in fact, that the enthymematic form has been analyzed as a separate argument form entirely, the *modus brevis* (Sadock, 1977). Including the major premise of a *modus ponens* usually leads to hopelessly cumbersome text – though in certain extreme situations (high levels of audience skepticism or cognitive load), it may be appropriate to make all three components of the argument explicit (Reed, 1999). In argumentation schemes,

however, it is not just the (defeasible) major premises that are left implicit. In many cases there is a range of assumptions, all of which can be seen as acting as implicit linked premises. For example, recall the scheme capturing *argument from position to know* introduced earlier:

(P1) *a* is in a position to know whether *A* is true (false).
(P2) *a* asserts that *A* is true (false).
(C) Therefore, *A* is true (false).
(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)?

In a canonical use of this scheme, the second premise, P2, is asserted explicitly, as is the conclusion. Premise P1 is left implicit (and, as Walton points out, is probably assumed by the hearer by Grice's Principle of Charity, by which an assumption of honesty and relevance is made). The argument thus has its conclusion C, supported by the two linked premises P1 and P2 (if either premise fails, then the argument falls down, just as with the minor and major premises of a *modus ponens*).

In addition, however, the propositional content of the critical questions forms necessary assumptions if the argument scheme is to successfully carry the burden of proof. Thus, for an argument from position to know to be successful, it is necessary for an audience to accept that *a* is honest – in addition to the premises P1 and P2. Furthermore, this additional premise is also linked: if *a* were believed to be dishonest, then the entire argument would fall down.

The complete set of linked premises employed in a scheme is thus the union of those given as premises and (the propositional content of) those listed as critical questions. In the current fluidity of active work on argumentation schemes, the distinction between premises and critical questions may be unclear. For example, in argument from position to know, CQ1 and P1 are closely related and might be characterized as a single premise; CQ2 is clearly distinct and forms a second premise; but although P2 and CQ3 are similar, it might be argued that the critical question is subtly different, aiming for the very words that *a* spoke, as opposed to a paraphrasing or interpretation. It is not the aim here to resolve such potential disputes, but rather to show that any particular interpretation of a list of premises and critical questions can be adequately characterised as a set of linked premises, many of which may be left implicit in an actual text.

4. ENTHYMEMES, SCHEMES, AND CRITICAL QUESTIONS

The term 'enthymeme' is standardly used in logic to refer to an argument in which one or more statements that are part of the argument are not explicitly stated. Enthymemes are sometimes loosely referred to as arguments with "missing premises," but sometimes the missing statement is the conclusion. There are many problems with enthymemes that make the notion a difficult one to capture by means of some mechanical process. Attributing unstated assumptions to an arguer is a perilous kind of inference to draw, for it depends on interpreting what the arguer presumably meant to say. Any argument expressed in a natural language text of discourse is notoriously difficult to interpret. First of all, vagueness and ambiguity are common. But even worse, arguers sometimes achieve plausible deniability by exploiting innuendo and concealed meaning. When a meaning is attributed to him, the arguer may deny it, even alleging that the other party has committed the straw man fallacy. This fallacy is the tactic of exaggerating or distorting an opponent's argument to make it more vulnerable to refutation (Scriven, 1976, pp. 85–86). One might think that the problem of enthymemes could be solved by attributing arguments to someone else only if the argument comes out as deductively valid. But here an even worse problem lurks (Burke, 1985; Gough and Tindale, 1985; Hitchcock, 1985). Making the argument valid may not represent what the arguer really meant to say. Maybe the argument he intended to put forward is invalid. At any rate, it is not too hard to appreciate that the problem of enthymemes is far from trivial, and that it would be extremely difficult to find some algorithm that could mechanically plug in the right missing statements.

