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ARGUMENTATION THEORY: A VERY SHORT INTRODUCTION

Since the time of the ancient Greek philosophers and rhetoricians, argumentation theorists have searched for the requirements that make an argument correct, by some appropriate standard of proof, by examining the errors of reasoning we make when we try to use arguments. These errors have long been called fallacies, and the logic textbooks have for over 2000 years tried to help students to identify these fallacies, and to deal with them when they are encountered. The problem was that deductive logic did not seem to be much use for this purpose, and there seemed to be no other obvious formal structure that could usefully be applied to them. The radical approach taken by Hamblin (1970) was to refashion the concept of an argument to think of it not just as an arbitrarily designated set of propositions, but as a move one party makes in a dialog to offer premises that may be acceptable to another party who doubts the conclusion of the argument. Just after Hamblin's time a school of thought called informal logic grew up that wanted to take a new practical approach to teaching students skills of critical thinking by going beyond deductive logic to seek other methods for analyzing and evaluating arguments. Around the same time, an interdisciplinary group of scholars associated with the term 'argumentation', coming from fields like speech communication, joined with the informal logic group to help build up such practical methods and apply them to real examples of argumentation (Johnson and Blair, 1987).

The methods that have been developed so far are still in a process of rapid evolution. More recently, improvements in them have been due to some computer scientists joining the group, and to collaborative research efforts between argumentation theorists and computer scientists. Another recent development has been the adaption of argumentation models and techniques to fields in artificial intelligence, like multi-agent systems and artificial intelligence for legal reasoning. In a short paper, it is not possible to survey all these developments. The best that can be done is to offer an introduction to some of the basic concepts and methods of argumentation theory as they have evolved to the present point, and to briefly indicate some problems and limitations in them.

1. Arguments and Argumentation

There are four tasks undertaken by argumentation, or informal logic, as it is also often called: identification, analysis, evaluation and invention. The task of identification is to identify the premises and conclusion of an argument as found in a text of discourse. A part of this task is to determine whether a given argument found in a text fits a known form of argument called an argumentation scheme (more about schemes below). The task of analysis is to find implicit premises or conclusions in an argument that need to be made explicit in order to properly evaluate the argument. Arguments of the kind found in natural language texts of discourse tend to leave some premises, or in some instances the conclusion, implicit. An argument containing such missing assumptions is traditionally called an enthymeme. The task of evaluation is to determine whether an argument is weak or strong by general criteria that can be applied to it. The task of invention is to construct new arguments that can be used to prove a specific conclusion. Historically, recent work has mainly been directed to the first three tasks, but there has been a tradition

of attempting to address the fourth task from time to time, mainly based on the tradition of Aristotelian topics (Walton, Reed and Macagno, chapter 8).

There are differences in the literature in argumentation theory on how to define an argument. Some definitions are more minimal while others are more inclusive. We start here with a minimal definition, however, that will fit the introduction to the elements of argumentation presented below. An argument is a set of statements (propositions), made up of three parts, a conclusion, a set of premises, and an inference from the premises to the conclusion. An argument can be supported by other arguments, or it can be attacked by other arguments, and by raising critical questions about it.

Argument diagramming is one of the most important tools currently in use to assist with the tasks of analyzing and evaluating arguments. An argument diagram is essentially a box and arrow representation of an argument where the boxes contain propositions that are nodes in a graph structure and where arrows are drawn from nodes to other nodes representing inferences. At least this is the most common style of representation. Another style growing in popularity is the diagram where the nodes represent arguments and the boxes represent premises and conclusions of these arguments. The distinction between a linked argument and a convergent argument is important in argumentation theory. A linked argument is one where the premises work together to support the conclusion, whereas in a convergent argument each premise represents a separate reason that supports the conclusion. Arguments fitting the form of an argumentation scheme are linked because all of the premises are needed to adequately support the conclusion. Here is an example of a convergent argument: gold is malleable; it can be easily made into jewelry, and my metallurgy textbook says it is malleable. In the example shown in figure 1, two linked arguments are combined in a chain of reasoning (called a serial argument).

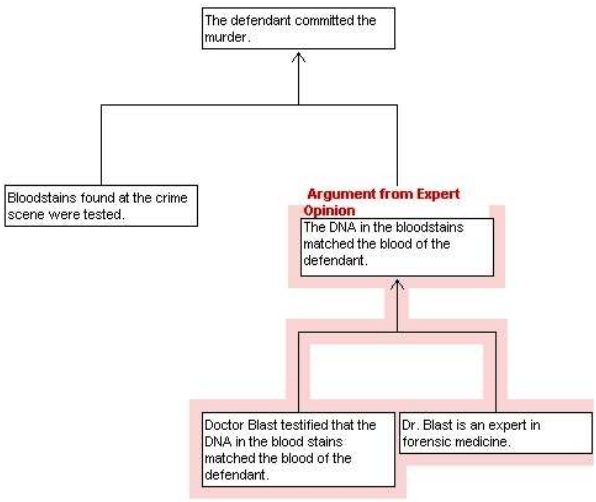

Figure 1: Example of an Argument Diagram

The linked argument on the right at the bottom has a colored border and the label Argument from Expert Opinion is shown in a matching color at the top of the conclusion. This label represents a type of argument called an argumentation scheme.

Figure 1 was drawn with argument diagramming tool called *Araucaria* (Reed and Rowe, 2004). It assists an argument analyst using a point-and-click interface, which is saved in an Argument Markup Language based on XML (Reed and Rowe, 2004). The user inserts the text into *Arauacaria*, loads each premise or conclusion into a text box, and then inserts arrows showing which premises support which conclusions. As illustrated above, she can also can insert implicit premises or conclusions and label them. The output is an argument diagram that appears on the screen that can be added to, exported or printed (http://araucaria.computing.dundee.ac.uk/).

The other kind of format for representing arguments using visualization tools is shown in the screen shot in figure 2. According to this way of representing the structure of the argument, the premises and conclusions appear as statements in the text boxes, while the nodes represent the arguments. Information about the argumentation scheme, and other information as well, is contained in a node (http://carneades.berlios.de/downloads/).

