

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 artificial 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 Toulmin 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*