Parenthetically, it might be noted that even the term 'enthymeme' itself seems to be a historical misnomer. Burnyeat (1994) has examined the textual evidence of Aristotle's manuscripts and the early commentators on them. In the *Prior Analytics* (70a10), Aristotle wrote that an enthymeme is an incomplete (*ateles*) *sullogismos* from plausibilities or signs. But Burnyeat has cast doubt on whether Aristotle wrote the word *ateles* in the original manuscript. It seems more likely that it was inserted by one of the earliest commentators and then kept in. According to Burnyeat's analysis, what Aristotle really meant by 'enthymeme' is a plausibilistic argument of the kind he treated in the *Topics* and the *Rhetoric*. Such an argument is syllogistic in appearance, but based on a warrant that is defeasible, or true only "for the most part" (to use Burnyeat's translation of Aristotle's phrase). If Burnyeat's interpretation

is right, the outcome is significant for argumentation theory. It means that 'enthymeme', in the original Aristotelian meaning, refers to presumptive argumentation schemes, not to incomplete arguments.

Now let's go on to discuss the general question of how the critical questions are related to missing premises. To pose this question more effectively, we need to consider a reformulation of appeal to expert opinion as an argumentation scheme. Various ways of setting up the schemes by formulating explicit premises can be considered. The scheme representing appeal to expert opinion as a form of argument quoted earlier, from Walton (1997, p. 210), could be called version I. In an alternate version, a conditional premise that links the major to the minor premise has been added.

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).

Version II has taken the old argumentation scheme and added a premise that expresses the Toulmin warrant that gives the argument its backing. What version II reveals is that the argument has a *modus ponens* structure as an inference. But it is not a deductively valid *modus ponens* argument. It has the form we could call defeasible *modus ponens*. For example, in a given case, an argument having the form of version II could throw weight on the conclusion that a proposition *A* is plausible. But then it might be pointed out that *E* is not a credible expert, for some reason. This information would defeat the appeal to expert opinion, undermining the previous grounds for accepting *A*.

Now the question arises whether version II could be made even more explicit. Could it be done by building the critical questions into the argumentation scheme? According to this proposal, the new scheme would have the following form.

Appeal to Expert Opinion (Version III)

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), and *E* is credible as an expert source, and *E* is an expert in the field *A* is in, and *E* asserted *A*, or a statement that implies *A*, and *E* is personally reliable as a source, and *A* is consistent with what other experts assert, and *E*'s assertion is based on evidence, then *A* may plausibly be taken to be true (false).
Conclusion: *A* may plausibly be taken to be true (false).

Version III makes the conditional premise seem cumbersome and hard to remember. Another way to accomplish the same result would be to add the content of each of the critical questions as a separate premise. This yields version IV.

Appeal to Expert Opinion (Version IV)

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).
Expertise Premise: *E* is credible as an expert source.
Field Premise: *E* is an expert in the field that *A* is in.
Opinion Premise: *E* asserted *A*, or made a statement that implies *A*.
Trustworthiness Premise: *E* is personally reliable as a source.
Consistency Premise: *A* is consistent with what other experts assert.
Backup Evidence Premise: *E*'s assertion is based on evidence.
Conclusion: *A* may plausibly be taken to be true (false).

In version IV, all the critical questions have been built in as premises. Now the argumentation scheme is complete by itself, and we don't need the device of critical questions any longer, or so it would seem.

Technically speaking, version III or version IV would work as well as version II, with accompanying critical questions, as a format for analyzing and evaluating appeals to expert opinion as arguments. It doesn't really matter that much which version you use. The advantage of version II is that it strikes a nice balance. It shows you what you basically need as the core of the appeal to expert opinion. It indicates to a user what essential elements give this form of argument the weight that it can carry to command rational assent in a case by shifting a presumption from one side of a dialogue to the other. But then the critical questions offer the user (interlocutor, analyst, evaluator, student) a choice among strategies for probing the weak points in such an argument. Like a traditional topic,

they function as a memory device. We tend to defer to an expert, and may be hard-pressed to think of the right question to ask. To open the discussion up, a user can cast around among the list of standard critical questions and find one that best expresses his doubts or his failure to make sense of what the expert has said. Thus version II is a good way in which to express the form of appeal to expert opinion.

Version II is also the most attractive option for diagramming. Having to include in a diagram all the implicit premises of version IV introduces unnecessary complexity, while diagramming the extra, convoluted warrant of version III fails to elucidate the structure of the argument. Instead, marking the general, typical structure with a scheme, and then allowing access to that scheme's critical questions during the analysis process, allows the analyst the flexibility to include the critical question premises where they are included in the original text, but to leave them out of the diagram where they are not required. The full set of critical questions is retained in the definition of the scheme to remind the analyst of the assumptions that are being made, and to aid in the process of evaluation. This is the approach adopted in Araucaria.