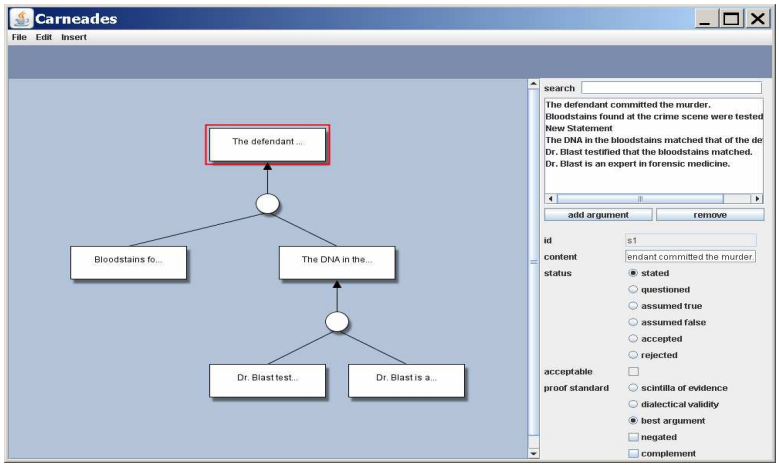

Figure 2: Carneades Screen Shot of an Argument

Both arguments pictured in figure 2 are linked. Convergent arguments are represented as separate arguments. Another paper in the body image shows how Carneades represents different proof standards of the kinds indicated on the lower right of the screen shot.

Argument diagrams are very helpful to display premises and conclusions in an argument and to show how groups of premises support conclusions that can in turn be used as premises in adjoining arguments. Smaller arguments are chained together into longer sequences, and an argument diagram can be very useful to help an analyst keep track of the chain of reasoning in its parts. However, typical argument diagrams are made up only of statements in text boxes joined together by arrows. Such an argument diagram is limited or very little use when it comes to representing critical questions and the relationship of these questions to an argument.

The definition of ‘argument’ relied on so far could be called a minimal inferential definition, and the method of argument diagramming shown so far fits this minimal definition. The boxes represent propositions and the arrows represent inferences from some propositions to others.

The general approach or methodology of argumentation can be described as distinctively different from the traditional approach based on deductive logic. The

traditional approach concentrated on a single inference, where the premises and conclusion are designated in advance, and applied formal models like propositional calculus and quantification theory determine whether the conclusion conclusively follows from the premises. This approach is often called monological.

In contrast, the argumentation approach is called dialogical (or dialectical) in that it looks at two sides of an argument, the pro and the contra. According to this approach, the method of evaluation is to examine how the strongest arguments for and against a particular proposition at issue interact with each other, and in particular how each argument is subject to probing critical questioning that reveals doubts about it. By this dialog process of pitting the one argument against the other, the weaknesses in each argument are revealed, and it is shown which of the two arguments is the stronger.[1]

To fill out the minimal definition enough to make it useful for the account of argumentation in the paper, however, some pragmatic elements need to be added, that indicate how arguments are used in a dialog between two (in the simplest case) parties. Argumentation is a chain of arguments, where the conclusion of one inference is a premise in the next one. There can be hypothetical arguments, where the premises are merely assumptions. But generally, the purpose of using an argument in a dialog is to settle some disputed (unsettled) issue between two parties. In the speech act of putting forward an argument, one party in the dialog has the aim of trying to get the other party to accept the conclusion by offering reasons why he should accept it, expressed in the premises. This contrasts with the purpose of using an explanation, where one party has the aim of trying to get the other party to understand some proposition that is accepted as true by both parties. The key difference is that in an argument, the proposition at issue (the conclusion) is doubted by the one party, while in an explanation, the proposition to be explained is not in doubt by either party. It is assumed to represent a factual event.

2. Argument Attack and Refutation

One way to attack an argument is to ask an appropriate critical question that raises doubt about the acceptability of the argument. When this happens, the argument temporarily defaults until the proponent can respond appropriately to the critical question. Another way to attack an argument is to question one of the premises. A third way to attack an argument is to put forward counter-argument that opposes the original argument, meaning that the conclusion of the opposing argument is the opposite (negation) of the conclusion of the original argument. There are other ways to attack an argument as well (Krabbe, 2007). For example, one might argue that the premises are not relevant to the conclusion, or that the argument is not relevant in relation to the issue that is supposedly being discussed. One might also argue that the original argument commits a logical fallacy, like the fallacy of begging the question (arguing in a circle by taking for granted as a premise the very proposition that is to be proved). However, the three first ways cited above of attacking an argument are especially important for helping us to

[1] This approach has been neglected for a long time in the history of logic, but it is not new. Cicero, based on the work of his Greek predecessors in the later Platonic Academy, Arcesilaus and Carneades, adopted the method of dialectical inquiry that, by arguing for and against competing views, reveals the one that is the more plausible (Thorsrud, 2002, 4).

understand the notion of argument refutation. A refutation of an argument is an opposed argument that attacks the original argument and defeats it.

A simple way to represent a sequence of argumentation in the dialogical style is to let the nodes in a graph represent arguments and the arrows represent attacks on arguments (Dung, 1995). In this kind of argument representation, one argument is shown as attacking another. In this example, argument A1 attacks both A2 and A3. A2 attacks A6. A6 attacks A7, and A7 attacks A6. A3 attacks A4, and so forth.

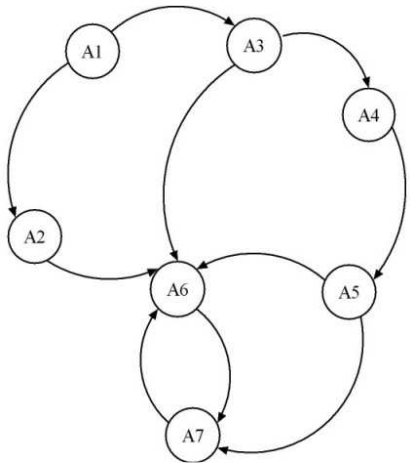

Figure 3: Example of a Dung-style Argument Representation

Notice that arguments can attack each other. A6 attacks A7 and A7 also attacks A6. An example (Besnard and Hunter, 2008, 23) is the following pair of arguments.

Richard is a Quaker and Quakers are pacifists, so he is a pacifist.
Richard is a Republican and Republicans are not pacifists, so he is a not a pacifist.

