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Common Knowledge in Legal Reasoning about Evidence

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Common Knowledge in Legal Reasoning about Evidence*

Douglas Walton and Fabrizio Macagno

Abstract

It is shown how tools of argument analysis currently being developed in artificial intelligence can be applied to legal judgments about evidence based on common knowledge. Chains of reasoning containing generalizations and implicit premises that express common knowledge are modeled using argument diagrams and argumentation schemes. A controversial thesis is argued for. It is the thesis that such premises can best be seen as commitments accepted by parties to a dispute, and thus tentatively accepted, subject to default should new evidence come in that would overturn them. Common knowledge, on this view, is not knowledge, strictly speaking, but a kind of provisional acceptance of a proposition based on its not being disputed, and its being generally accepted as true, but subject to exceptions.

KEYWORDS: presumption, defeasible reasoning, Wigmore chart, generalization, crime scene

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Introduction

Researchers in argumentation theory began developing tools of argument analysis some years ago. Those concepts help to illuminate the role of so-called “common knowledge” in reasoning about evidence at trial. (Jackson and Jacobs, 1980; van Eemeren and Grootendorst, 1992; Walton, 1996).¹ Argumentation theory is the study of normative models of rational argument, inference, and speech acts (such as asking a question) and how they apply to arguments in everyday conversational speech. The models provide criteria that one can use to judge whether a party to a communication has used a given argument or other speech act properly. For a long time, logicians and other scholars only used deductive (and inductive) logics to provide such standards, but now many other models are available. Argumentation theory’s models apply not only to arguments for logically entailed conclusions, but also to defeasible arguments, meaning arguments that are tentatively acceptable, given that later evidence may show that a new conclusion is superior—or, at least, may show that the original conclusion is unacceptable or inapplicable—in effect, defeating it.

Argumentation theory shares a great deal of common ground with the better-known field of artificial intelligence. Artificial intelligence researchers, naturally, study intelligence, which involves research on models of reasoning and argument (Schum, 1994; Gordon, 1995; Reed and Rowe, 2005; Bex, Prakken, Reed and Walton, 2003; Veheij, 2005; Walton, 2005). Mutual recognition of those shared interests led, among other things, to evolution of common conceptual and research tools, and interdisciplinary research (Walton, 2005). The models that argumentation theory and artificial intelligence have jointly developed treat statements of the kind that courts call “common knowledge” as implicit and explicit premises (or conclusions) that fit into certain defeasible argumentation schemes, which, in turn, form chains of evidential reasoning.² We show how

¹ This article discusses a state of belief, commitment or knowledge that lawyers and others often call “common knowledge,” even though, as we argue, it may not be knowledge. Rather than surround the term with quotation marks every time we use it, which would be distracting or annoying, we simply use the term to refer to that state, believing that avoidance of distraction or annoyance will outweigh any possible tendency to mislead our readers.

² Recent research in artificial intelligence has developed models for reasoning from evidence available at trial, which might eventually give rise to programs that are, in effect, automated assistants for formulation and evaluation of arguments from evidence (Verheij, 2005). In other words, they are developing computational models of inference from evidence (Gordon, 2005). Gordon’s model is meant to provide an integrating framework for a wide variety of reasoning tasks in the legal system. Gordon (2005, p. 54) has prepared Figure 1 in the appendix, which suggests, in very general form, how such practical software could support a number of common tasks.

what lawyers call common knowledge is an essential ingredient in formulation and assessment of arguments about evidence at trial³ in three ways. First, and most visibly, the oldest and plainest justification for judicial notice of a matter, which is conclusive on the parties and the trier of fact, is that the matter is common knowledge (Strong, 1992, p. 388; Park, Leonard and Goldberg, 1998, p. 45). Second, common knowledge functions as a basis for generalizations needed as implicit premises in the underlying chain of reasoning on which inference from evidence at trial is based (Anderson and Twining, 1996; Schum 2001). Third, and more generally, it is an essential ingredient in enthymemes, arguments which rely on evidence offered at the trial, but which do not state one or more premises, or the conclusion. The premise or conclusion that an enthymeme omits is not superfluous, but critical to the argument—particularly so in the case of the conclusion (Hitchcock, 1985; Walton and Reed, 2005). The first example that we analyze concerns an inference from reported observations of a suspect fleeing the scene of a crime. Then we turn to a fictional case involving a Sherlock Holmes story, to illustrate how the chain of reasoning used by a detective depends on implicit premises expressing what jurists might call “common knowledge.”

We also investigate a deeper problem: how one can justify or challenge such provisional assumptions within a rational framework with which we can evaluate arguments about the probative force of evidence (Prakken and Sartor, 1996; Gordon, 2005)? Is common knowledge really knowledge, in some sense recognized in epistemology, or is it merely recognition of an assumption so broadly accepted that requiring proof of it would be wasteful when (1) no party actively contests it or (2) no party contesting it could reasonably expect to prevail? The doctrine of judicial notice (under which a judge can instruct the jury to accept a fact as conclusive if the fact is so commonly known in the community that there is no need to prove it) suggests that the criteria for what the law calls common knowledge are (1) and (2).

The solution we present to the deeper problem is that the assumptions that the law refers to as common knowledge are justifiable commitments that both parties to a dispute accept. Those commitments also include the defeasible inferences that parties make in reliance on argumentation schemes, utilizing a form of reasoning that is subject to default (that is, falsification) and critical questioning (Prakken and Sartor, 2003; Reed and Walton, 2005). The court, the

No researchers have fully implemented such systems yet, but there are many useful tools that one could use to build them, such as Verheij's *ArguMed*, the PARMENIDES system of Atkinson, Bench-Capon and McBurney, and Reed and Rowe's *Araucaria*. Gordon's work is meant to be a computational model of argumentation that is a high-level specification into which practical components can fit, and be further developed and integrated into the semantic web.

³ Argumentation scholars would refer to such arguments as “legal argumentation,” but, to avoid confusion with arguments about questions of law rather than fact, we will refrain from using that term.

jury, and the parties can rationally use those defeasible inferences to resolve conflicts of opinions about the evidence or issues of fact even though neither party has proved them with the quantum of evidence that would be required to meet the standard of burden of proof that applies to formal factual issues in the case (Prakken, Reed and Walton, 2005). Instead, we can conceptualize the process through which reasoning about issues of fact incorporates those inferences as (i) a goal-directed dialogue incorporating both collaborative rational argumentation and strategic maneuvering (van Eemeren and Houtlosser, 2002), (ii) which establishes, through a balance of considerations, (iii) that the defeasible inferences are not worth disputing. As part of our argument in support of that analysis, we show how models employing argumentation schemes and critical questions can be key analytical tools for many familiar kinds of evidence and inferences from common knowledge.⁴

1. An Ancient Example

Jurists have long recognized that legal argumentation about evidence in trials often relies on common knowledge as a source of critical premises (Strong, 1992; Park, Leonard and Goldberg, 1998; Twining, 1999; Walton, 2002). Courts and parties sometimes take presupposed premises for granted in their arguments at trial on the reasonable assumption that no one is likely to challenge them, as compared to other premises that may be more controversial. As Cicero showed in *De Inventione* (1993, p. 107), the speaker has no obligation to demonstrate a proposition that is not open to reasonable dispute, given the existing state of affairs:

There is no point in requiring proof or demonstration of a premise which contains a plain statement which must be granted by everyone. The following is an example: “If I was in Athens on the day on which the murder was committed at Rome, I could not have been present at the murder.” Because this is obviously true, there is no point in having it proved. Therefore we should pass immediately to the minor premise, as follows: “But I was at Athens that day.” If it is not granted, it needs proof, after which the conclusion follows. There is, therefore, a kind of major premise

⁴ Our claim is, however, not an empirical one but a normative one, meaning it is about the kinds of requirements that should be used to identify, analyze and evaluate legal arguments about evidence. Research on argumentation recognizes two fundamental types. Empirical argumentation research examines properties of real instances of discourse, for example by studying conversational interactions. Normative argumentation research constructs abstract (ideal) models that contain criteria that are used, for example, to identify types of arguments, analyze arguments, and evaluate them as strong or weak.

which does not need proof. What, then, is the point of showing that there is a premise which does need proof, for that can easily be seen by everyone?

His illustration is a very good example of how a premise that one might take for granted as common knowledge can play a role in fact-finding even though its proponent had no obligation to offer any evidence supporting the premise. Cicero pointed out that the argument has two premises. The minor premise is the statement that the accused was in Athens on a certain day. Assuming the speaker made the statement while testifying, the weight that fact-finders would give it would vary with the speaker's credibility and the extent to which other evidence corroborated or contradicted it. The major premise is the statement that if he was in Athens on the day on which the murder was committed at Rome, he could not have been present at the murder. In logic, that statement is a conditional (if-then statement), of a kind often called a rule in AI (in rule-based systems). Lawyers might call it a generalization (Anderson and Twining, 1991).⁵ In Cicero's time, no court would require a party to prove it, since everyone involved would take for granted as a matter of common knowledge that you cannot get from Rome to Athens in one day. Nor would the opposing side in a murder trial dispute it. Any effort to disprove it would simply weaken the opposing side's credibility. As Cicero wrote, because it is "obviously true," there would be no point in proving it.

It would be rare for a witness to testify to such a generalization, and so it would not be "evidence" in the sense in which lawyers use the term.⁶ Rather, the generalization would be an analytical tool that lawyers would use, either explicitly or by taking it for granted in their arguments in a trial, encouraging jurors to use that same tool when they reason from the evidence the lawyers have presented.

Propositional logicians might formulate Cicero's argument in the following terms.

The Athens and Rome Example

Major Premise: If I was in Athens on the day on which the murder was committed at Rome, I could not have been present at the murder.

⁵ See section 2, below.

⁶ Although lawyers use the term 'evidence' in a narrower sense, referring to information such as that the witnesses affirmatively present in a trial (for example, a witness's statement that the accused was in Athens on a certain day) students of argumentation use the term in a broader sense that encompasses the logical reasoning underlying inferences from such statements. That is, research on argumentation uses the term "evidence," to include both conclusions derived by logical reasoning from such explicit utterances in argument in a trial, and implicit premises on which the chain of reasoning logically rests.

Minor Premise: I was in Athens on the day on which the murder was committed at Rome.

Conclusion: Therefore I could not have been present at the murder.

Let's represent the proposition, 'I was in Athens on the day on which the murder was committed at Rome' as *A*, and represent the proposition 'I could not have been present at the murder' as *B*. The argument is then shown to be an instance of the deductively valid form called *modus ponens*: if *A* then *B*; *A*; therefore *B*. But is the Athens and Rome example a deductively valid argument? That is, could the conclusion be false if the premises were true? Many now working in the field of argumentation and AI would say that it is not (Prakken and Sartor, 2003; Verheij, 2005). The reason essentially is that it is most accurate to see the major premise as a defeasible rule, one that held generally in Cicero's time, but that later evidence showed to be subject to defeat by a new generalization, or by other evidence that defeated the original generalization. As time and methods of transportation changed, it became possible, or even routine, to get from Athens to Rome in a day or less. Thus the major premise would have been acceptable in trial as common knowledge in Cicero's time, while one who sought to rely on it now would have an uphill battle to show that she could not have traveled from Athens to Rome in a day.