5. PEDAGOGY

One of the advantages of adopting argumentation schemes as a component of argument analysis is in teaching critical thinking skills. In the first place, the structure provided by a scheme narrows the options, and can serve as an aid to the student in identifying missing premises. Thus if a *circumstantial argument against the person* (Walton, 1996, p. 58) is a strong candidate for explaining a particular stretch of text, the analyst might look in more detail for the appropriate premises – that the speaker claims that everyone should act in a particular way, and so on. The analyst is then led to identify premises specified by the scheme but not present in the text – such as the premise usually left implicit in circumstantial ad hominem arguments, that if any speaker claims that something should hold for everyone, then it should hold for that speaker too.

The critical questions associated with each scheme have several roles to play. First, they aid in the initial identification – if critical questions are inappropriate in a given case, the chances are that the argument scheme too is inappropriate. Of course, the critical questions are also crucial in guiding an analyst toward an evaluation of the argument, supporting in some detail a critical approach to the argumentation presented. In more formal approaches, the only tools that a student has available are

soundness and validity; critical questions offer rich contextual prompts to support the analysis process. The use of argumentation schemes, and their close relation to fallacies, also introduces another key advantage: flexibility. By accepting the fact that there may be a scale from good to bad argument, it becomes possible to equip learners with the flexibility necessary for handling real – rather than logic-textbook – arguments. The scale thus encompasses deductively strong arguments and downright fallacies (in the broadest sense, including examples such as affirming the consequent, which is not only 'bad' but also fails by most standards to appear 'good') – and as well as examples lying somewhere in between, where support might be 'substantial' or 'slight'.

Two further features of argumentation schemes in the context of pedagogy are the ease with which they can be integrated into traditional diagramming techniques and the possibility of supporting such diagramming with software tools. Every text has an argumentative purpose, that is, it aims at supporting a conclusion with the use of inferential passages proceeding from premises. Its logical structure can be represented as a tree, constituted by arguments, connected or convergent, dependent on assumptions or other statements, directed toward the end of the communicative move. For this reason, every text is, at the argumentative level, a hierarchical structure of links and dependencies, a complex map of relations. Diagrams are visualizations of this structure; they are means to represent and identify the specific role of each subsequence and each implicit premise. Diagramming, consequently, is an indispensable pedagogic tool: by inquiring into the fundaments and the function of every discursive step, the analyzer can reconstruct and understand the implicit basis of every statement, how it is connected with the rest of the move, and identify the inferential link that warrants the link itself. Argumentation schemes are related to the latter point of this analysis. They are the inferential patterns, the quasi-logical models used to support a conclusion. They motivate the connections, represent how the premises act as reasons, and assign to them a specific function. For these reasons, diagramming is an effective means to concretely apply topical models; on the other hand, argumentation schemes are indispensable to analyzing a text under the argumentative point of view, the purpose of diagrams themselves.

A diagram is constituted by a set of propositions (premises or conclusions) and a set of arrows representing the inferential steps. The technique of visualizing the reasoning structure of a text was used first

in law by Wigmore (1931), in order to facilitate evidential assessment, and developed by David Schum (1994) with the introduction of generalizations, introduced to show the nature and defeasibility of the inference. The concept of generalization, used to analyze the reasoning, is based on Toulmin's model of argument, composed of premises, conclusions, and warrants. The warrant is the reason why a determinate conclusion can be drawn from the given starting points. In Walton's discussion (1996, Chapter 6), the warrant, or generalization, is examined in terms of schemes that can be traced back to basic patterns, differently instantiated in particular arguments. Inferential steps, for this reason, are organized, in diagrams, in a finite set of sequences connecting sets of points by argumentation schemes. Argument evaluation follows Rescher's rules of practical reasoning, distinguishing between linked and convergent arguments. While in the former the strength of the inference to the conclusion depends on the weaker premise, in the latter it is the strongest premise that influences the evidential strength of the inference.