In Dungs' system, the notions of argument attack are undefined primitives, but the system can be used to model criteria of argument acceptability. One such criterion is the view that an argument should be accepted only if every attack on it is attacked by an acceptable argument (Bench-Capon and Dunne, 2005, 3).

There is general (but not universal) agreement in argumentation studies that there are three standards by which the success of the inference from the premises to the conclusion can be evaluated. This agreement is generally taken to mean that there are three kinds of arguments: deductive, inductive, and defeasible arguments of a kind widely thought not to be inductive (Bayesian) in nature. This third class includes arguments like 'Birds fly; Tweety is a bird; therefore Tweety flies', where exceptions, like 'Tweety has a broken wing' are not known in advance and cannot be anticipated statistically. Many of the most common arguments in legal reasoning and everyday conversational argumentation that are of special interest to argumentation theorists fall into this class. An example would arguments from expert opinion of this sort: Experts are generally right about things in their domain of expertise; Dr. Blast is an expert in domain D, Dr. Blast asserts that A, A is in D; therefore an inference can be drawn that A is acceptable, subject to default if any reasonable arguments to the contrary or critical questions are raised. Arguments of this

sort are important, for example in legal reasoning, but before the advent of argumentation theory, useful logical tools to identify, analyze and evaluate them were not available.

3. Argumentation Schemes

Argumentation schemes are abstract argument forms commonly used in everyday conversational argumentation, and other contexts, notably legal and scientific argumentation. Most of the schemes that are of central interest in argumentation theory are forms of plausible reasoning that do not fit into the traditional deductive and inductive argument forms. Some of the most common schemes are: argument from witness testimony, argument from expert opinion, argument from popular opinion, argument from example, argument from analogy, practical reasoning (from goal to action), argument from verbal classification, argument from sign, argument from sunk costs, argument from appearance, argument from ignorance, argument from cause to effect, abductive reasoning, argument from consequences, argument from alternatives, argument from pity, argument from commitment, *ad hominem* argument, argument from bias, slippery slope argument, and argument from precedent. Each scheme has a set of critical questions matching the scheme and such a set represents standard ways of critically probing into an argument to find aspects of it that are open criticism.

A good example of a scheme is the one for argument from expert opinion, also called appeal to expert opinion in logic textbooks. In this scheme (Walton, Reed and Macagno, 2008, 310), *A* is a proposition, *E* is an expert, and *D* is a domain of knowledge.

MAJOR PREMISE:	Source *E* is an expert in subject domain *S* containing proposition *A*.
MINOR PREMISE:	*E* asserts that proposition *A* is true (false)
CONCLUSION:	*A* is true (false)

The form of argument in this scheme could be expressed in a *modus ponens* format where the major (first) premise is a universal conditional: If an expert says that *A* is true; expert *E* says that *A* is true; therefore *A* is true. The major premise, for practical purposes, however, is best seen as not being an absolute universal generalization of the kind familiar in deductive logic. It is best seen as a defeasible generalization, and the argument is defeasible, subject to the asking of critical questions. If the respondent asks any one of the following six critical questions (Walton, Reed and Macagno, 2008, 310), the proponent must give an appropriate reply or the argument defaults.

CQ_1:	*Expertise Question*. How credible is *E* as an expert source?
CQ_2:	*Field Question.* Is *E* an expert in the field that *A* is in?
CQ_3:	*Opinion Question*. What did *E* assert that implies *A*?
CQ_4:	*Trustworthiness Question.* Is *E* personally reliable as a source?
CQ_5:	*Consistency Question.* Is *A* consistent with what other experts assert?
CQ_6:	*Backup Evidence Question.* Is *E*'s assertion based on evidence?

Some other examples of schemes will be introduced when we come to study the example of extended argumentation in section 2.

4. Enthymemes

As indicated in the introduction, an enthymeme is an argument with an implicit premise or conclusion that needs to be made explicit before the argument can be properly understood or evaluated. The classic example is the argument: all men are mortal; therefore Socrates is mortal. As pointed out in many logic textbooks, the premise 'Socrates is a man' needs to be made explicit in order to make the argument into a deductively valid argument. Because both premises are needed to support the conclusion adequately, this argument is linked.

Consider the following example of an enthymeme.

The Free Animals Example

Animals in captivity are freer than in nature because there are no natural predators to kill them.

The explicit conclusion is clearly the first statement: animals in captivity are freer than in nature. The explicit premise offered to support the conclusion is the statement that there are no natural predators to kill animals that are in captivity. There are two assumptions that play the role of implicit premises in the argument. The first is the statement that there are natural predators to kill animals that are in nature. The second is the conditional statement that if animals are in a place where there are no natural predators to kill them, they are freer than if they are in a place where there are natural predators to kill them. The first implicit premise is a matter of common knowledge. The second one, however, expresses a special way that the arguer is using the word 'free' that seems to go against common knowledge, or at any rate, does not seem to be based on it. It seems to represent the arguer's own special position on the meaning of 'freedom'.

In the argument diagram in figure 4, the two premises on the right are enclosed in darkened boxes, with a broken line around the border, indicating that both are implicit premises. The one in the middle is labeled as based on common knowledge (CK) and the one on the right is labeled as based on the arguer's special commitment (COM).

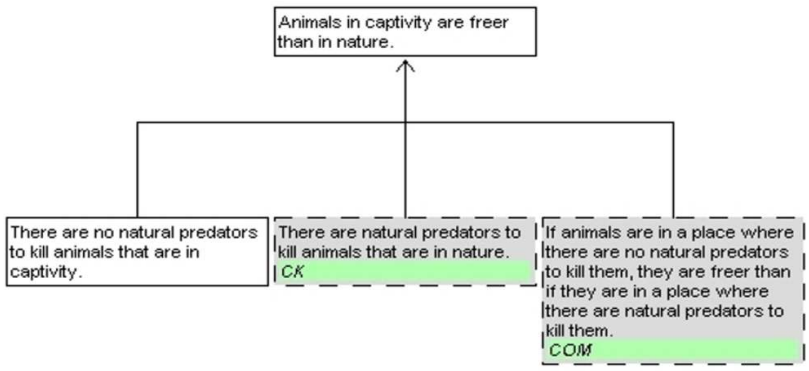

Figure 4: Argument Diagram of the Free Animals Example

The argument shown in figure 4 is clearly a linked argument, since all three premises are required to adequately support the conclusion. They all function together in support of the conclusion, rather than being separate reasons, each of which supports the conclusion independently of the others.