Cicero's example suggests that there is an important logical problem with the way that common knowledge functions in the thought processes of fact-finders. Although his example has the deductively valid *modus ponens* form, it clearly is a defeasible argument of the kind currently the focus of so much attention in artificial intelligence (sometimes called "AI") (Walton, 2001; Verheij, 2005). The classic example is the argument, 'Birds fly; Tweety is a bird; therefore Tweety flies'. It is common knowledge that birds fly. If we start with that assumption, add to it the assumption that Tweety is a typical bird, and if the premises are acceptable, then the conclusion that 'Tweety flies' should also be acceptable. The common knowledge is the generalization that birds of the common sort we are familiar with, generally fly. However, if you take the major premise 'Birds fly' to represent the universal generalization, 'All birds (without exception) fly', the inference has quite different properties. We know that people commonly make statements such as 'Birds fly' without meaning to assert that, e.g., ostriches and emus are often airborne.

In modeling reasoning in practice, we would best regard statements such as 'Birds fly' as defeasible. Hence, we should regard conclusions based on the assumption that such statements are universal generalizations as not deductively valid (Bex, Prakken, Reed and Walton, 2003). Even if the premises are true, it is possible that the conclusion could be false. Returning to Cicero's example, we

should regard the major premise as a defeasible conditional. Thus, to be accurate, we should classify the argument as an instance of the argumentation scheme (form of inference) called defeasible *modus ponens* (DMP) rather than as an instance of strict *modus ponens* (SMP). In an argument such as Cicero's example that fits the DMP form of inference, the premises provide only a tentative kind of support for the conclusion, support that is subject to defeat if the argument is undercut by changing circumstances.

2. The Argumentation Scheme for Practical Reasoning

One common example of an argument about evidence at trial that relies on common knowledge is the inference that flight from the scene of a crime is evidence of guilt. Anderson and Twining (1991, p. 43) concluded that this kind of inference is based on a common sense generalization. But why do we so easily characterize it as a matter of common sense? That generalization about flight rests on shared or common knowledge about reasons for common kinds of actions. For one thing, it relies on assumptions about on what the criminal is likely to know, namely that presence at the crime scene is an important indicator of guilt, or of being a suspect. Evidence that the accused was present at the crime scene, at the time of the crime, is quite often critical in criminal prosecutions. Most criminals are likely to know that. And we as observers take for granted that they know it. Thus, we expect that a criminal will try to remove himself from the crime scene as rapidly as possible. Based on that expectation, flight can be an important kind of evidence in criminal cases. Given that few, if any, courts or jurors would expect that the prosecution introduce evidence to show that guilty people are likely to flee the scene of the crime, the question is whether we can explain and justify the inferential process that might lead the jury to weigh flight against a defendant.

One hypothesis is that such an argument is as an instance of abductive reasoning, or inference to the best explanation, a plausibilistic type of argumentation (Magnani, 2001). That is, we could use abduction to identify explanations of the fact of flight of a suspect seen fleeing from a crime scene. We might consider a number of possible alternative explanations, one of which could be that the suspect did not want to be linked to the crime, and was trying to get away from it as fast as possible. In that light, we would derive the generalization that flight is a sign of guilt from goal-directed practical reasoning.

Scholars of argumentation have developed logical models to show how such practical reasoning works. New computational models of argumentation that might lead to automated systems for development of arguments from evidence employ argumentation schemes (Verheij, 2003; Atkinson and Bench-Capon, 2006). Argumentation schemes are forms of argument for stereotypical patterns of human reasoning, such as the scheme for practical reasoning (Walton, 1990).

That argumentation scheme uses as its premises a specified goal and the possible means for achieving that goal, and its conclusion specifies an action that is the means to the goal (Walton, 1990; Atkinson, Bench-Capon and McBurney, 2004). Practical reasoning is carried out by an *agent*, an entity that is capable of intelligent action on the basis of information used for guiding its actions (Wooldridge, 2000). It allows the agent to modify its actions in light of incoming information. Practical reasoning works by a chaining together of practical inferences. In the scheme below, the letters *A*, *B*, *C*, . . . , stand for “states of affairs.” They are meant to be proposition-like entities that can be brought about by actions.⁷ First- person pronouns such as ‘I’ or ‘my’ in such as scheme refer to the agent.

Argumentation Scheme for Practical Reasoning

A is my goal.
To bring about *A*, I need to bring about *B*.
Therefore I need to bring about *B*.

The expression ‘need to’ in the scheme represents a notion that one should take prudent action to carry out a goal in a given set of circumstances that can change over time. Because agents never have complete information about the circumstances that might affect their decisions, models of practical reasoning presuppose that the agent must adjust its actions according to the new information it comes to possess.⁸

In other words, practical reasoning in situations where the knowledge of the agent is incomplete is a defeasible kind of reasoning that is subject to questioning. Five critical questions delineate the fundamental issues for this argumentation scheme (Walton, 1990).

⁷ ‘Bringing about’ is a critical concept here, and in one school of action theory. ‘John painted the fence red’ can be analyzed as saying something like ‘John brought about a state of affairs in which the fence was red’, or ‘John made it true that the fence was red’. In other words, one school of thought on how to represent the logical form of statements about action uses this notion of “bringing about” (making true) to analyze the notion of an action, and as the basis of its analysis of practical reasoning (Walton, 1990). (The complete analysis of ‘John painted the fence red’ is more complex, involving the process of painting as well, but that explanation will suffice for present purposes.) To put the point in more general terms, “bringing about” is the critical concept for one approach to parsing action-sentences. There is also an opposed theory that analyzes actions as a species of events.

⁸ The variant of the practical reasoning scheme that Atkinson, Bench-Capon and McBurney (2005) employ takes values as well as goals of the agent into account. They use this scheme to reconstruct the chain of reasoning in a well known case in property law[0], *Pierson vs. Post*, 3 Cai, R. 175, 2 Am. Dec. 264 (N.Y.Sup. Ct., 1805).

- CQ1.* Are there alternative possible courses of action to *B*?
CQ2. Is *B* the best (or most acceptable) of the alternatives?
CQ3. Do I have goals other than *A* that ought to be considered?
CQ4. Is it possible to bring about *B* in the given situation?
CQ5. Does *B* have known bad consequences that ought to be taken into account?

Practical reasoning suggests a conclusion that is tentatively plausible, but defeasible when answers to any one of the five critical questions suggest a better alternative. Intelligent systems can use the argumentation scheme, along with the accompanying set of critical questions, to implement a multi-agent dialogue system that can assist a user in intelligent deliberation by exchanging information on the Internet (Atkinson, Bench-Capon and McBurney, 2006). For example, such systems can be used for internet commerce, or as internet agents to monitor stocks and make decisions on what to buy and sell, as new information comes in from the stock market. They might also facilitate electronic democracy. A system could provide voters with information, for example about a new train system, and allow them to express their opinions about where the system should go. In other words, the practical reasoning scheme is a model of rational decision-making that concludes in an action.⁹

Returning to the example of flight from the scene of a crime, the culprit who wanted to conceal his guilt would want to avoid being found at the crime scene, because his presence there would often be an important indicator of guilt to the trier of fact. Accordingly, to fulfill that goal, he would leave the crime scene. An imprudent criminal might do this by “fleeing,” often meaning running away in a hurry. A prudent criminal would tend to choose different means, such as walking away in a normal manner. But some decision-makers might also regard that as “fleeing” depending on how they define the term. The ambiguity of the word ‘flee’ is a problem. It might mean ‘go away speedily or hastily’ or just ‘go away’. Efforts to formulate generalizations linking guilt and fleeing must, thus, take account of at least two possible problems. First, sophisticated criminals would be less likely to flee than less sophisticated criminals would, if fleeing refers to departing speedily. And the occasional innocent person might depart hastily out of fear. Second, if fleeing refers to leaving slowly, then any number of innocent persons might leave the scene of the crime slowly.

We should probably express any generalization linking guilt and flight that jurors might employ in evaluating evidence of flight as ‘persons who have committed a crime might normally be expected to flee from the scene of the crime’. That wording makes the generalization seem less like a statistical or

⁹ The appendix discusses, very generally, preliminary efforts to develop automated legal assistants that employ argumentation tools.

inductive generalization, and more like a defeasible generalization based on practical reasoning of agents. Practical reasoning in fact-finding is a kind of multi-agent reasoning. We, as observers, take for granted that even a mildly sophisticated criminal would assume that he needs to absent himself from the crime scene. We assume this because the criminal is an agent (practical reasoner) and so are we, the observers. That information about the likely practical reasoning of others comes from scripts (that is, implicit knowledge of common ways of dealing with situations) and hence could be classified under the heading of common knowledge of a sort. But it is not a kind of common knowledge that should be properly analyzed as resting on any one person's knowledge or beliefs.

3. Common Knowledge is Common, but is it Really Knowledge?

The information and assumptions that courts call common knowledge or generalizations may not be knowledge in any rigorous sense of the term. Legal commentators have identified two ways in which premises drawn from common knowledge play critical roles in arguments about the significance of evidence at trial. First, generalizations that underlie inferences from specific evidence to conclusions about specific historical facts often presuppose common knowledge or take it for granted, whether parties explicitly rely on the generalizations or use them as implicit premises. As the example of flight from the scene of a crime suggests, knowledge premises and implicit generalizations are ubiquitous and essential for arguments about, and inferences from, evidence at trial.

Anderson and Twining (1991, 368-369) identified five types of generalizations that are especially common and important for reasoning from evidence in legal proceedings. Case specific generalizations are those that are or may be established in a particular case. For example, the generalization, "in most matters concerning their relationship, Edith dominated Freddie" played an important role in arguments about the evidence in a famous murder trial. Scientific generalizations (p. 368) state laws of science, like the law of gravity, or well-established principles, like the technique of fingerprint identification. In trials, parties usually employ expert testimony to introduce such generalizations. General knowledge generalizations, such as "Palm trees, rain, and high humidity are common in Miami, Florida" (pp. 368-369) are widely known in a particular community, so that there is no need to explicitly state them in order to make an argument that relies on them. Experience-based generalizations, such as "Someone who has been unfairly treated by the police, may, rightly or wrongly, conclude that police officers are not to be trusted" (p. 369), rest on common knowledge about events and actions familiar to many. As Anderson and Twining noted (p. 369), belief generalizations are sometimes based on superficial impressions. A belief generalization is one that the relevant persons accept on the

basis of information rather than direct experience (p. 369), for example: “Most Poles are devoted Catholics.” Thus, in some instances, belief generalizations can be prejudices based on stereotypes, leading to fallacies and dogmatic thinking. Even so, they are necessary assumptions in arguments on a broad reach of issues.