While the importance of diagrams has been recognized in law, as we have seen, and in computer science, where they are used to structure evidential reasoning, their application to teaching philosophy is fairly recent (Rowe et al., 2006). The arguments a philosopher uses as persuasive means to prove a thesis using rational argumentation can be reconstructed, and the interpretation displayed on an argument diagram. Diagrams are instruments for textual analysis: by examining every sequence of reasoning, visualizing the relations between its points, and showing the inferential pattern and the implicit assumptions, the analyst can assess and judge the fundamental reasons and assumptions found in philosophical theories.

Diagrams are useful tools for both teachers and students. By means of visualizations, the principal steps of reasoning supporting a thesis may be represented in an organized structure, showing the position of every subargument. By recognizing inferential steps in a chain of reasoning, it is possible to reconstruct missing premises necessary to support the conclusion as reasonably following from the starting points. In this way, explaining the basic arguments and their critical points of weakness to students becomes much more effective. By means of applying such diagrams, the user can rapidly develop critical skills. In order to draw a diagram of a text, it is necessary, first of all, to identify premises, ultimate and final conclusions, and to connect them in linked or convergent arguments, according to their function. By developing the capability for

dividing a text into argumentative sequences and organizing them, the user can improve his or her logical thinking skills. For these reasons, diagramming is a useful instrument in teaching, and an efficient means for developing the basic skills for the critical study of philosophical, literary, and political discourses, and arguments in every kind of communicative text.

6. INTRODUCING ARAUCARIA

Current collaborative research is under way at the University of Dundee to build a software tool that integrates traditional argument reconstruction and diagramming with the specification of argument schemes. A key feature of this software is that selecting schemes allows students to view critical questions and supply appropriate missing premises. In practical terms, the software is also designed for portability; it runs on Windows, Mac, and UNIX, and it saves arguments using XML, a common interlingua that is easily converted into web pages.

Araucaria is a software tool for supporting the process of constructing an argument diagram (Reed and Rowe, 2001). It is available free on the web at ⟨www.computing.dundee.ac.uk/staff/creed/araucaria⟩. It supports argumentation schemes, and it has an online repository of analyzed arguments. Once an argument has been analyzed, it can be saved in a format called AML (the Argument Markup Language) that can then be used for many purposes – for example, in a database or on a web page. An example is shown in Figure 1.1. Work is currently under way to provide web access to the online database of argument analyses independently of the Araucaria application. Araucaria has been designed for use by teachers and students in critical thinking courses, or in courses with a critical thinking aspect. But because it is a powerful tool in certain respects, its most important application may be to research problems in the field of argumentation.

Araucaria is similar to a software tool called Reason!Able devised by Tim van Gelder of the Department of Philosophy of the University of Melbourne, which has been well tested and is very simple and easy to use. Where Araucaria is aimed at argument analysis, for researchers and undergraduate teaching, Reason!Able is aimed at argument construction, for more introductory teaching earlier in the curriculum. The two thus complement each other.

Applying Araucaria to many basic problems of argumentation and informal logic has just begun. We will use some simple examples to discuss