In some cases of enthymemes it is fairly obvious to determine what the missing premise or conclusion should be. In such cases, an argumentation scheme can often be used to apply to the argument given in the text of discourse to see which premise is missing. In other cases, however, there can be different interpretations of the text of discourse, and different judgments about what the missing premise should be taken to be. The more general problem is to judgment what an arguer's commitment is, given some evidence of what the arguer has said and how he has responded to criticisms and other moves in a dialog. If an arguer explicitly asserts a statement and does not retract it, then it is clear that he is committed to that statement. But suppose he explicitly asserts two statements, and a third statement follows from the first to by modus ponens. Is he then committed to the third statement? Logically, it seems that he should be, but when he is confronted with a third statement he may deny that he is committed to it. The other party in the dialogue should then challenge him to resolve the inconsistency one way or the other, by either retracting the third statement or one of the premises.

5. An Example Dialog

In the following dialog, called the smoking dialog, two participants Ann and Bob, are discussing the issue of whether governments should ban smoking. They take turns making moves, and each move after Ann's opening move appears to address the prior move of the other party. Thus the dialog has an appearance of being connected and continuous in addressing the issue by bringing forward arguments pro and con.

The Smoking Dialogue

Ann (1): Governments should protect its citizens from harm. There is little doubt that smoking tobacco is extremely harmful to the smoker's health. Therefore governments should ban smoking.

Bob (2): How do you know that smoking tobacco is extremely harmful to the smoker's health?

Ann (3): Smoking leads to many other health problems, including lung cancer and heart disease. According to the American Cancer Society, 3 million people die from smoking each year.

Bob (4): The government has a responsibility to protect its citizens, but it also has a responsibility to defend their freedom of choice. Banning smoking would be an intrusion into citizens' freedom of choice.

Ann (5): Smoking is not a matter of freedom of choice. Nicotine is an addictive drug. Studies have shown that once smokers have begun smoking, they become addicted to nicotine. Once they become addicted they are no longer free to choose not to smoke.

Bob (6): Governments should not stop citizens from doing things that can be extremely harmful to their health. It is legal to eat lots of fatty foods or drink alcohol excessively, and it makes no sense for governments to try to ban these activities.

Commentary

Examining Ann's first argument, it is fairly straightforward to put in a format showing that it has two premises and a conclusion.

Governments should protect its citizens from harm.
Smoking tobacco is extremely harmful to the smoker's health.
Therefore governments should ban smoking.

This argument looks to be an instance of the argumentation scheme for argument from negative consequences (Walton, Reed and Macagno, 2008, 332). The reason it offers to support its conclusion that governments should ban smoking is that smoking has negative consequences. An implicit premise is that being extremely harmful to health is a negative consequence, but we ignore this complication for the moment.[2]

Scheme for Argument from Negative Consequences

PREMISE: If *A* is brought about, then bad consequences will occur.
CONCLUSION: Therefore *A* should not be brought about.

The reason is that a premise in the argument claims that the practice of smoking tobacco has harmful (bad) consequences, and for this reason the conclusion advocates something that would make it so that smoking is no longer brought about.

However there is another argumentation scheme, one closely related to argument from negative consequences, that could also (even more usefully) be applied to this argument. It is called practical reasoning. The simplest version of this scheme, called practical inference in (Walton, Reed and Macagno, 2008, 323) is cited below with its matching set of critical questions.

Scheme for Practical Inference

MAJOR PREMISE: I have a goal *G*.
MINOR PREMISE Carrying out this action *A* is a means to realize *G*.
CONCLUSION: Therefore, I ought (practically speaking) to carry out this action *A*.

[2] To more fully analyze the argument we could apply a more complex scheme called value-based practical reasoning (Bench-Capon, 2003).

Critical Questions for Practical Inference

CQ_1: What other goals do I have that should be considered that might conflict with *G*?
CQ_2: What alternative actions to my bringing about *A* that would also bring about *G* should be considered?
CQ_3: Among bringing about *A* and these alternative actions, which is arguably the most efficient?
CQ_4: What grounds are there for arguing that it is practically possible for me to bring about *A*?
CQ_5: What consequences of my bringing about *A* should also be taken into account?

CQ_5 asks if there are negative consequences of the action (side effects) that need to be taken into account, and it can be seen that it covers argumentation from both positive and negative consequences.

Applying the argumentation scheme for practical reasoning, we get the following reconstruction of the original argument. Premise 1: Governments have the goal of protecting their citizens from harm. Premise 2: Smoking is harmful to their citizens. Premise 3: Carrying out the action of banning smoking is a means for governments to protect their citizens from this harm. Conclusion: governments should ban smoking. This argument can be diagrammed as shown in figure 5.

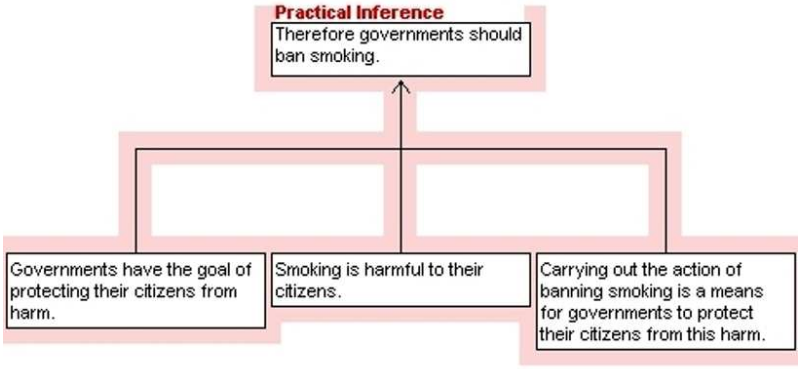

Figure 5: Argument Diagram of the Smoking Example with Practical Inference

At his first move, Bob questions one of the premises of Ann's argument. He asks her to give a reason to support her assertion that smoking tobacco is extremely harmful to the smoker's health. In response to Bob's question, Ann offers two such reasons. There could be various ways to represent the structure of her additional argument. The two reasons could perhaps function together as a linked argument, or they could function as two separate reasons having the structure of a convergent argument. But there is another way to analyze her additional argumentation.