Premises that rely on common knowledge can also play a significant role in fact-finding through judicial notice of adjudicative facts at trial. Lawyers can use judicial notice to prove facts that they can not easily prove through testimony of a witness (Park Leonard and Goldberg (1998, p. 45). Under Rule 201 of the Federal Rules of Evidence, a lawyer can establish an adjudicative fact that is not subject to reasonable dispute by asking the court to take judicial notice of it. In a civil case the judge will typically instruct the jury to accept the noticed a fact as conclusive, even if the only evidence given to support is testimony that the fact is generally known or proven by sources whose accuracy is not in question (Park, Leonard and Goldberg, p. 45). In criminal cases, depending on the jurisdiction, the court will either instruct the jury to accept judicially noticed facts as conclusive, or that they may, but need not, accept noticed facts as conclusive.¹⁰ According to *McCormick on Evidence* (Strong, 1992, p. 388), “the oldest and plainest ground for judicial notice is that the fact is so commonly known in the community as to make it unprofitable to require proof, and so certainly known as to make it indisputable among reasonable men.” *McCormick* relies on an old case, *Varcoe v. Lee*, (180 Cal. 338, 346-347, 181 P. 223, 227 (1919)) for its two questions for identifying noticeable facts: (1) Is the fact one of common, everyday knowledge in that jurisdiction, which everyone of average intelligence and knowledge of things about him can be presumed to know? (2) Is it certain and indisputable? That test may seem intuitively acceptable, but there is at least one problem: whether anything can ever be certain and indisputable.

Recent philosophical developments challenge traditional definitions of the term ‘knowledge’. Since the time of Descartes, philosophers have widely held the view that knowledge cannot exist without certainty, that only something that can be proved beyond doubt can be knowledge. This traditional view is often known as ‘foundationalism’. But more recently, philosophers have come to believe that certain knowledge of this kind is unattainable, and to take the position that we can have knowledge of matters that can be reasonably proved by the standards of a science or discipline (Toulmin, 1958). Leiter endorsed Quine’s rejection of foundationalism, because foundationalism holds that we can only have knowledge by relying on basic beliefs that are infallible (Redmayne, 2003, p. 855).¹¹ Allen

¹⁰ See Uniform Rule of Evidence 201(g) (conclusive); Federal Rule of Evidence 201(g) (“the jury . . . may, but is not required to, accept as conclusive any fact not judicially noticed.”)

¹¹ Traditional philosophical standards hold that we cannot know something unless it is true. For example, the entry on knowledge and belief in *The Encyclopedia of Philosophy* (Quinton, 1967, p. 345), states, “It is obvious and generally admitted that we can have knowledge only of what is true”.

and Leiter (2003), in contrast, offered a view associated with Goldman's social epistemology, which sees knowledge as justified true belief. They want to expand epistemology so that it takes inquiry into account—inquiry being the process whereby knowledge is collected and verified by evidence. I think what Allen and Leiter are saying is that traditional epistemology focuses on defining knowledge, but not on inquiry—meaning in their sense the process of how knowledge is acquired, for example by questioning. This is what philosophers might call an expansionist view of epistemology (Redmayne, 2003, p. 853) in that it includes factors that epistemology has not traditionally addressed. Allen and Leiter's view has one problem, in that it regards truth as a necessary property of any proposition that we can be said to know. If inquiry can establish truth, and, hence, knowledge, then knowledge proved by an inquiry cannot be defeasible. A proposition that is true cannot be false, and hence if an inquiry finds a proposition to be true, no later evidence can cause it to default or be defeated, that, is to be falsified. In sharp contrast, efforts to model practical reasoning through knowledge-based systems in computing, especially fact-finding in legal disputes, suggest that postulating that we can only have 'knowledge' of true propositions is excessively idealistic. Instead, those models suggest that we should establish a threshold standard for the "knowledge" that we take for granted in practical reasoning statements: a requirement that we can prove the things that we claim to know under exacting standards of argumentation, such as those appropriate for scientific fields. Even that more relaxed view of the standards for knowledge in practical reasoning threatens to make the expression 'common knowledge' an oxymoron.

Let's consider once again how judicial notice can lead the court or the jury to accept facts at trial, based on some notion of common knowledge. According to Park, Leonard and Goldberg (1998, p. 46), the rationale for employing judicial notice to require the jury to accept statements as conclusive (or nearly so) is the argument that if everybody knows something, there's no argument about it, and hence it should not be subject to dispute. Professor Park and his colleagues quoted (p. 46) a New York court, "What everybody knows the courts are assumed to know". To illustrate a statement that satisfies that standard, they cited the proposition that everybody knows that the Eiffel Tower is in Paris, France. They added, however, that the courts, in practice, adopted a weaker criterion. The court may take judicial notice of a proposition that it is not known by everybody, but is only generally known, and perhaps only generally known within the territorial jurisdiction. They cited as an example the fact that the Chicago Cubs last won the World Series in 1908. According to *McCormick on Evidence* (Strong, 1992, p. 390), in practice, the scope of common knowledge for purposes of judicial notice may include facts so generally known within the community as not to be reasonably subject to dispute. The editors of *McCormick* use as an example a case involving the installation of a natural gas pipeline where the issue turned on whether deep chisel-style plowing might rupture the pipeline on a farm property

and cause an explosion. The court was willing to sustain an award of damages in the absence of specific evidence of the risk at trial. It reasoned that, since the rural jury shared common knowledge of the danger, there was no need to introduce evidence to prove that such a danger existed.

Philosophical issues about the theory of knowledge, taken with our observations about the degree to which judicial notice invokes a conception of common knowledge to justify the use of an adjudicative tool in trials, make the concept of common knowledge appear puzzling. Is common knowledge really a kind of knowledge, in some sense, or is it a very flattering label for ideas that a group generally accepts, with potential support that might go so far as expert testimony? We can bring some precision into the discussion by considering a pair of argumentation schemes, argument from expert opinion and argument from generally accepted opinion.

4. Argumentation Based on Expert Opinion and Popular Opinion

Researchers working at the crossroads of artificial intelligence and law have recently devoted a great deal of attention to two argumentation schemes (Verheij, 2003; Walton, 2005), one for the argument from expert opinion (often called the appeal to expert opinion in logic textbooks) and one for the argument from general acceptance (which logic texts also call the appeal to popular opinion). The rationale for an appeal to expert opinion is not hard to understand, either from a point of view of argumentation theory or artificial intelligence. Trials commonly include expert opinion testimony, even though there are many controversies about how it should be evaluated (Walton, 1997). Arguments that we should rely on expert opinion rest on the assumption that the expert cited is in a position to know about some domain of knowledge. This assumption means that an appeal to expert opinion is, at least indirectly, a form of knowledge-based argumentation.

In order to explain how the appeal to expert opinion works, we need one more concept from artificial intelligence, that of commitment. Recent developments in epistemology that section 3 discussed paralleled a dispute in artificial intelligence between the BDI (belief-desire-intention) model of an intelligent agent's decision-making process and the commitment model. Van Eemeren and Grootendorst (1992) argued that we should analyze rational argumentation in terms of commitment (or acceptance) in a critical discussion. Walton and Krabbe (1995), following Hamblin (1970), formalized the notion of commitment in dialogue with respect to different types of dialogue, but especially for persuasion dialogue. In all these approaches, commitment is different from belief. "Belief," as the BDI model uses the term, is an internal psychological state of a person or agent. The central problem for the BDI model is what traditional philosophy called the problem of other minds: that one person can't directly tell

what another person really believes. Indeed, it can even be difficult for one person to figure out what she herself really believes about some issue or subject. As argumentation theory uses the term, “commitment,” unlike belief, is not private or resistant to direct assessment. A participant in a dialogue becomes committed to a proposition (statement) when she has gone “on record” in some public way as supporting it, or says that it is true or acceptable for her. Thus it is possible that she might be committed to a proposition she does not actually believe.

To put the point a slightly different way, the traditional approach to knowledge analyzes knowledge as a species of justified belief. In order to avoid the problem of determining what arguers’ belief really is (a psychological question), Hamblin (1970), developed the idea of a formal game of dialogue (or array of social conventions) containing rules for making moves and rules for commitment sets. Each participant has a commitment set, and the commitment rules determine how additions to or deletions from that set are made. The commitment rules determine when the participant may retract a commitment. The idea is that if a participant in dialogue says something, like ‘I believe that snow is white’, then what she said commits her to that statement. In other words, commitment is a public notion that is determined by what a participant in a discussion actually went on record as stating. This contrasts with the traditional approach to epistemology, based on the notion of belief, which is much more indeterminate.

Thus what determines commitment is not something private, like a belief. It is a public set of moves (statements that have effects under social conventions) recorded in a dialogue, and there is a set of rules governing the various kinds of moves, which specify how each type of move affects addition and deletion of commitments. The notion of commitment in dialogue is therefore critical to understanding the appeal to expert opinion.

In the argumentation scheme for appeal to expert opinion, *A* is a proposition, *E* is an expert, and *S* is a domain of knowledge of a subject domain (Walton, 1997).

Argumentation Scheme for the Appeal to 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).

The two premises represent assumptions that, if made in a given case, warrant the drawing of a defeasible inference¹² to the conclusion, sufficiently strong to establish an obligation on the party of the opposing party to make one of the permissible responses.¹³

An opposing party who wishes to fulfill that obligation, and in the process suggest an alternative inference that would supplant the defeasible inference, must obtain an answer to one of the following six critical questions sufficient to support the alternative theory (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?

If the opponent asks any one of these critical questions, the proponent is obliged to give an appropriate answer.¹⁴ Otherwise the appeal to expert opinion defaults, or goes for naught. One might pose each of these questions any number of ways, (including sub-questions that only raise one aspect of each issue) so that the list can never be exhaustive.¹⁵ One can ask those questions in various forms, or pose questions that address only specific aspects of the general questions, or implications of the general questions, so that no list of the critical questions can ever be complete enough to terminate the dialogue.

The appeal to generally accepted opinion has always been much more problematic than the appeal to expert opinion. While a lot of people may think or say that a proposition is true, or that the people in general accept the proposition as true, neither would necessarily be sufficient to justify the conclusion that the proposition really is true. Even so, in everyday practice, people often take general acceptance of some proposition as at least a tentative rationale for accepting it as a premise in an argument, especially if it is an implicit premise of the kind that the other parties to the argumentation or discussion are not inclined to dispute. But what is the justification for such a commonly accepted practice? Is it the

¹² Argumentation theory would describe this as a presumptive inference, which might cause readers to confuse it with the evidentiary law on presumptions.

¹³ Argumentation theory would describe this as a "weight of presumption," which might be confusing for those primarily familiar with the law of evidence.

¹⁴ Argumentation theory would refer to that reallocation of an obligation as a shift in the "burden of proof," a term that might cause confusion with the burden of proof at trial.

¹⁵ See (Walton, 1997) for lists of such sub-questions. For example, under the trustworthiness for question, one might ask whether the expert might be biased.

assumption that proposition represents some kind of knowledge, or is it just that it can be taken for granted because it would be too much trouble to dispute it?