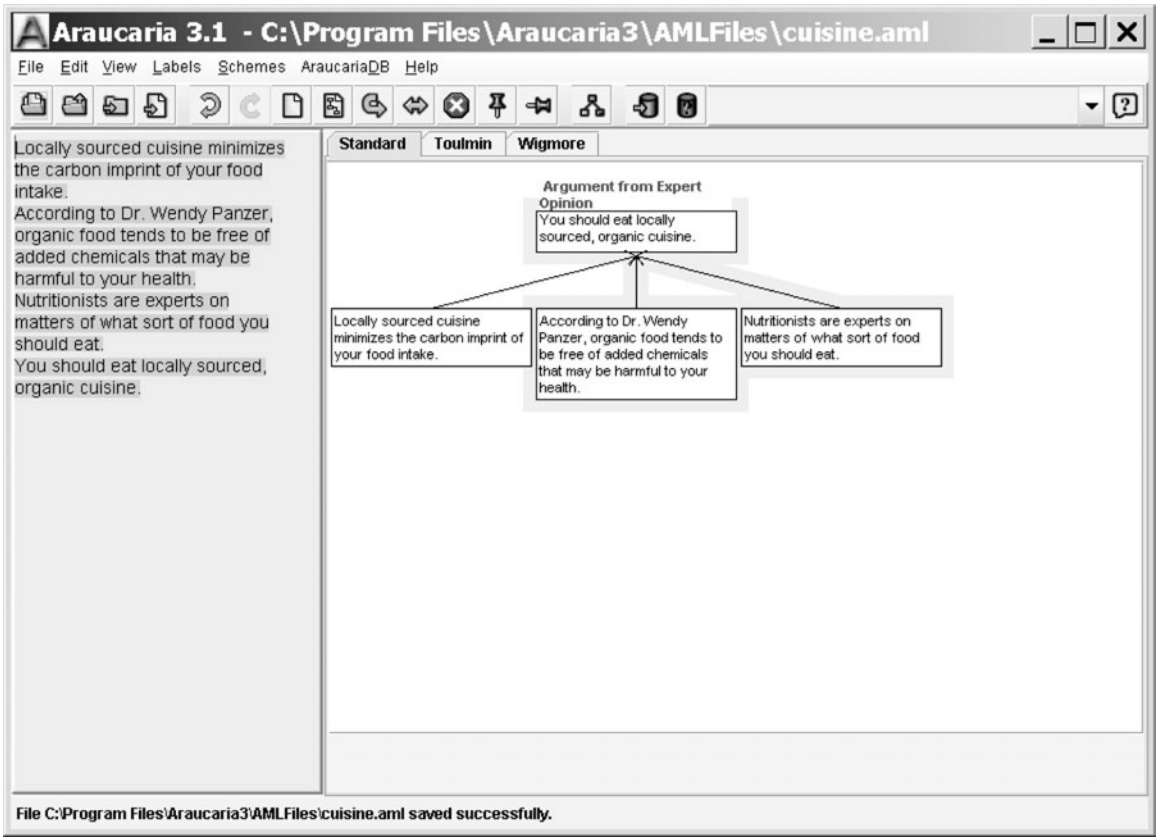

FIGURE 1.1. Araucaria main window.

some of the more basic points. In this discussion, we concentrate on our current joint research project that has the aim of developing a more sophisticated analysis, classification, and formalization of argumentation schemes. To begin, some introduction to schemes is presented. But to keep the discussion within reasonable limits, the scheme for appeal to expert opinion is taken as a case in point.

As an illustration of how this scheme is applied in Araucaria, we select two cases for analysis. Both are from the leading logic textbook (Hurley, 2000). Both are presented by Hurley (p. 139) as examples of the fallacy of "appeal to unqualified authority" or *argumentum ad verecundiam*.

The Bradshaw Example

Dr. Bradshaw, our family physician, has stated that the creation of muonic atoms of deuterium and tritium holds the key to producing a sustained nuclear fusion reaction at room temperature. In view of Dr. Bradshaw's expertise as a physician, we must conclude that this is indeed true.

The basic problem of fallaciousness in the Bradshaw example arises from the field critical question. As Hurley puts it, "The conclusion deals with nuclear physics, and the authority is a family physician" (p. 139).

The Tobacco Example

James W. Johnston, chairman of R. J. Reynolds Tobacco Company, testified before Congress that tobacco is not an addictive substance and that smoking cigarettes does not produce any addiction. Therefore, we should believe him and conclude that smoking does not in fact lead to any addiction.

The basic problem of fallaciousness in the tobacco example arises from subquestion one of the trustworthiness critical question. Even if one should take him to be an authority, Johnson may be presumed to be biased. As Hurley puts it (p. 139), Johnston had a "clear motive to lie," for if he had admitted that tobacco is addictive, government regulations could have put his company out of business.

Let's consider how these two examples would be processed by Araucaria, or indeed by any comparable system for argument analysis and diagramming. The two premises and the conclusion in the Bradshaw example can be highlighted, and the linked argument diagram can be constructed. If the argument were cleaned up a little before being inserted into Araucaria as text, it might come out something like this.