When Ann puts forward her argument, it appears that she is using our new assertion that smoking leads to many other health problems, including lung cancer and heart disease, as additional support for her previous premise that smoking tobacco is extremely harmful to the smoker's health. What about her next statement that according to the

American Cancer Society, 3 million people die from smoking each year? It appears that this statement is being used to back up her previous statement that smoking leads to many other health problems, including lung cancer and heart disease. This seems to be a plausible reconstruction of her argument.

We can produce an even better analysis of her argument using the argumentation scheme for argument from expert opinion. It would appear that she is citing the American Cancer Society as an expert source on health issues relating to cancer and smoking. We could analyze her argument by inserting an implicit premise to this effect, as shown in the argument diagram in figure 6.

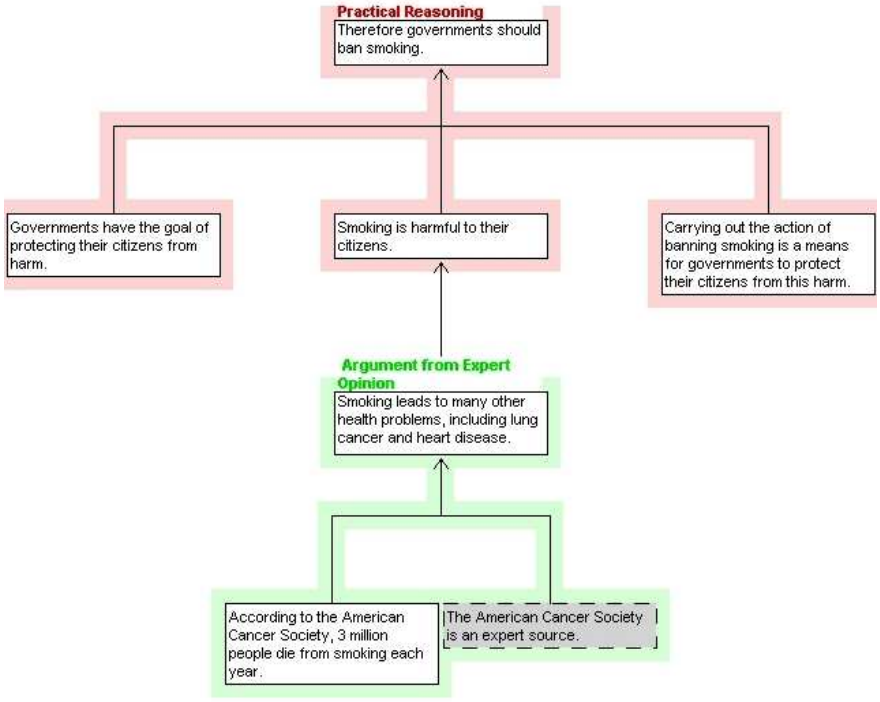

Figure 6: Argument Diagram of the Smoking Example with Implicit Premise

On this analysis, the implicit premise that the American Cancer Society is an expert source is shown in the darkened box with dashed lines around it at the lower right. This premise, when taken with Ann's explicit premise shown on the left, makes up an argument from expert opinion supporting her previous claim. This example shows how an argumentation scheme can be useful in helping an argument analyst to identify an implicit premise that is not explicitly stated in the argument, but that is important for helping us to realize what the basis of the argument is.

At move 4, Bob concedes Ann's claim that the government has a responsibility to protect its citizens, but then he introduces a new argument. This argument is an interesting example of an enthymeme because the implicit statement needed to complete the argument is its conclusion.

Premise: governments have a responsibility to defend citizens' freedom of choice.

Premise: banning smoking would be an intrusion into citizens' freedom of choice.
Implicit Conclusion: governments should not been smoking.

Notice that the conclusion of this argument is the opposite of Ann's previous argument that had the conclusion that governments should ban smoking. Thus Bob's argument above is meant as a refutation of Ann's previous argument. It is easy to see that Bob's argument is connected to Ann's whole previous argumentation, and is meant to attack it. This observation is part of the evidence that the dialogue to this point hangs together in the sense that each move is relevant to previous moves made by one party or the other.

There is perhaps one exception to the general pattern in the dialog that each move is connected to the prior move made by the other party. There is something that Bob should perhaps question after Ann's move 5 when she attacks Bob's assertion that banning smoking would be an intrusion into citizens' freedom of choice. She attacks his assertion by arguing that smoking is not a matter of freedom of choice, but does this attack really bear on Bob's assertion? One might reply that even though it may be true that citizens who have been smoking for a while are addicted to the habit, still, for the government to ban smoking would be an intrusion into citizens' freedom of choice. It would force them by law to take steps to cure their addiction, and it would even force them by law not to start smoking in the first place. Whether Ann's argument at move 5 really refutes Bob's prior argument at move 4 is questionable. Instead of raising these questions about the relevance of Ann's argument, Bob moves on to a different argument at his move 6. It could be suggested that he might have done better at his move 6 to attack Ann's prior argument instead of hastily moving ahead to his next argument.

7. Types of Dialog

Six basic types of dialog are fundamental to dialog theory - persuasion dialog, the inquiry, negotiation dialog, information-seeking dialog, deliberation, and eristic dialog. The properties of these six types of dialog are summarized in Table 1.

TYPE OF DIALOG	INITIAL SITUATION	PARTICIPANT'S GOAL	GOAL OF DIALOG
Persuasion	Conflict of Opinions	Persuade Other Party	Resolve or Clarify Issue
Inquiry	Need to Have Proof	Find and Verify Evidence	Prove (Disprove) Hypothesis
Negotiation	Conflict of Interests	Get What You Most Want	Reasonable Settlement Both Can Live With
Information-Seeking	Need Information	Acquire or Give Information	Exchange Information
Deliberation	Dilemma or Practical Choice	Co-ordinate Goals and Actions	Decide Best Available Course of Action
Eristic	Personal Conflict	Verbally Hit Out at Opponent	Reveal Deeper Basis of Conflict

Table 1.2: Six Basic Types of Dialog

In argumentation theory, each type of dialog is used as a normative model that provides the standards for analyzing a given argument as used in a conversational setting in a given case. Each type of dialog has three stages, an opening stage, an argumentation stage and a closing stage. In a persuasion dialog the proponent, has a particular thesis to be proved, while the respondent has the role of casting doubt on that thesis or arguing for an opposed thesis. These tasks are set at the opening stage, and remain in place until the closing stage, when one party or the other fulfils its burden of persuasion. The proponent has a burden of persuasion to prove (by a set standard of proof) the proposition that is designated in advance as her ultimate thesis.[3] The respondent's role is to cast doubt on the proponent's attempts to succeed in achieving such proof. The best known normative model of the persuasion type of dialogue in the argumentation literature is the critical discussion (van Eemeren and Grootendorst, 2004). It is not a formal model, but it has a set of procedural rules that define it as a normative structure for rational argumentation.