The argument from generally accepted opinion has eleven different forms (Walton, 1999, 223-227). (Logic textbooks commonly call them collectively the appeal to popular opinion, which carries with it the prejudicial suggestion that the appeal may be a fallacy). While there are obviously differences among these eleven subtypes, each of them follows the same essential form of argument: if everyone or nearly everyone accepts *A* as true, that is taken as evidence that *A* is acceptable. The following argumentation scheme represents that basic form:

Argumentation Scheme for Appeal to Generally Accepted Opinion

General Acceptance Premise: *A* is generally accepted as true.

Presumption (as argumentation theory uses the term) Premise: If *A* is generally accepted as true, that gives a reason in favor of accepting *A*.

Conclusion: There is a reason in favor of accepting *A*.

One issue that this scheme raises is whether the general acceptance premise should be a universal generalization, defeated by one exception, or whether we should regard it as a defeasible generalization of the kind studied by Anderson and Twining. According to *McCormick on Evidence* (Strong, 1992, p. 389), the courts sometimes describe the common knowledge that is a basis for judicial notice as universal knowledge, meaning that everybody knows the fact in question. However, *McCormick* adds that more reflective judicial descriptions of common knowledge speak of it in terms of the knowledge of “most men” or even in terms of what “well-informed persons generally know” or “the knowledge that every intelligent person has”. By itself, an argument that relies on the knowledge of even a well-informed majority is not very strong, as it is easy to show that the majority is often wrong. Generally an argument from generally accepted opinion is weaker than an argument from expert opinion (though experts are often wrong, as well). Still, an argument that relies on popular opinion can make a claim plausible when the proponent deploys it in a dialogue in which the parties offer reasons both for and against the claim. Argument from generally accepted opinion typically helps to set limits on contentiousness. In resolving controversial issues through argument, when some related proposition is relatively uncontroversial (whether it is accepted by nearly everyone, or by everyone that is party to the dialogue), the parties and the fact-finder can rationally “take it for granted” or accept it tentatively as uncontroversial. Such points of agreement can be critical to the progress of an investigation or of fact-finding, since they help the decision-maker to focus her efforts on the truly critical questions (Jackson and Jacobs, 1980).

An opposing party who wishes to refute or frustrate a contention that employs the argumentation scheme for an argument from generally accepted opinion should focus on the following two questions.

1. What evidence supports the claim that *A* is generally accepted as true?
2. Even if *A* is generally accepted as true, are there any good reasons for doubting it is true?

Although arguments from generally accepted opinion are not very strong in themselves, they are often bolstered by combining them with arguments based on some kind of stronger knowledge claim, such as an appeal to expert opinion. For example, (Walton, 1996, p. 83).

Premise: It is generally accepted by those who live in Cedar Rapids that the lake is a good place to swim in the summer.

Conclusion: The lake in Cedar Rapids is (plausibly) a good place to swim in the summer.

The implicit assumption that makes this appeal to generally accepted opinion plausible is that the people who live in Cedar Rapids are familiar with the area. Given that assumption, it is reasonable to infer that they are likely in a position to know whether the lake in the area is a good place for swimming or not.

Our analysis of these argumentation schemes suggests that argumentation based on common knowledge (as law uses the term) does not rely on knowledge in any sense that implies certainty or truth, whether such an argument depends on generalizations and on other kinds of implicit premises, or on judicial notice to establish a fact conclusively. Instead it relies on arguments that conform to the schemes for argument from general acceptance and argument from expert opinion model, and perhaps to other argumentation schemes.

5. Implicit Premises in Argumentation Theory and Logic

In her widely used textbook, *The Practical Study of Argument*, Govier (1992, p. 120), wrote that a premise in an argument is based on common knowledge if the premise states something known by virtually everyone, even though the matter is dependent on audience, context, time and place.¹⁶ She cited the examples, 'Human beings have hearts' and 'Many millions of civilians have been killed in twentieth-century wars' (p. 120). Freeman (1995, p. 269) defined common

¹⁶ The reader might recall that what has been accepted as common knowledge has often been refuted by science, as stressed by the accounts of the fallacy of appeal to popular opinion (so-called) in the logic textbooks.

knowledge in a somewhat different way. In his view, saying that a claim is a matter of common knowledge means that many, most, or all people accept that claim. However he was careful to add the qualification, “popularity is never sufficient to warrant acceptance.”¹⁷ Instead, Freeman argued that what justifies reliance on common knowledge in rational argumentation is the acceptability of assumptions derived from the lived experience of those who are participants in the argumentation (p. 272).

Arguments about the effect of evidence at trial often rely on implicit premises such as, ‘Everybody accepts that statement; therefore is it not really in doubt here’, or, ‘Scientific experts agree that this statement is true; therefore we will provisionally accept it here.’ Unless the unstated premises (or set of premises) or conclusions are made explicit, we cannot properly understand, analyze or evaluate the arguments that turn on them, which logicians often call enthymemes.¹⁸ Burke (1985, p.115) differentiated two meanings of ‘missing premise,’ each of which is important here. Missing premises may be necessary conditions for the inference to be justified (unstated assumptions on which the argument depends), or merely needed unstated assumptions on which the strength of the argument depends.

Common knowledge, as Govier and Freeman delineate it, does seem to be a reasonable basis for assuming the implicit propositions in enthymemes, if we treat the non-explicit premises or conclusions as propositions that the parties to a discussion can tentatively accept. Participants in argumentation commonly take missing premises for granted. If we argue ‘All men are mortal, therefore Socrates is mortal’, the missing premise ‘Socrates is a man’ is unstated, presumably because it is common knowledge.¹⁹ It is historically true that he was a man, as a matter of what is generally accepted. Even the experts in ancient philosophy agree on it. Nobody seriously disputes it. The guiding notion for justifying such a practice of tentative acceptance is that there may be no need to dispute some assumption, even though it is assumed as a premise of an argument put forward by one side or the other. Such assumptions have three characteristics, in the context of the dispute. The first is that the circumstances suggest no present need

¹⁷ As we noted earlier, reliance on popularity to support an argument can sometimes lead to the fallacy *argumentum ad populum* (or appeal to popular opinion) rather than to legitimate support for a claim.

¹⁸ Ennis (1982, p.78) defined implicit premises as assumptions and differentiated them from presuppositions on the basis of the roles they fill in the communicative process. Both implicit premises and presuppositions are assumptions, in the sense that they are “taken for granted as a basis of argument or action” and the presupposer is committed to their truth. However, while missing premises are part of an argument whose truth or falsity respectively contributes to the conclusion, presuppositions are conditions for the verification of a proposition.

¹⁹ This particular example is deductively valid once the missing premise has been filled in. On the issue of whether deductive logic is sufficient to analyze enthymemes, see Groarke (1999).

to dispute the proposition in question, because the real bone of contention lies elsewhere. Second, acceptance need only be tentative: if new facts or arguments later in the discussion turn out to refute the proposition, it is subject to retraction at that point. Finally, since the proposition is acceptable in that it conforms to the common practices and lived experiences of both parties, it is acceptable even though neither has offered any proof for it.

Many traditional logic textbooks address enthymemes when discussing syllogisms, deductively valid forms of argument. On that basis, one might easily assume that the best method for modeling reasoning with enthymemes is to insert the missing premise or premises needed to make the argument valid. But utilizing that method may misrepresent what the arguer meant to say (Burke, 1985; Gough and Tindale, 1985; Hitchcock, 1985). Whether one inserts what one believes to be the missing premise or uses some other method, there is the danger of misinterpreting an arguer's position, or even committing the straw man fallacy (Walton and Reed, 2005). We commit the straw man fallacy whenever we exaggerate or distort an interpretation of an argument in order to make it look more extreme than it is, thereby making it easier to attack or refute it (Scriven, 1976, pp. 85-86). We may be particularly prone to commit this fallacy when attempting to criticize an opponent's argument. The realization that enthymemes often rely on common knowledge can help us to keep this tendency towards error and misinterpretation in check. Enthymemes are arguments with non-explicit premises (or conclusions), thus the problem in analyzing such arguments is that we must try to identify the missing premise (or conclusion). Misinterpretation is a constant risk in that process. Hence the close link with straw man fallacy and other problems arising from misinterpreting an arguer's position.²⁰

We will analyze the function of enthymemes in resolution of questions of fact with a simple fictional case from the Sherlock Holmes stories. Others have analyzed the importance of enthymemes in real cases, with argument diagrams comparable to Wigmore charts. (Schum, 2001; Bex, Prakken, Reed and Walton, 2003). The latter paper analyzes the *Umilian* case (first diagrammed by Wigmore), and the Sacco and Vanzetti case, based on Schum's analysis (1994). Analyzing such a case would be too long and complex for a short paper. In any event, detective stories are fertile ground for analysis of inference from evidence. Wigmore (1931, p. 1016) compared the task of the detective and the prosecuting attorney in a murder case. What detectives and prosecutors do may seem very different, and in certain respects it is. For one thing, the detective moves forward from few evidential data to an undefined *probandum*, while the lawyer selects the relevant data from a mass of evidence to prove a designated *probandum*. But

²⁰ Walton (1996a) discusses the straw man fallacy, and other problems of interpretation, including misquotation. Walton and Reed (2005) analyzes the frequency with which those problems arise from non-explicit premises

Wigmore maintained that they use the same reasoning processes, and that indeed, these same reasoning processes are necessary for any thinking about evidential data (p. 1016). Both prosecutor and detective use reasoning about evidence based on implicit premises expressing assumptions about common knowledge to build up complex theories or argumentation from basic argumentation schemes.

6. The Silver Blaze Case

Arguments based on common knowledge are often enthymematic, that is, dependent on unstated premises. Those premises quite frequently represent defeasible generalizations, generalizations that are subject to exceptions that may arise unpredictably in the future. When those exceptions arise, they make the argument fail (or default). Despite the possibility of future default, rational jurors can tentatively accept such arguments as part of the information (argumentation scholars would say “evidence”) on which they can justifiably base a conclusion. The following argument, from the Sherlock Holmes story, ‘The Adventure of Silver Blaze,’²¹ is an interesting example of use of an enthymeme in resolution of a question of fact (Walton and Reed, 2005).

The Silver Blaze Case

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

That analysis of evidence relies on a missing premise that is a common knowledge generalization, ‘A dog will generally bark when a midnight visitor enters an enclosed area unless the dog knows the person well’ (G). That common knowledge generalization is not absolute. It admits of exceptions, also based on common knowledge. We all know from common experience that some dogs will bark at any person who enters an area, while others are unpredictable. Alternatively a dog might fail to bark when it had been drugged. Still, an argument based on a generalization such as G can play an important role when we weigh evidence. A single counter-example could falsify a strict (absolute) generalization, and any argument that relied on it. But when a proponent relies on a defeasible generalization such as G, that generalization can still hold even if counter-examples are known to be possible, as long as the counter-examples do not seem to be true of the case at hand. The fictional Sherlock also implicitly

²¹ Sir Arthur Conan Doyle, ‘Silver Blaze’, in *The Complete Sherlock Holmes: The A. Conan Doyle Memorial Edition*, vol. 1, Garden City, New York, Doubleday, Doran & Co. Inc., 1932, p. 27.

assumed another premise in his argument, that a stable is an enclosed area—important in that, otherwise, the dog might not observe the person who took the horse. The case of the dog that did not bark typifies use of evidence in both legal and everyday contexts, in that it is based both on argumentation schemes (in this instance, argument from ignorance) and on common knowledge premises not identified with any particular argumentation scheme.