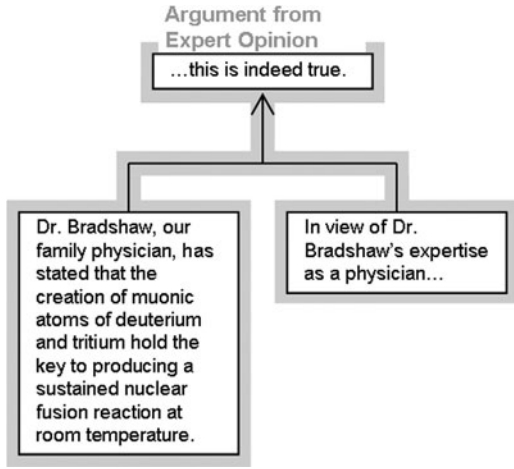

FIGURE 1.2. Argument diagram of the Bradshaw example.

Cleaned-Up Version of the Bradshaw Example

Dr. Bradshaw says that the muonic atoms are crucial to nuclear fusion (etc.).

Dr. Bradshaw is an expert in the field of medicine.

Therefore, (C) the claim that muonic atoms are crucial to nuclear fusion (etc.) may plausibly be taken to be true.

(In Figure 1.2, the shaded area around the three boxes shows the putative use of the argumentation scheme Appeal to Expert Opinion).

The problem is that the subject domain containing the proposition displayed in Figure 1.2 is not medicine, but physics. Therefore, this argument doesn't even get off the ground. The domain variable, *S*, in the major premise stands for medicine, while *S* in the minor premise stands for physics. The problem seems to be one of equivocation, or perhaps one of the argument not fitting the argumentation scheme at all (although it may superficially appear to, in the view of the uncritical thinker).

And yet there is another way of diagnosing the problem or fallacy in the argument in the Bradshaw example. If the field critical question is asked, the answer is "No, *E* is not an expert in the field that *A* is in." So here we seem to have a kind of duplication. The fault is diagnosed twice. Is this really necessary or desirable? Should the scheme and critical questions for Appeal to Expert Opinion be reformulated to eliminate this redundancy? That is the problem, anyhow.

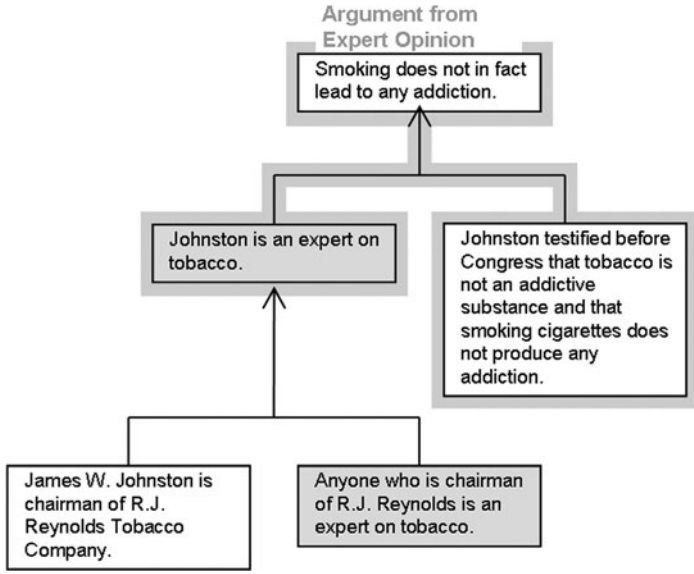

FIGURE 1.3. Argument diagram of the tobacco example.

Now consider the tobacco example. Like the previous one, this argument could perhaps be cleaned up a little in order to make it more visibly match the scheme.

Cleaned-Up Version of the Tobacco Example

(A) Johnston is chairman of R. J. Reynolds.
(B) Anyone who is chairman of R. J. Reynolds is an expert on tobacco.
(C) Johnston is an expert on tobacco.
(D) Johnston says that tobacco is not addictive (etc.)
Therefore, (E) "Tobacco is not addictive" may plausibly be taken to be true.

(In Figure 1.3, the scheme is again shown as a shaded outline; the greyed boxes indicate reconstructed claims that have been introduced during the analysis rather than being present in the original.)