The goal of a persuasion dialog is to reveal the strongest arguments on both sides by pitting one against the other to resolve the initial conflict posed at the opening stage. Each side tries to carry out its task of proving its ultimate thesis to the standard required to produce an argument stronger than the one produced by the other side. This burden of persuasion, as it is called (Prakken and Sartor, 2007), is set at the opening stage. Meeting one's burden of persuasion is determined by coming up with a strong enough argument using a chain of argumentation in which individual arguments in the chain are of the proper sort. To say that they are of the proper sort means that they fit argumentation schemes appropriate for the dialog. 'Winning' means producing an argument that is strong enough to discharge the burden of persuasion set at the opening stage.

In a deliberation dialog, the goal is for the participants to arrive at a decision on what to do, given the need to take action. Hitchcock, McBurney and Parsons (2001) set out a formal model of deliberation dialog in which participants make proposals and counter-proposals on what to do. In this model (p. 5), the need to take action is expressed in the form of a governing question like, "How should we respond to the prospect of global warming?" Deliberation dialog may be contrasted with persuasion dialog.

In the model of McBurney, Hitchcock and Parsons (2007, 100), a deliberation dialog consists of an opening stage, a closing stage, and six other stages making up the argumentation stage.

Open: In this stage a governing question is raised about what is to be done. A governing question, like 'Where shall we go for dinner this evening?', is a question that expresses a need for action in a given set of circumstances.
Inform: This stage includes discussion of desirable goals, constraints on possible actions that may be considered, evaluation of proposals, and consideration of relevant facts.
Propose: Proposals cite possible action-options relevant to the governing question
Consider: this stage concerns commenting on opposes from various perspectives.
Revise: goals, constraints, perspectives, and action-options can be revised in light of comments presented and information gathering as well as fact-checking.

[3] The notions of burden of persuasion and burden of proof have recently been subject to investigation (Gordon, Prakken and Walton, 2007; Prakken and Sartor, 2007). Here we have adopted the view that in a persuasion dialog, the burden of persuasion is set at the opening stage, while a burden of proof can also shift from one side to the other during the argumentation stage.

Recommend: an option for action can be recommended for acceptance or non-acceptance by each participant.
Confirm: a participant can confirm acceptance of the recommended option, and all participants must do so before the dialog terminates.
Close: The termination of the dialog.
The initial situation of deliberation is the need for action arising out of a choice between two or more alternative courses of action that are possible in a given situation. The ultimate goal of deliberation dialog is for the participants to collectively decide on what is the best available course of action for them to take. An important property of deliberation dialog is that an action-option that is optimal for the group considered as a whole may not be optimal from the perspective of an individual participant (McBurney, Hitchcock and Parsons, 2007, 98).

Both deliberation and persuasion dialogs can be about actions, and common forms of argument like practical reasoning and argument from consequences are often used in both types of dialog. There is no burden of persuasion in a deliberation dialog. Argumentation in deliberation is primarily a matter of supporting one's own proposal for its chosen action-option, and critiquing the other party's proposal for its chosen action-option. At the concluding stage one's proposal needs to be abandoned in favor of the opposed one if the reasons given against it are strong enough to show that the opposed proposal is better to solve the problem set at the opening stage. Deliberation dialog is also different from negotiation dialogue, which centrally deals with competing interests set at the opening stage. In a deliberation dialog, the participants evaluate proposed courses of action according to standards that may often be contrary to their personal interests.

8. Dialectical Shifts

In dialectical shifts of the kind analyzed in (Walton and Krabbe, 1995, pp. 100-116), an argument starts out as being framed in one kind of dialog, but as the chain of argumentation proceeds, it needs to be framed in a different type of dialog. Here is an example.

The Dam Example

In a debate in a legislative assembly the decision to be made is whether to pass a bill to install a new dam. Arguments are put forward by both sides. One side argues that such a dam will cost too much, and will have bad ecological consequences. The other side argues that the dam is badly needed to produce energy. A lot of facts about the specifics of the dam and the area around it are needed to reasonably evaluate these opposed arguments. The assembly calls in experts in hydraulics engineering, ecology, economics and agriculture, to testify on these matters.

Once the testimony starts, there has been a dialectical shift from the original deliberation dialog to an information-seeking dialogue into issues like what the ecological consequences of installing the dam would be. But this shift is not a bad thing, if the information provided by the testimony is helpful in aiding the legislative assembly to arrive at an informed and intelligent decision on how to vote. If this is so, the goal of the first dialogue, the deliberation, is supported by the advent of the second dialogue, the information-seeking interval. A constructive type of shift of this sort is classified as an

embedding (Walton and Krabbe, 1995, 102), meaning that the advent of the second dialog helps the first type of dialog along toward it goal. An embedding underlies what can be called a constructive or licit shift.

Other dialectical shifts are illicit, meaning that the advent of the second dialog interferes with the proper progress of the first toward reaching its goal (Walton and Krabbe, 1995, p. 107). Wells and Reed (2006) constructed two formal dialectical systems to help judge whether a dialectical shift from a persuasion dialog to a negotiation dialog is licit or illicit. In their model, when a participant is engaged in a persuasion dialog, and proposes to shift to a different type of dialog, he must make a request to ask if the shift is acceptable to the other party. The other party has the option of insisting on continuing with the initial dialog or agreeing to shift to the new type. Wells and Reed have designed dialog rules to allow for a licit shift from persuasion to negotiation. Their model is especially useful in studying cases where threats are used as arguments. This type of argument, called the *argumentum ad baculum* in logic, has traditionally been classified as a fallacy, presumably because making threat to the other party is not a relevant move in a persuasion dialog. What one is supposed to do in a persuasion dialog is to offer evidence to support one's contention, and making a threat does not do this, even though it may give the recipient of the threat a prudential reason to at least appear to go along the claim that the other party wants him to accept.