Enthymemes such as Holmes' analysis in *The Silver Blaze* can employ various kinds of missing (non-explicitly stated) premises or conclusions (Walton, 2001; Walton and Reed, 2004).²² Nevertheless, common knowledge shared by an arguer and respondent (or audience) is an especially important source of implicit premises or conclusions for enthymemes.

Schematic and graphic depictions of the argument help to clarify the point. *Araucaria* is an automated system for constructing an argument diagram using a computer (Reed and Rowe, 2005).²³ It can represent argumentation based on schemes and enthymemes. First, we can reconstruct the *Silver Blaze* argument in terms of the following premises and conclusion.

Key List of Statements in the Silver Blaze Argument

Explicit Premise (A): A dog was kept in the stable.

Implicit Premise (B): A stable is an enclosed area.

Explicit Premise (C): Someone had been in the stable, a midnight visitor who entered and fetched out a horse.

Explicit Premise (D): The two lads in the loft were not roused during the night.

Implicit Premise (E): If the dog had barked, the two lads in the loft would have been roused during the night.

Implicit Conclusion (F): The dog did not bark.

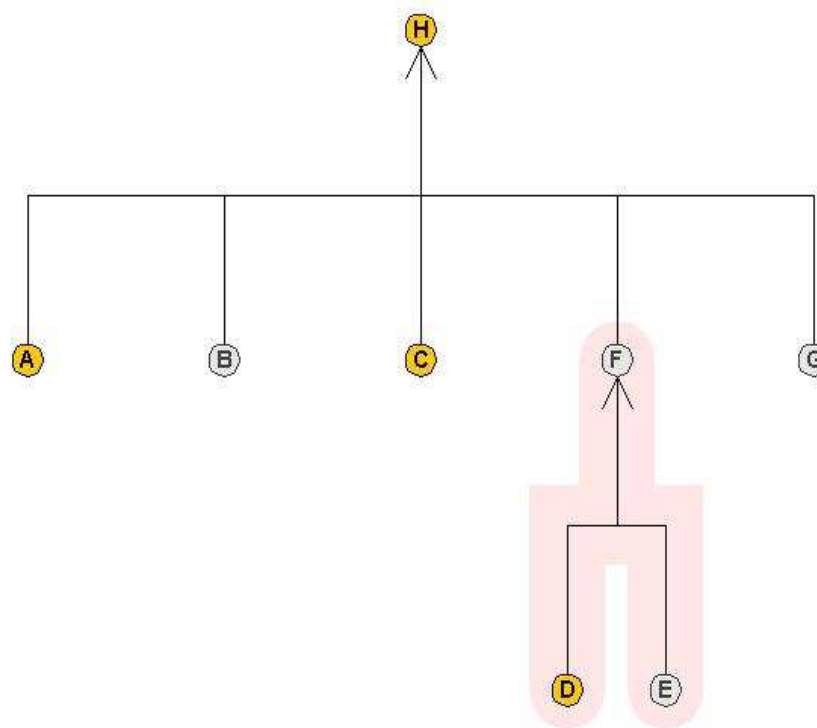
²² They can be based on the known position of the speaker on the issue, custom, habit, or normal ways of doing something, conceptual links holding an argument together, assumptions of practical reasoning in ways of carrying out actions, and innuendo (which is based on conversational implicature).

²³ The *Araucaria* software can be downloaded from the following location on the Internet: www.computing.dundee.ac.uk/staff/creed/araucaria/. *Araucaria* aids an argument analyst to diagram a given argument using a simple point-and-click interface to insert the text into a document and then mark the premises and conclusion of the argument that has been identified. Once an argument has been diagrammed using the system, the outcome is a graphical representation with points representing premises and conclusions. The inference structure joining the points is represented as a tree, where each branch of the tree (edge of the graph) is drawn as an arrow. The resulting diagram can be saved in a portable format called *AML*, *Argument Markup Language*, based on *XML* and converted to other formats for the user (Reed and Rowe, 2004).

Implicit Premise (G): A dog will generally bark when a midnight visitor enters an enclosed area, unless he is someone the dog knows well.

Conclusion (H): The midnight visitor was someone the dog knew well.

We used *Araucaria* to model the structure of the argument in the diagram below. D and E are premises in a linked argument (an argument whose conclusion is a premise in another argument) has statement F as its conclusion. F is then used again as a premise in another linked argument that contains statements G, A, B and C combined with statement F as premises that support conclusion H.



In this diagram, the darker circled letters represent implicit premises or conclusions. In other words, the arguments containing these darkened statements are enthymemes. Holmes' fictional analysis is based on an argumentation scheme, namely what argumentation theory calls the "presumptive argument from ignorance." The argument from ignorance is the basis of the argument from premises D and E to conclusion F. Its underlying argumentation scheme is relatively simple (Walton 1995, p. 150).

Major Premise: If A were true, then A would be known to be true.

Minor Premise: It is not the case that A is known to be true.

Conclusion: Therefore A is not true.

While the portion of the diagram above that includes D, E, and F depicts the argumentation scheme for the argument from ignorance, the full text diagram below includes some useful detail. It shows, in particular, the scheme for the plausible argument from ignorance. That argument is the “plausible” argument from ignorance to distinguish it from more certain forms of the argument.

To the extent that a database (or the information available) represents all the knowledge in a case, what one might call epistemic closure obtains, meaning that the inquiry is complete and no further knowledge will be added to the database. Let’s take an example. Suppose there has been no search into the background of Mr. X, but still, it can be assumed that he is not a spy. Nevertheless, this argument from ignorance is only weak. Now suppose that a security search by a reputable agency has found no positive evidence that Mr. X is a spy. Now the argument from ignorance is much stronger. Epistemic closure could be invoked in that case, because enough data has been collected so that we can say that Mr. X has passed his security clearance. We take epistemic closure to be equivalent to what is called the closed world assumption in computing, which presupposes a database that lists all available positive information, implying that propositions not listed (or inferable) from the database must be false.²⁴ (Reiter, 1980, p. 69) offered the following illustration in which an intelligent question-answering system would consult a database, add information from general knowledge, and conclude that, if the system could justify a positive conclusion from that database and other information, it should base its answer on the conclusion.

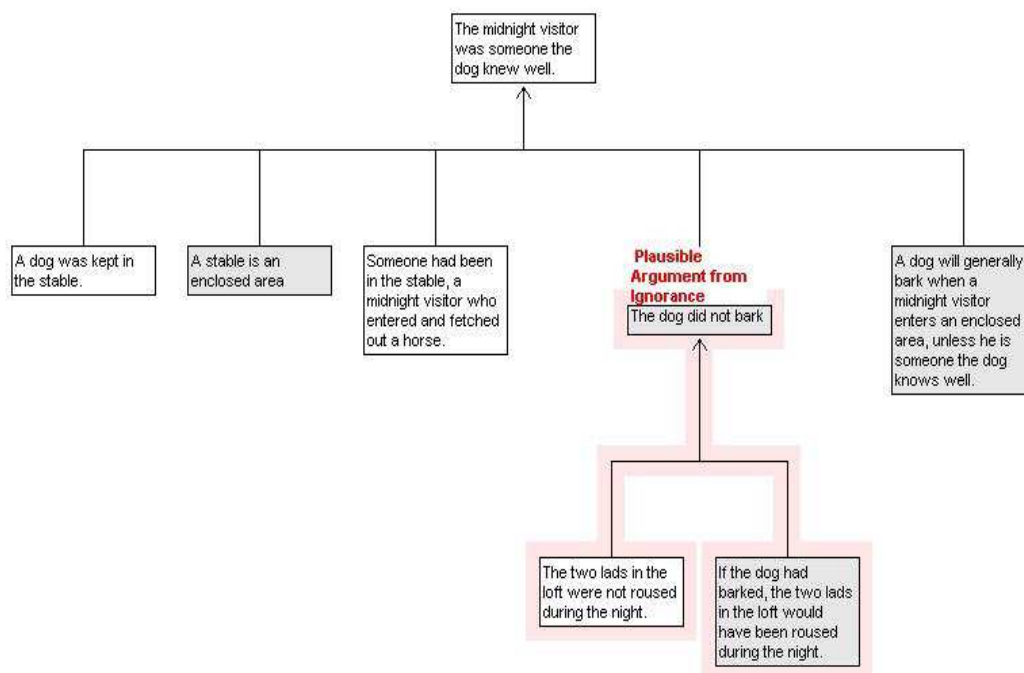
Consider a data base representing an airline flight schedule and the query “Does Air Canada flight 113 connect Vancouver with New York?” A deductive question-answering system will typically treat the data base together with some general knowledge about the flight domains as a set of premises from which it will attempt to prove $\text{CONNECT}(\text{AC113}, \text{VAN}, \text{NY})$. If this proof succeeds, then the system responds “yes”.

²⁴ Others may define the term “epistemic closure” in a different way. See “The Epistemic Closure Principle” in The Stanford Encyclopedia of Philosophy, <http://plato.stanford.edu/entries/closure-epistemic/>

If, on the other hand, the database was comprehensive, and the search failed, the system would respond “no,” based on an argument from ignorance. A human reasoner scanning the flight monitor at the Vancouver airport could make the same sort of inference based, again, on an argument from ignorance. She could assume that all the connecting flights are listed, and draw the conclusion that the flight she was looking for was not offered, because the monitor did not list it.

The strength of an argument from ignorance varies with the degree to which our knowledge is complete and certain. When a database represents all the knowledge that could possibly be available (which, of course might never really happen in a real case, as there is growth of knowledge in science), and we can say that the knowledge base is closed, and a proposition is not in the database, then you can say it is false.²⁵ In contrast, in many examples of ordinary argumentation, knowledge is incomplete. The agent’s knowledge may only consist of a few defeasible generalizations. As a result, any inference from ignorance must be uncertain. Epistemic closure does not apply in such cases and the argument from ignorance is only a plausible inference. Having now drawn the contrast between an argument from ignorance where our stock of information is both complete and certain, and one where it consists of a limited number of defeasible propositions, we now return to our analysis of the Silver Blaze case.

²⁵ One might attempt to expand our notion of epistemic closure, arguing that when a database (or the information available) represents all the knowledge that the agent has about a case at a given point in time, epistemic closure obtains. If so, it would follow that the inquiry is complete, and no further knowledge will be added to the database. Yet, it is questionable whether epistemic closure should obtain when the agent’s body of relevant knowledge contains little or nothing, i.e., just a few weak defeasible generalizations. So here we have to distinguish between two levels of completeness of a database, one pertaining to how much is known, and the other pertaining to how much what is known relates to how much knowledge is available. In other words, some areas of science could be judged to be well investigated, so that the experts might be said to know a lot of what one could possibly know, whereas in other areas, very little might be known, or have even been investigated.