One problem here is the slight dubiousness of the second premise, (B), as a generalization. This premise is true in certain respects, meaning that such a person is an expert on certain aspects of tobacco, like its manufacturing. But it is false in other respects, because such a person is not necessarily, or as far as we know, a medical or scientific expert on addiction or on the properties of addictive substances. But this is not the major

problem with the argument as an *ad verecundiam*, judging by Hurley's diagnosis. The main problem is that the example triggers the bias subquestion of the trustworthiness critical question (to put it in our terms).

It should be mentioned that both these cases are relatively simple examples of the *ad verecundiam* fallacy taken from a logic textbook. In the textbook, they are used pedagogically to introduce students to the most simple or obvious kind of case that the students will see as fallacious right away. In more complex examples, the mistake or blunder is not so obvious. And indeed, in the kind of case emphasized by Walton (1997), the proponent adopts a strategy of blocking progress in a dialogue by trying to prevent the respondent (in advance) from raising the appropriate critical questions. One leading example in Walton's book is a case where the parents of a sick child are prevented from asking questions about how to help their child by physicians who dismiss their claims as "anecdotal," suggesting that the parents do not really have a right to discuss questions of medical treatment with them. But this kind of case raises a problem identified by Jovicic (2002, p. 29). In the case she postulates, a proponent advances an argument from expert opinion using the appropriate argumentation scheme, and the premises are presumptively strong. But he is an arrogant person who blocks off the attempts of the nonspecialist audience to ask appropriate critical questions. Thus, by the Walton criterion, his argument commits the *ad verecundiam* fallacy. And yet, suppose that the argument, when presented to an audience of specialists, who do not even need to ask these critical questions, is based on evidence in the field, making it presumptively strong. It may be too early to tell what the best solution to this problem is. But it does suggest that the argumentation scheme for appeal to expert opinion, even with the matching critical questions, may be only part of the answer when dealing with the *ad verecundiam* fallacy. Somehow the argumentation scheme, the critical questions, and the profile of dialogue (Krabbe, 1999) may all need to be taken into account in the big picture. The problems with the tobacco case and the Bradshaw case are just the beginning.

In the tobacco case, then, the argument has some problems fitting the form of the appeal to expert opinion. But once it gets past this snag, its underlying problem is deeper. So in the tobacco case, as contrasted with the Bradshaw case, the deeper problem that is the basis for judging the argument to be an *ad verecundiam* fallacy comes out only when the right critical question is asked. And even then, the precise diagnosis of the fault is pinpointed exactly only when the level of the critical subquestions is reached.

The problem, then, is one of finding a uniform method of balancing off the format of the argumentation scheme in relation to the critical questions so that the processes of argument analysis and evaluation are most user-friendly. Maybe a little bit of redundancy is OK, as long as all the bases are touched at least once.

7. PROBLEMS TO BE SOLVED

A general problem is how an argumentation scheme can have normative bite in a dialogue if the respondent can continue the dialogue by asking critical questions or by otherwise challenging the argument. If these arguments are defeasible, how can they ever be used to pin down a respondent's commitments? One tool that can be used to deal with this problem is the profile of dialogue (Krabbe, 1999). A profile of dialogue is a sequence of moves that represents only a small part of a longer sequence of dialogue. For example, it might represent a question, a reply to that question, and then a next move or two. Profiles are not just descriptive tools for identifying common patterns of moves in examples of argumentation. They can also be used in a normative way to represent how an ideal sequence of dialogue should go, or to diagnose faults, errors, or fallacies. The argumentation scheme for appeal to expert opinion, along with the set of matching critical questions, can easily be used to set up a normative profile for the typical kind of case in which appeal to expert opinion is used to support a claim. The first point in the profile will be an argument or question put forward by the respondent. The next point will be the appeal to expert opinion put forward by the proponent in reply to this move. At the next point, the respondent's set of allowed options can be represented by eight branches in a tree diagram. The respondent can (a) ask a critical question, (b) challenge one of the premises of the appeal to expert opinion, or (c) accept the conclusion of the argument as a commitment. Thus the profile of dialogue shows how the argument has normative bite when used in a dialogue.