The study of dialectical shifts is important in the study of informal fallacies, or common errors of reasoning, of a kind studied in logic textbooks since the time of Aristotle. A good example is provided in the next section.

9. Fallacious Arguments from Negative Consequences

Argument from consequences (*argumentum ad consequentiam*) is an interesting fallacy that can be found in logic textbooks used to help students acquire critical thinking skills. The following example is quoted from Rescher (1964, p. 82).

The Mexican War Example

> The United States had justice on its side in waging the Mexican war of 1848. To question this is unpatriotic, and would give comfort to our enemies by promoting the cause of defeatism.

The argument from consequences in this case was classified as a fallacy for the reason that is not relevant to the issue supposedly being discussed. Rescher (p. 82) wrote that "logically speaking", it can be "entirely irrelevant that certain undesirable consequences might derive from the rejection of a thesis, or certain benefits accrue from its acceptance". It can be conjectured from the example that the context is a persuasion dialog in which the conflict of opinions is the issue of which country had justice on its side in the Mexican war of 1848. This issue is a historical or ethical one, and prudential deliberation about whether questioning whether the U.S. had justice on its side would give comfort to our enemies is not relevant to resolving it. We can analyze what has happened by saying that there has been a dialectical shift at the point where the one side argues that questioning that the U.S. was in the right would promote defeatism.

Notice that in this case there is nothing wrong in principle with using argumentation from negative consequences. As shown above argument from the negative consequences is a legitimate argumentation scheme and any argument that fits this scheme is a reasonable argument in the sense that if the premises are acceptable, then subject to defeasible reasoning that might have been if new circumstances come to be known, the conclusion is acceptable as well. It's not the argument itself that is fallacious, or structurally wrong as an inference. The problem is the context of dialogue in which these instances of argumentation from negative consequences has been used. Such an argument would be perfectly appropriate if the issue said at the opening stage was how to make a decision about how to best support the diplomatic interests of the United States. However, notice that the first sentence of the example states very clearly what the ultimate thesis to be proved is: "The United States had justice on its side in waging the Mexican war of 1848". The way that this thesis is suppose to be proved is by giving the other side reasons to come to accept it is true. Hence it seems reasonable to conjecture that the framework of the discussion is that of a persuasion dialog.

Rescher (1969, 82) classified the Mexican War example as an instance of argument from negative consequences that commits a fallacy of relevance. But what exactly is relevance? How is it to be defined? It can be defined by determining what type of dialog an argument in a given case supposedly belongs to, and then determining what the issue to be resolved is by determining what the goal of the dialog is. The goal is set at the opening stage. If during the argumentation stage, the argumentation strays off into a different path away from the proper kind of argumentation needed to fulfill this goal, a fallacy of relevance may have been committed. Based on this analysis, it can be said that a fallacy of relevance has been committed in the Mexican war example. The dialectical shift to the prudential issue leads to a different type of dialogue, a deliberation that interferes with the progress of the original persuasion dialogue. The shift distracts the reader of the argument away by introducing another issue, whether arguing this way is unpatriotic, and would give comfort to enemies by promoting the cause of defeatism. That may be more pressing, and it may indeed be true that arguing in this way would have brought about the negative consequences of giving comfort to enemies in promoting the cause of defeatism. Still, even though this argument from negative consequences might be quite reasonable, framed in the context of the deliberation, it is not useful to fulfill the burden of persuasion necessary to resolve the original conflict of opinions.

10. Relevance and Fallacies

Many of the traditional informal fallacies in logic are classified under the heading of fallacies of relevance (Hurley, 1994). In such cases, the argument may be a reasonable one that is a valid inference based on premises that can be supported, but the problem is that the argument is not relevant. One kind of fallacy of irrelevance, as shown in the Mexican War example above, is the type of case where there has been a dialectical shift from one type of dialogue to another. However, there is also another type of fallacy of relevance, where there is no dialectical shift, but there still is a failure to fulfill the burden of persuasion. In this kind of fallacy, which is very common, the arguer stays within the same type of dialog, but nevertheless fails to prove the conclusion he is supposed to prove and instead goes off in a different direction.

The notion of relevance of argumentation can only be properly understood and analyzed by drawing a distinction between the opening stage of a dialog, where the burden of persuasion is set, and the argumentation stage, where arguments, linked into chains of argumentation, are brought forward by both sides. In a persuasion dialog, the burden of persuasion is set at the opening stage. Let's say, for example, that the issue being discussed is whether one type of light bulb lasts longer than another. The proponent claims that one type of bulb lasts longer than another. She has the burden of persuasion to prove that by bringing forward arguments that support it. The respondent takes the stance of doubting the proponent's claim. He does not have the burden of persuasion. His role is to cast doubt on the proponent's attempts to prove her claim. He can do this by bringing forward arguments that attack the claim that one type of bulb lasts longer than another. Suppose, however, that during the argumentation stage, he wanders off to different topic by arguing that the one type of bulb is manufactured by a company has done bad things that have led to negative consequences. This may be an emotionally exciting argument, and the claim made in it may even be accurate, but the problem is that it is irrelevant to the issue set at the opening stage.

This species of fallacy of relevance is called the red herring fallacy. It occurs where an arguer wanders off the point in a discussion, and directs a chain of argumentation towards proving some conclusion other than the one he is supposed to prove, as determined at the opening stage. The following example is a classic case of this type of fallacy cited in logics textbook (Hurley, 1994).

The Light Bulb Example

The *Consumers Digest* reports that GE light bulbs last longer than Sylvania bulbs.[4] But do you realize that GE is this country's major manufacturer of nuclear weapons? The social cost of GE's irresponsible behavior has been tremendous. Among other things, we are left with thousands of tons of nuclear waste with nowhere to put it. Obviously, the *Consumers Digest* is wrong.