In this diagram, the four premises support the conclusion that the dog knew the visitor well. They are linked, because the argument cannot be valid without one of them. In other words, they are all needed for the conclusion. They constitute the minor premises of the implied major premise, which is the instantiation of the argument scheme for the plausible argument from ignorance.²⁶ That is, the argument from ignorance supports the inference to the conclusion that the dog did not bark, which is a major premise of the argument that leads to the conclusion that the dog knew the midnight visitor well.

We could not comprehend Holmes' argument without reference to the presupposed specific scheme for the argument from ignorance. Conan Doyle, the author, does not state the argument scheme because it is part of our stock of common knowledge and hence it would not be informative to state it explicitly. Hence, it is presupposed. If readers (or Holmes' fictional audience) did not know it and fit it to the related circumstances of the case, Holmes' whole sequence of reasoning would be incomprehensible—the hearer or the audience would not be

²⁶ To see which is the major and which the minor premise, return to the argumentation scheme two pages earlier. To relate that diagram to the one on the page prior to this one, consult the two bottom boxes in the later diagram. The box on the right is the major premise and the one on the left is the minor. The scheme heading "Plausible Argument from Ignorance" ties them both together (which is known as a 'linked argument').

able to understand the evidential link between premises and conclusion. The Silver Blaze Case shows two aspects of the importance of common knowledge in the analysis of evidence. First, we can use our common knowledge of argumentation schemes as a device to extract missing premises or conclusions from an argument in a given text of discourse. Second, common knowledge is an extremely important source of implicit premises or conclusions in such enthymematic arguments.

If The Silver Blaze Case led to a trial, Holmes' argument would bear on the weight the jury gave the evidence.²⁷ It would have persuasive impact if the trial concerned the theft of the horse; a jury or a judge could be rationally persuaded to accept the conclusion that the horse was removed from the stable by someone who the dogs knew well. The common knowledge premise that the dog would bark if it saw a stranger is a common sense generalization that is defeasible, depending on the circumstances of a given case in dispute. Such common sense assumptions must be generally accepted, and are typically subject to default depending on what else is known or believed in a given case. General acceptance is critical.—certainty is not required.

7. Implicit Premises, Dialogues and Common Knowledge

All of this talk about general agreement might seem to ignore the nature of Anglo-American system of trials. The adversarial Anglo-American system of trials seeks to resolve issue of fact through conflict. Each adversary has an incentive to gather evidence and to present arguments that favor its own position. To that extent, the system discourages each adversary from accepting any premise that might be used against its own case. The context is not collaborative, except that there is agreement on procedural rules such as the rules of evidence. At first blush, it might seem that the parties are only engaging in a collaborative dialogue to the extent that the judge requires them to. Hence, their reasons for acquiescing in a collaborative model of dialogue in which common knowledge assumptions are conceded might, initially, be a mystery. Yet it is not in the interest of either adversary to hurt its own credibility (an important asset in an adversarial system) by seeming to be obstructive—whether to conceal or delay. Trials involve a lot of strategic maneuvering, as would any critical discussion (van Eemeren and Houtlosser, 2002). Attacking a proposition pointlessly—and appearing as a result to be uncooperative and or to deny something that is obviously true to any sensible person—will adversely affect the attacker's credibility in the eyes of the trier of fact in an adversary proceeding. In any event, delays in the resolution of a

²⁷ Argumentation theorists might regard Holmes' argument as evidence, but it seems likely that a court would regard information about the habits of dogs to be so well known as to render testimony about it inadmissible.

trial caused by contentiousness over premises that are, for all practical purposes, indubitable would impose costs on party engaging in the delay: attorney's fees, inconvenience to witnesses, and so forth. Finally, the judge has the job of preventing undue delay. Given those constraints, it is our contention that the context of dialogue of the Anglo-American trial, although very complex with many participants, centrally fits a model of communication called the critical discussion dialogue, a species of persuasion dialogue (Feteris, 1999; Walton, 2002; 2005).²⁸

The concept of a critical discussion dialogue developed, at least in part, from recognition of the important roles that stated and unstated premises and conclusions based on common knowledge have in communication. That recognition leads us to reconceptualize the communication event (the whole communicative move or action that the speaker directs to the hearer) as a unity when we seek to identify missing premises or conclusions in an argument. Conditions necessary for critical discussion to resolve a conflict of opinions include conventions for acceptance of propositions that both parties have no interest in disputing. The parties in argumentation may accept—or refrain from disputing—opinions because the parties share them, or because other important groups accept them. Such groups might be the social community or linguistic community to which the interlocutors belong, the people who speak the same language, the majority or the wise. We believe that the justification for provisional acceptance of such premises in many common examples of rational argumentation is not knowledge or belief in those premises, but rather rational commitment in dialogue. That is, provisional acceptance occurs after each party in a dialogue has gone on record as committing himself to in previous statements and arguments, and to what follows from such commitments.

Jackson and Jacobs (1980, p. 263) posit that rules of conversation allow participants to work together collaboratively. Therefore, they believe, there is no need to explicitly state, much less to challenge, many implicit assumptions that the parties share and accept as common knowledge in a conversation. Speaker and hearer in a given case may also accept implicit assumptions in arguments because neither party disputes them at that point. The parties may question those assumptions later—no one has proven the assumptions. Instead, they are based on common knowledge and plausible—supported by opinions of the wise and the majority, for example. In that light, they can be said to be part of the stock of common knowledge, but only in a restricted sense.

²⁸ That being said, however, there are all kinds of reasons why participants might violate such normative and strategic rules. Tricky tactics and pathologies of argumentation, such as the straw man fallacy mentioned above, are very much worth investigating, but we cannot pursue them in this paper. We have carried out some research on these matters in yet unpublished work on tactics of misquotation.

Parties to a critical discussion, or other type of dialogue, cannot dispute everything or they would never resolve the dispute. So they agree (implicitly or explicitly) not to dispute certain statements that are not controversial in light of what they are presently disputing. They may not be able to prove these propositions. But there is no point in disputing them, since anyone would accept them. They are propositions such as, ‘Snow is white’, ‘A person may normally be assumed to have two ears’, or ‘Los Angeles is in California’. Under the conventions of conversation such statements are part of each party’s commitment set, and no party has an obligation to offer evidence in support of them. Because such a statement is a part of common knowledge, it is part of the matters that the parties will tend to take for granted in resolving the dispute. When they begin to address the dispute, there is no need to prove it, yet one or both parties can question it if there is reason to do so. A conversation of the type that Walton and Krabbe (1995) classify as a permissive persuasion dialogue inevitably involves some premises or propositions that the parties explicitly state and others that they leave unexpressed. The parties’ ability to convey information through the unexpressed, implicit aspect of communication is critical to the efficient development of the exchange enabling the speaker to avoid both repetition of propositions already known or accepted, and explicit statement of information that the other party already has. We can conceptualize common knowledge propositions as presuppositions and commitments to which the speaker has apparently committed herself as part of a communicative move or action.²⁹ Van Eemeren and Grootendorst (1992, p.63) considered the non-expression of a premise in argumentation as a kind of indirect speech act, that is, an implicit part of a communicative action that nevertheless has effect in the world. Even if the speaker does not explicitly assert the implicit proposition, he commits himself to it, if he is not already committed. He cannot later plausibly deny the commitment that the hearer would derive from what the speaker said earlier. The hearer would make such a determination based on the speaker’s previous commitments, as well as on the context of dialogue and the relevance of the move in that context. In addition, the hearer would rely on the rules or conventions for the critical discussion or other type of dialogue in which the two parties are supposed to be engaged.³⁰

²⁹ Argumentation theorists might say “presumed within a communicative move.”

³⁰ To illustrate, suppose we begin our analysis of the role of common knowledge in resolving disputes of fact with a set of common starting points *S*, representing the given facts of a case that no parties to the case dispute, and that are not known to be false. To this set *S* we add two means of drawing conclusions by inference from *S*. One is a set of argumentation schemes, *AS*. The other is a set of defeasible generalizations *DG*, to which all parties are committed, subject to possible retraction later in the dialogue, as new evidence comes in. The set *S* is closed defeasibly under inferences drawn by *AS* and *DG*. This means that each party in the dialogue is committed to not only the statements included in the common starting points, but also to all the statements that

Hearers are entitled to infer that the speaker is committed to premises implicit in any arguments that she makes, even though lack of an explicit statement means that any such determination is less than certain. Reasoning in light of that uncertainty, we should regard commitments that hearers infer from unexpressed premises as only defeasible inferences. When the hearer interprets the speaker's arguments according to his own interests or according to his own tactics he decides to follow, he can fall into uncharitable interpretations or even build a straw man. He can slightly distort the premises, magnifying them by ignoring qualifications, for instance, and then attack the resulting straw man. The hearer's conclusions do not bind the speaker, who can deny the implicit commitments. If the speaker has never actually stated the proposition that the hearer has attributed to him,³¹ he can defend himself by denying accountability for it. Van Eemeren and Grootendorst (1992, p.147) ascribed a status to unexpressed premises that is very close to presupposition, by showing how any meaningful interpretation of argumentative discourse requires the use of such premises. In the examples we analyzed above, the dialogue could not move forward without reliance on implicit common knowledge premises to fill out the relevant argumentation schemes. In communicative contexts in which implicit assumptions are appropriate, arguments resting on assumptions about common knowledge can be provisionally acceptable. Saying that the arguments are provisionally acceptable means, however, that they are subject to challenge. Even so, the conventions of communication regulate such challenges.

Questioning an implicit premise apparently based on common knowledge requires that the hearer challenge the speaker's reliance on the conventions or rules of the dialogue in which they are engaged.³² The hearer might, for instance, in the example of the dog, challenge the missing premise, asking "Why don't dogs usually bark at strangers?", or refuse to accept the assumption that they do. However this challenge (or "meta-dialogue move") could be a violation of the social convention (or "game") unless the hearer has made it at an appropriate juncture in the dialogue. If the hearer makes the challenge at an inappropriate point, she interrupts the dialogue and begins a new dialogue that might focus on norms of dispute and, so, have no direct bearing on the subject of the argumentation in the original dialogue.

we can draw from that set either through use of argumentation schemes or inference from defeasible generalizations combined with accepted facts.

³¹ An argumentation theorist might phrase this as, "the proposition he is presumed to be committed to."

³² An argumentation theorist might describe such a challenge as "making a meta-dialogical move by taking the dialogue to higher level. This is done technically by assigning each moves in dialogue a level, so that, for example a disputed question about burden of proof concerning an argument at level n can be discussed by moving to level $n + 1$ " (Prakken, Reed and Walton, 2005, p. 121).