Another problem concerns enthymemes. Can the critical questions be used, in addition to the argumentation scheme, to specify additional missing premises that can be added to a given argument? Because the critical questions are formulated in advance, it seems possible that they could be used as part of an automated device to pick out missing premises in enthymemes. But this problem leads back to the earlier one. It could be called the completeness problem for critical questions. Once the respondent has run through the list of critical questions matching a

scheme, can he go on to ask even more specific critical questions raised by the previous answers? The problem is one of how argumentation schemes are binding on a respondent. Presumptive schemes are defeasible. They are not deductively valid. The question, then, is how long the process of asking critical questions can continue before the argument must finally be accepted as binding the respondent to acceptance of the conclusion, if he has accepted the premises.

As an example, let's go back to appeal to expert opinion, where the basic critical questions are known to have subquestions falling under each of them. For example, three critical subquestions have been cited (Walton, 1997, p. 217) as falling under the trustworthiness critical question.

Subquestions for the Trustworthiness Question

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

Bias means failure to represent both sides of an issue in a balanced way. Bias is not always bad, because advocacy is sometimes quite appropriate in argumentation. Still, bias can be important in judging the worth of an argument based on appeal to expert opinion. Honesty means telling the truth, or whatever is perceived as being the truth of a matter. Conscientiousness means care in collecting sufficient information. Thus the subquestions just listed represent more specific ways in which the trustworthinesss of an expert can be questioned.

Using this scheme, the completeness problem can be posed. Suppose the proponent has answered all of the six basic critical questions posed by the respondent in prior dialogue exchanges. Is the respondent obliged at that point to accept the appeal to expert opinion as reasonable? If he accepts the premises, is he now obliged to accept the conclusion as a commitment in the dialogue? Or can he carry on asking more specific critical subquestions? The danger is that the dialogue could go on indefinitely. What burden of proof is appropriate for the proponent? At what point can he stop the process and say that his appeal to expert opinion should now carry weight?

There are two issues that are combined by the foregoing considerations. One is the issue of the critical questions, and whether there should be some kind of burden of proof attached to asking them. The other is the issue of how arguments should be attacked or criticized generally.

This second issue is often phrased in terms of Pollock's (1987) distinctions between defeaters and undercutters, but this terminology can be a bit confusing itself. Let's begin with the idea that there are two ways to attack (criticize, refute) an argument. One is to use a counterargument. A counterargument is an argument with a conclusion that is the opposite (negation) of the original argument that was attacked by it. The other way is to attack the premises of the argument, either by questioning them or by arguing that one or more of them is false. This seems simple enough, but it applies only to deductive, or perhaps to inductive arguments. With defeasible arguments, the situation is more complex, because an opponent can attack the inference rule, the warrant or generalization the argument is based on, by citing an exception to the rule.

Thus, in general, a defeasible argument can be attacked in only three ways, by an attack on a premise, by a counterargument with an opposite conclusion, or by an argument attacking the inference rule. But some see the inference rule as really just acting as another premise. You can attack it, or you can attack any other premise of the argument. Thus, from this point of view, there are just two ways of attacking (and defeating) any argument. You can attack the premises or you can attack the argument by presenting a counterargument with the opposite conclusion. Let's call the latter form of attack a rebuttal.

Next there is the issue of where and how critical questions fit in as a form of attack on a defeasible argument, or something similar to an attack. One possible theory is that the critical questions represent additional premises that are additional assumptions of the argument at a deeper level. They are like unstated premises. This is all controversial, however. If the critical questions can be treated as implicit premises, that supposition has implications for any attempt to formally model argumentation. Another possible theory is that some critical questions function as implicit premises, while others function as starting points for finding rebuttals. The crucial difference is that the latter have a burden of proof attached for the questioner, while the former do not.

To take a hard look at one argumentation scheme to see how these two approaches will differ, let us return once again to the critical questions matching the appeal to expert opinion, and examine them individually.

1. *Expertise Question*: How credible (knowledgeable) is *E* as an expert source?
2. *Field Question*: Is *E* an expert in the field that *A* is in?