In the first sentence of the sample, the arguer states the claim that he is supposed to prove (or attack) as his ultimate *probandum* in the discussion. He is supposed to be attacking the claim reported in the *Consumers Digest* that GE light bulbs last longer than Sylvania bulbs. How does he do this? He launches into a chain of argumentation, starting with the assertion that GE is this country's major manufacturer of nuclear weapons. This makes GE sound very bad, and it would be an emotionally exciting issue to raise. He follows up the statement with another one to the effect that the social cost of GE's irresponsible behavior has been tremendous. This is another serious allegation that would rouse the emotions of readers. Finally he uses argumentation from negative consequences by asserting that because of GE's irresponsible behavior, we are left with thousands of tons of nuclear waste with nowhere to put it. This line of argumentation is a colorful and accusatory distraction. It diverts the attention of the reader, who might easily fail to recall that the real issue is whether GE light bulbs last longer than Sylvania bulbs. Nothing in all the allegations made about GE's allegedly responsible behavior carries any probative

[4] In the 1994 edition (p. 127), the first sentence of the light bulb example is, "The Consumers Digest reports that Sylvania light bulbs last longer than GE bulbs". The example makes more sense if the two light bulb manufacturers names are reversed, and so I have presented the light bulb example this way.

weight of the purpose of providing evidence against the claim reported in the *Consumers Digest* that GE light bulbs last longer than Sylvania bulbs.

In the red herring fallacy the argumentation is directed along a path of argumentation other than one leading to proving the conclusion to be proved. The chain of argumentation goes off in a direction that is exciting and distracting for the audience to whom the argument was directed. The red herring fallacy becomes a problem in cases where the argumentation moves away from the proper chain of argument leading to the conclusion to be proved. Sometimes the path leads to the wrong conclusion (one other than the one that is supposed to be proved), but in other cases it goes nowhere. The general pattern of this type of fallacy is displayed in figure 7.

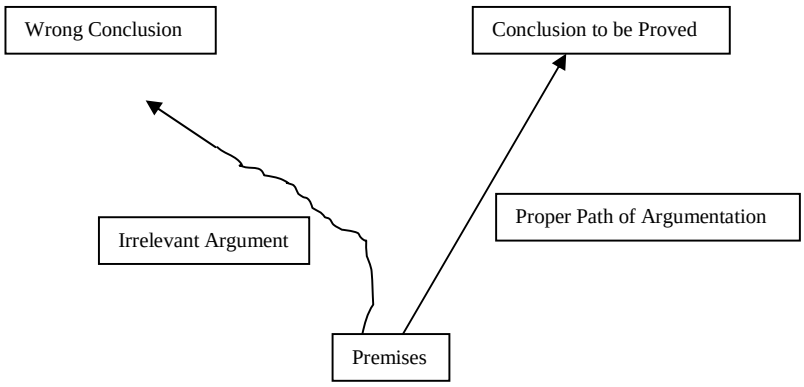

Figure 7: General Pattern of the Red Herring Fallacy

Such a distraction may be harmless if there is plenty of time for discussion. But it can be a serious problem if there is not, because the real issue is not discussed. According to the burden of persuasion, the line of argumentation has as its end point a specific conclusion that needs to be proved. And if the argumentation moves away, it may not do this.

12. Basic Problems to be Solved

This paper has only touched on the main concepts of argumentation theory and the main techniques used in argumentation studies. It is important to emphasize that the use of such concepts and techniques, while they have proved very valuable for teaching skills of critical thinking, have raised many problems about how to make the concepts and techniques more precise so that they can be applied more productively to realistic argumentation in natural language texts of discourse. Many of these problems arise from the fact that it can be quite difficult to interpret what is meant in a natural language text of discourse and precisely identify arguments contained in it. Ambiguity and vagueness are extremely common, and in many instances, the best one can do is to construct a hypothesis about how to interpret the argument based on the evidence given from the text of discourse. Much of the current research is indeed directed to studying how to marshal such evidence in an objective manner.

For example, applying an abstract argumentation scheme to an argument in a specific case can be very tricky. In some cases, the same argument can fit more than one scheme. A project that needs to be undertaken is to devise criteria that students of critical thinking can use to help them determine in a particular case whether a given argument correctly fits a scheme or not. Another problem is that schemes can vary contextually. For example the scheme for argument from expert opinion used in law has to be different in certain respects from the standard scheme for argument from expert opinion cited above. The reason is that in the law rules have been developed for the admissibility and evaluation of expert opinion evidence. Any argumentation scheme for argument from expert opinion suitable for use in law would have to take these legal developments into account.

Similarly, the problem of how to deal with enthymemes in a precise and objective manner has still not been solved, because we lack tools for determining what an arguer's commitments are, and what should properly be taken to constitute common knowledge, in specific cases where we are examining a text of discourse to find implicit statements. While the field has helped to develop objective methods for collecting evidence to deal with these problems in analyzing arguments, much work remains to be done in making them more precise.

Of all the types of dialog, the one that has been most carefully and systematically studied is persuasion dialog, and there are formal systems of persuasion dialog (Prakken, 2006). Just recently, deliberation dialog also has come to be formally modeled (McBurney, Hitchcock and Parsons, 2007). There is an abundance of literature on negotiation, and there are a software tools for assisting with negotiation argumentation. Comparatively less work is noticeable on information-seeking dialog and on the inquiry model of dialog. There is a scattering of work on eristic dialogue, but there appears to be no formal model of this type of dialog that has been put forward, or at least that is well known in the argumentation literature. The notion of dialectical shift needs much more work. In particular, what kinds of evidence are useful in helping an argument analyst to determine when a dialectical shift has taken place during the sequence of argumentation in discourse is a good topic for study.

The concepts of burden of proof in presumption are also central to the study of argumentation in different types of dialog. Space has prevented much discussion of these important topics, but the recent work that has been done on them raises some general questions that would be good topics for research. This work (Gordon, Prakken and Walton, 2007; Prakken and Sartor, 2007) suggests that what is called the burden of persuasion is set at the opening stage of a persuasion dialog, and that this burden affects how a different kind of burden, often called the burden of production in law, shifts back and forth during the argumentation stage. Drawing this distinction is extremely helpful for understanding how a persuasion dialog should work, and more generally, it helps to grasp how the critical questions should work as attacks on an argumentation scheme. But is there some comparable notion of burden of proof in the other types of dialog, for example in deliberation dialog? This unanswered question points a direction for future research in argumentation.

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