8. Conclusions

We have analyzed examples of the ways in which lawyers and judges make and evaluate arguments, and have discussed research in artificial intelligence that seeks to replicate those processes. The fact that artificial intelligence seeks to replicate the reasoning processes that lawyers already employ may seem to suggest that practicing lawyers, or legal commentators, have nothing to learn from the computational models. Such an assumption would disserve research, both in artificial intelligence and in the law of evidence. As Wigmore (1931) insisted, there is a process of rational argumentation that underlies decision-making based on evidence in trials and other legal proceedings. In the short run, both successes and failures in efforts to model the processes of formulation of arguments and evaluation of evidence at trial can tell us a good deal about fact-finding. And, as the newly emerging AI systems applied to law change to reflect increasing knowledge of how the process of argumentation and evaluation works in the legal system, they will be much more powerful and useful. Each discipline can benefit. Thus, investigation of argumentation structures underlying argument and fact-finding is useful even though it may not lead to immediate or specific law reform. Its teachings about the structure of arguments about questions of fact that are based on common knowledge have implications not only for the study of argumentation and for law, but also for the development of tools for formulation and assessment of arguments.

The term ‘common knowledge’, as conventional theory uses it to describe missing premises in argumentation, may be a misnomer, or is at least misleading. Propositions involving so-called common knowledge are not so much statements we know or believe to be true as statements that do not seem worth disputing, in light of the stakes and issues in the conflict on which we have focused at the time.

In rational argumentation, we can’t dispute everything all at once, nor can we know everything or believe it rationally on the basis of evidence we can examine directly. We accept “common knowledge” statements provisionally, even though we may not prove them, because disputing them might not be worth the effort. It may be rational to accept an idea or generalization that the majority or the wise accept as a premise, but to regard it as a defeasible generalization that may be subject to question.

We must localize our disputes if we hope to resolve them by rational argumentation. To do so, we often have to take common knowledge assumptions for granted, by fixing or bracketing them as beyond the arena of the present dispute. In a trial, or in many other cases of argumentation, there is a central issue, and the purpose of the disputation is to resolve this issue. Of course, as the disputation proceeds, the parties will raise specific arguments that relate to sub-issues that do, at least in the short run, make resolving the dispute more complicated. For example, the issue in a trial might be whether the accused is

guilty of the crime alleged. Argumentation about specific issues related to guilt (such as arguments about the persuasive value of forensic evidence concerning a blood sample found at the crime scene) may increase the complexity of the issues in the short run. Even then, however, as the process of argumentation proceeds, and the parties contest and support inferences from the evidence, a localized dispute (or a small number of localized disputes) may then emerge as the parties and the courts use implicit assumptions to narrow the dispute in order to resolve it.

Common knowledge can play a role in argumentation about facts in five ways. In all five ways, parties can explicitly rely on propositions from common knowledge, but often, they will support their positions with propositions that will be implicit premises in enthymemes.

1. The parties to a dispute may concede some propositions based on common knowledge in order to provide common starting points that neither party has any interest in disputing or questioning. We can conceptualize such statements as inserted into the commitment stores of both parties at the beginning of the argumentation stage of a dialogue.³³ Alternatively, the parties can concede them through failure to contest those points in pleadings or otherwise. Finally, when the opponent refuses to concede a point that has sufficiently broad acceptance, the court may take judicial notice of it, without that party's consent. Judicial notice is usually binding in civil cases, and, at a minimum, requires the court to inform the jury that they may find the fact judicially noticed.
2. One can also derive so-called premises through inference from the set of accepted facts in a dialogue by inferences and argumentation schemes.
3. A few argumentation schemes (for practical reasoning, argument from expert opinion and generally accepted opinion, lack of evidence, and argument from ignorance) are especially important schemes for arguments involving common knowledge. We can regard the major premise that warrants an inference based on an argumentation scheme as a kind of generalization, for example 'If an expert in a domain of knowledge says that *A* is true then *A* is generally true'.³⁴

³³ This remark relates to the notion of commitment (Hamblin, 1970) fundamental to the argumentation approach to an intelligent agent's decision making that distinguishes it from the BDI approach.

³⁴ Other important schemes, like appeal to witness testimony, not considered in this paper, have been studied in (Walton, 2005).

4. In other cases, common knowledge inferences stem from various sorts of generalizations, including case-specific generalizations, scientific generalizations, general knowledge generalizations, experience-based generalizations and belief generalizations, as Anderson and Twining (1991) classified them. The generalization key to Sherlock Holmes' fictional reasoning in the Silver Blaze Case, 'Dogs generally tend to bark if someone they do not know well enters an enclosed area,' is a good example.
5. In many cases, arguments from common knowledge combine the conventional argument known as the argument from expert opinion with another form, the argument from generally accepted opinion, in an effort to use the strong knowledge claim from the expert opinion to bolster the rather weak argument from generally accepted opinion, typically by referring to expertise in a domain of scientific knowledge.

In all the kinds of cases we studied in this paper, it is somewhat misleading to call the basis of the argument common knowledge, in light of the traditional neglect of inquiry as a mode of acquiring knowledge in epistemology, and with it, the view that we cannot have knowledge of something that is uncertain or untrue (Allen and Leiter 2003; Redmayne, 2003). It would be more accurate to say that common knowledge arguments rest on premises that are generally accepted as knowledge of one sort or another. Sometimes they rely on generally accepted scientific knowledge. At other times, common knowledge arguments rely on opinions of experts in a domain of science, whether quoted or not.³⁵ Sometimes premises that ostensibly incorporate common knowledge statements do not really represent knowledge at all, in the stricter philosophical meanings of that term, but rather commitments widely taken to be true or acceptable for various reasons.

In many instances, courts and parties accept such statements not because they are known to be true, but because they are thought to be true, can be justified by supporting arguments, and are not known to be false. In other words, they are accepted as tentative assumptions, based on argumentation schemes, even though they could be challenged later in an investigation should they become controversial, or should new evidence come in that shows they are false. Thus, as Reiter's airport example shows, familiarity with the argument from ignorance is critical for identifying and assessing premises based on so-called common knowledge. We see here clearly that the expression 'common knowledge' is a misnomer that can easily exaggerate the epistemic status of the kinds of statements with which we have been concerned.

³⁵ Here we have not gone into the controversial issue of legal standards for expert opinion evidence, from *Frye* to *Daubert*, *Kumho Tire* and beyond.

Parties in argumentation can, therefore, justifiably use implicit premises in their arguments, if those propositions are appropriate for provisional acceptance by the interlocutors in the context in which the argumentation occurs. After the parties have accepted those propositions, there is no need to prove them. Of course, the parties may later question those premises, but if they are defeasible conclusions that rest on common knowledge, questioning them would fundamentally alter the dialogue, opening a meta-dialogue, or argumentation on whether the parties would be entitled to take the matter in question (or anything) for granted as common knowledge.

Appendix: Artificial Intelligence Tools as Legal Argument Assistants

This appendix is meant to be helpful to readers who are not familiar with recent developments in artificial intelligence and law, but are interested in exploring them further or in seeing how automated assistants of various kinds might develop. Many researchers have developed or proposed computer systems to analyze, evaluate and generate arguments on topics that are of interest to lawyers. We cannot describe all these systems here, but fortunately we can highly recommend two recent papers. Bench-Capon and Prakken (2005) presented a useful survey in which they outlined many of the initiatives that have been undertaken in computer science to design programs that will help people in carrying out sophisticated and legal tasks. The more recent systems use case-based reasoning as their central framework for organizing, developing and evaluating arguments about the significance of evidence. Case-based reasoning in an intelligent system typically requires a description of a problem that the decision maker then seeks to solve by matching the given case against similar cases that have already been solved. The system works by retrieving the most similar case to the given case from a database of solved problems. It compares these cases to the given case to try to solve the current problem. If the solution proves unsatisfactory, the system can revise it. Bench-Capon, Freeman, Hohmann and Prakken, (2004, p. 110) summarized leading AI and law systems that either use argumentation theory explicitly or are built around the notion of argument in analyses of legal issues.

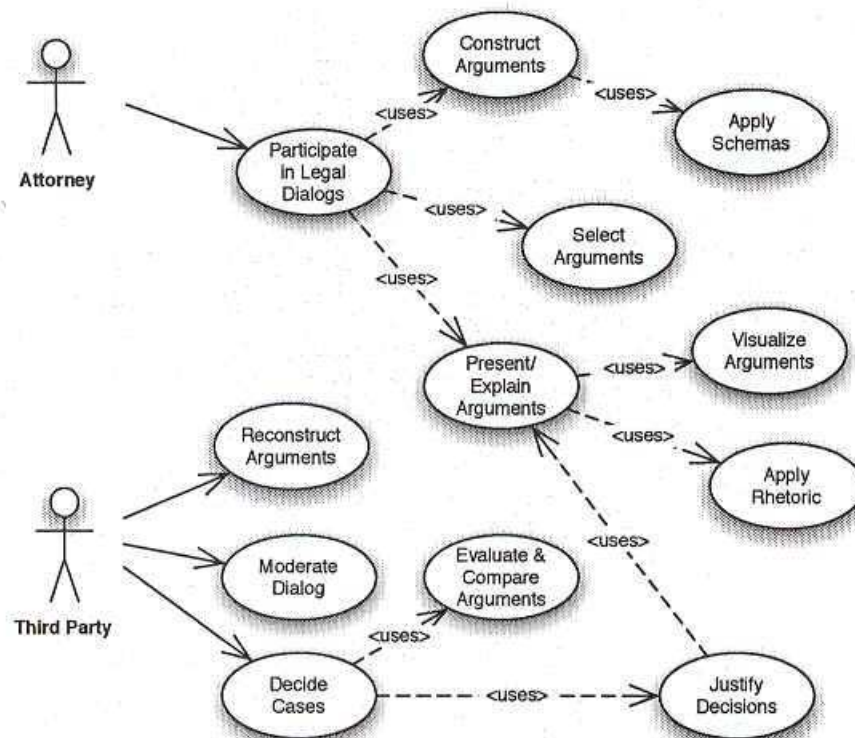
Research in artificial intelligence focuses on reasoning, and especially about defeasible reasoning in which there are arguments both pro and contra. While, in Oliver Wendell Holmes' terms, the life of the law may not be logic, there is no doubt that it needs logic for nourishment. Thus, when artificial intelligence took up new models of legal argument that argumentation theory developed, new possibilities arose for advances in argumentation and in artificial intelligence.

Artificial intelligence researchers have had an interest for some time in attempting to represent the structure of various kinds of arguments with a long term goal of developing software that lawyers and other legal professionals could use for practical tasks that they commonly carry out. So far, the software is still in a fairly elementary state of development—as research projects of more theoretical interest than practical use—although some have been tested and implemented in working (but not market-ready) programs. In any event, their potential, both practical and theoretical, is not hard to appreciate.

Figure 1 suggests the potential value of such systems, as devices that can assist lawyers in forming arguments. It does not fully explain such systems. For example, the application of rhetoric is itself a topic that would take up volumes. It does, however, illustrate how a system might link a number of aspects of

intelligence to assist in formulation and evaluation of legal arguments. Specifically, Figure 1 shows the potential uses of a new argumentation-based system for computer support of legal reasoning being developed by Thomas Gordon (2005) along with Douglas Walton. The ovals represent tasks that an attorney (or someone or something assisting the attorney) would or might carry out, in common legal activities. The arrows marked “use” represent tasks that the automated assistant might carry out. For example, attorneys often participate in legal dialogues. A software assistant could help in the task of constructing arguments in such a dialogue. One of the stick figures is labeled “third-party.” In simple matters that do not give rise to litigation, there are often only two parties (sides) in arguments. But in some cases, there is a third party, like a mediator or judge, who is also involved.

Figure 1: Legal Argumentation Use Cases (Gordon, 2005, p. 54)



One might initially have thought, as many people did, that AI and argumentation theory would only be useful for the task of mechanically deducing consequences

from a precisely stated set of facts and legal rules (Bench-Capon and Prakken, 2005, p. 61). But looking around at how research in AI and argumentation is currently going, it now appears much more plausible that the tools developed could be applied to all kinds of sophisticated legal tasks. For example, diagramming systems like *Araucaria* can be used to visualize arguments, helping a lawyer, judge or jury to better understand the reasoning underlying rules of evidence in trials. Or they could be used to help a team of lawyers form an argument strategy by building an argument diagram representing what they take to be the core argument in a case they are preparing for trial.

References

Ronald J. Allen and Brian Leiter, 'Naturalized Epistemology and the Law of Evidence: Reply to Redmayne', *Michigan State Law Review*, 4, 2003, 8885-892.

Terence Anderson and William Twining, *Analysis of Evidence: How to do Things with Facts Based on Wigmore's Science of Judicial Proof*, Boston, Little Brown & Co., 1991.

Katie Atkinson, Trevor Bench-Capon and Peter McBurney, 'Justifying Practical Reasoning', *Proceedings of the Fourth Workshop on Computational Models of Natural Argument* (CMNA 2004), ECAI 2004, Valencia, Spain, pp. 87-90.

Katie Atkinson, Trevor Bench-Capon and Peter McBurney, 'PARMENIDES: Facilitating Democratic Debate', *Electronic Government*, ed. R. Traummüller, Lecture Notes in Computer Science (LNCS), 3183. Third International Conference on eGovernment (EGOV 2004), DEXA 2004, Zaragoza, Spain, 2004a.

Katie Atkinson, Trevor Bench-Capon and Peter McBurney, 'Arguing about Cases as Practical Reasoning', *Proceedings of the Tenth International Conference on Artificial Intelligence and Law*, New York, The Association for Computing Machinery, 2005., 35-44.

Katie Atkinson and Trevor Bench-Capon, 'Legal Case-Based Reasoning as Practical Reasoning', *Artificial Intelligence and Law*, Special Issue on Argumentation in AI and Law, to appear, 2006.

Trevor Bench-Capon, James B. Freeman, Hanns Hohmann and Henry Prakken, 'Computational Models, Argumentation Theories and Legal Practice,

Argumentation Machines, ed. Chris Reed and Timothy J. Norman, Dordrecht, Kluwer, 2004, 85-120.

Trevor Bench-Capon and Henry Prakken, 'Argumentation', in A.R. Lodder & A. Oskamp (eds.): *Information Technology & Lawyers: Advanced Technology in the Legal Domain, from Challenges to Daily Routine*, Berlin, Springer Verlag, 2005, 61-80.

Floris Bex, Henry Prakken, Chris Reed and Douglas Walton, 'Towards a Formal Account of Reasoning about Evidence, Argument Schemes and Generalizations', *Artificial Intelligence & Law*, 11, 2003, 125-165.

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

Cicero, *De Inventione*, Harvard University Press, London, 1993.

Robert H. Ennis, 'Identifying Implicit Assumptions', *Synthese*, 51, 1982, 61-86.

Eveline T. Feteris, *Fundamentals of Legal Argumentation: A Survey of Theories of the Justification of Legal Decisions*, Dordrecht, Kluwer, 1999.

James B. Freeman, 'The Appeal to Popularity and Presumption by Common Knowledge', *Fallacies: Classical and Contemporary Readings*, ed. Hans V. Hansen and Robert C. Pinto, University Park, Pa., The Pennsylvania State University Press, 1995, 263-273.

Thomas F. Gordon, *The Pleadings Game: An Artificial Intelligence Model of Procedural Justice*, Dordrecht, Kluwer, 1995.

Thomas F. Gordon, 'A Computational Model of Argument for Legal Reasoning Support Systems', IAAIL Workshop Series, *Argumentation in Artificial Intelligence and Law*, ed. Paul E. Dunne and Trevor Bench-Capon, Nijmegen, Wolf Legal Publishers, 2005, 53-64. Available on Tom Gordon's web page: <http://www.tfgordon.de/publications/Gordon2005a.pdf>

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

Trudy Govier, *A Practical Study of Argument*, 3rd ed., Belmont, Wadsworth, 1992.

Leo Groarke, 'Deductivism Within Pragma-Dialectics', *Argumentation*, 13, 1999, 1-16.

Charles L. Hamblin, *Fallacies*, London, Methuen, 1970.

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

Sally Jackson and Scott Jacobs, 'Structure of Conversational Argument: Pragmatic Bases for the Enthymeme' *Quarterly Journal of Speech*, 66, 1980, 251-165.

Lorenzo Magnani, *Abduction, Reason and Science: Processes of Discovery and Explanation*, New York, Kluwer, 2001.

Timothy J. Norman, Daniela V. Carbogim, Erik C. W. Krabbe and Douglas Walton, 'Argument and Multi-Agent Systems', *Argumentation Machines: New Frontiers in Argument and Computation*, ed. Chris Reed and Timothy J. Norman, Dordrecht, Kluwer, 2003, 15-54.

Roger C. Park, David P. Leonard and Steven H. Goldberg, *Evidence Law*, West Group, St. Paul, Minnesota, 1998.

Henry Prakken, Chris Reed and Douglas Walton, 'Dialogues about the Burden of Proof', *Proceedings of the Tenth International Conference on Artificial Intelligence and Law*, New York, The Association for Computing Machinery, 2005, 115-126.

Henry Prakken and Giovanni Sartor, 'A Dialectical Model of Assessing Conflicting Arguments in Legal Reasoning', *Artificial Intelligence and Law*, 4, 1996, 331-368.

Henry Prakken and Giovanni Sartor, 'The Three Faces of Defeasibility in the Law', *Ratio Juris*, 16, 2003, 495-516.

Anthony Quinton, 'Knowledge and Belief', *The Encyclopedia of Philosophy*, ed. Paul Edwards, New York, Macmillan, 1967.

Mike Redmayne, 'Rationality, Naturalism, and Evidence Law', *Michigan State Law Review*, 4, 2003, 847-883.

Chris Reed, and Glenn Rowe, 'Araucaria: Software for Argument Analysis, Diagramming and Representation', *International Journal of AI Tools*, 14 (3-4), 2004, 961-980.

Chris Reed and Glenn Rowe, *Araucaria, Version 3, With User Manual*, 2005. Available at: <http://araucaria.computing.dundee.ac.uk/>

Chris Reed and Douglas Walton, 'Towards a Formal and Implemented Model of Argumentation Schemes in Agent Communication', *Argumentation in Multi-Agent Systems: First International Workshop, ArgMAS 2004, Revised Selected and Invited Papers*, ed. Iyad Rahwan, Pavlos Moraitis and Chris Reed, Berlin, Springer, 2005, 19-30.

Raymond Reiter, 'A Logic for Default Reasoning', *Artificial Intelligence*, 13, 1980, 81-132.

David A. Schum, *Evidential Foundations of Probabilistic Reasoning*, New York, John Wiley and Sons, 1994.

David A. Schum, 'Evidence Marshaling for Imaginative Fact Investigation', *Artificial Intelligence and Law*, 9, 2001, 165-188.

Michael Scriven, *Reasoning*, New York, McGraw-Hill, 1976.

John William Strong, editor, *McCormick on Evidence*, 4th ed., West Publishing Co., St. Paul, Minnesota, 1992.

Peter Tillers, *Probability and Uncertainty in Law*, International Summer School Lectures, Konstanz, 2003, <http://tillers.net/uncertainlaw/uncertain.html>

Peter Tillers, *Picturing Inference, An Essay in Honor of Professor Lothar Philipps*, 2004, <http://tillers.net/pictures/picturing.html>

Stephen Toulmin, *The Uses of Argument*, Cambridge, Cambridge University Press, 1958.

William Twining, 'Narrative and Generalizations in Argumentation About Questions of Fact', *South Texas Law Review*, 40, 1999, 351-365.

Frans H. van Eemeren and Rob Grootendorst, *Argumentation, Communication, and Fallacies*, Lawrence Erlbaum Associates, Hillsdale 1992.

Frans H. van Eemeren and Peter Houtlosser. 'Strategic Maneuvering with the Burden of Proof,' in Frans H. van Eemeren (ed.), *Advances in Pragma-Dialectics*, Amsterdam, Sic Sat, 2002, 13-28.

Bart Verheij, 'Dialectical Argumentation with Argumentation Schemes: An Approach to Legal Logic', *Artificial Intelligence and Law*, 11, 2003, 167-195.

Bart Verheij, *Virtual Arguments*, The Hague, Asser Press, 2005.

Douglas Walton, *Practical Reasoning*, Savage, Maryland, Rowman and Littlefield, 1990.

Douglas Walton, *Argumentation Schemes for Presumptive Reasoning*, Lawrence Erlbaum Publishers, Mahwah, 1996.

Douglas Walton, 'The Straw Man Fallacy', in *Logic and Argumentation*, ed. Johan van Bentham, Frans H. van Eemeren, Rob Grootendorst and Frank Veltman, Amsterdam, Royal Netherlands Academy of Arts and Sciences, North-Holland, 1996a, 115-128.

Douglas Walton, *Appeal to Expert Opinion*, University Park, Pennsylvania, Penn State Press, 1997.

Douglas Walton, *Appeal to Popular Opinion*, University Park, Pennsylvania, Penn State Press, 1999.

Douglas Walton, *Legal Argumentation and Evidence*, University Park, Pennsylvania, The Pennsylvania State University Press, 2002.

Douglas Walton, *Argumentation Methods for Artificial Intelligence in Law*, Berlin, Springer, 2005.

Douglas Walton and Erik C. W. Krabbe, *Commitment in Dialogue*, Albany State University of New York Press, 1995.

Douglas Walton and Chris Reed, 'Argumentation Schemes and Enthymemes,' *Synthese*, 145, 2005, 339-370.

John H. Wigmore, *The Principles of Judicial Proof*, Boston, Little, Brown and Company, 1913 (second edition, 1931).

Michael Wooldridge, *Reasoning about Rational Agents*, Cambridge, Mass., The MIT Press, 2000.