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An Automated System for Argument Invention in Law Using Argumentation and Heuristic Search Procedures*

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Abstract. A heuristic search procedure for inventing legal arguments is built on two tools already widely in use in argumentation. Argumentation schemes are forms of argument representing premise-conclusion and inference structures of common types of arguments. Schemes especially useful in law represent defeasible arguments, like argument from expert opinion. Argument diagramming is a visualization tool used to display a chain of connected arguments linked together. One such tool, *Araucaria*, available free at *http://araucaria.computing.dundee.ac.uk/*, helps a user display an argument on the computer screen as an inverted tree structure with an ultimate conclusion as the root of the tree. These argumentation tools are applicable to analyzing a mass of evidence in a case at trial, in a manner already known in law using heuristic methods (Schum 1994) and Wigmore diagrams (Wigmore 1931). In this paper it is shown how they can be automated and applied to the task of inventing legal arguments. One important application is to proof construction in trial preparation (Palmer 2003).

New tools have recently been developed for the analysis and evaluation of everyday arguments, notably including argumentation schemes (Walton 1996) and software systems for argument diagramming (Reed and Rowe 2002). They have also been applied to legal argumentation (Friedman 1986; Verheij 2003; Walton 2003), fitting with Wigmore-style diagrams as devices helpful for marshaling evidence, reconstructing argument, visualizing arguments and justifying decisions (Schum 1994; Anderson and Twining 1991). This investigation[1] poses the question of whether these argumentation tools

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[1] When I visited University of Miami Law School in 2004, Professor Terence Anderson asked whether these tools could be applied to invention of arguments. All I could reply at the time

could be applied to the invention of legal argumentation. Can the bridge from evaluating a given argument to discovering a new one be crossed? Here it will be shown how argumentation schemes can be used in a heuristic search procedure applied to legal cases using argument diagramming to guide the user in a search for new arguments.

Argumentation has shown much promise as a method of identification, analysis and evaluation of arguments that can be applied to problems of reasoning and evidence evaluation in legal cases (Bench-Capon 1997; Verheij 1996; Walton 2002; Bex, Prakken, Reed, and Walton 2003). In the normal kind of case of argument evaluation we are familiar with in logic, the argument is found in a text of discourse, and interpreted through a process of analysis. We identify the premises and conclusion, determine what type of argument it is, and judge by criteria whether the given argument is strong, weak or fallacious. Methods for carrying out these tasks, like argument diagramming and argumentation schemes are in use and currently under development, and are being applied to legal argumentation (Twining 1985; Verhiej 2003; Walton 2003), as well as everyday conversational argumentation (Reed and Norman 2003). Some of these tools, like Wigmore diagrams, have been used to map out the structure of evidence in a trial (Anderson and Twining 1991). Diagramming methods have also been used in artificial intelligence for modeling legal argumentation (Schum 1994; Gordon 1995; Prakken 1997, 2001a; Lodder 1999; Prakken, Reed, and Walton 2003; Verheij 2003; Bex, Prakken, Reed, and Walton 2003). But can the same tools be used to invent arguments? When building a case, for example, in law in preparation for a trial (Palmer 2003), can one use such argumentation tools to search around to discover the best arguments that might be potentially used to support the claim one needs to prove or refute? These are the questions that can only be answered by striking out into new territory.

The transition from the task of argument evaluation of a given text of discourse to the task of invention of new arguments seems like a difficult one to make. It represents the ancient gap between logic and rhetoric. Since the time of Plato, there has been a bitter quarrel between these two subjects. Logic sees rhetoric as having no concern for truth, while rhetoric sees logic as abstract and useless for persuasion. It has proved hard to reconcile the two disciplines, even though Aristotle saw them as functionally connected (Hohmann 1990). It will be argued that the key to making the transition is the notion of dialectical relevance, as analyzed in recent work on argumentation (Walton 2002). Relevance is an argumentation concept that is centrally important in law in trial rules, like the Federal Rules of Evidence (Callen 2003)[2]. At the same time it is central to argumentation theory generally

was that carrying out such a project was possible provided diagramming software could be developed in certain ways.

[2] The current version of the rules can be seen at the following web site: http://www.uscourts.gov/rules/newrules4/html

(Hohmann 1989; Walton 2004). In this paper it is shown how a diagrammatic method can be used to discover new arguments by searching through a database of facts in a case, using them as premises to seek out a relevant chain of argumentation that aims at an ultimate *probandum*. The tools currently being used to evaluate arguments are used in a different way to provide a heuristic for inventing new arguments, for example, for proof preparation tasks in a trial.

1. The Breach of Contract Case

In this section we take a simple hypothetical case of a typical legal argument in a case and apply a method called argument diagramming to it. Argument diagramming has recently been advocated as a method for analyzing a mass of evidence in a legal case (Friedman 1986; Schum 1994; Lodder 1999). It is also widely used in logic textbooks to identify the premises and conclusions of arguments (Copi 1982; Hurley 2003). The method has also come to be widely used in artificial intelligence as applied to legal argumentation (Gordon 1995; Reed and Norman 2003; Bex, Prakken, Reed, and Walton 2003). The founder of the method of argument diagramming was John H. Wigmore, who used a version of the technique to construct elaborate evidence charts representing the mass of evidence on both sides of a case at trial (Wigmore 1931; Anderson and Twining 1991; Friedman 1986; Schum 1994). To begin our study it will be helpful to see how the argument diagramming technique can be used to represent argumentation typical of the kind found in legal evidence.

There is now an extremely helpful software tool available to facilitate argument diagramming called *Araucaria* (Reed and Rowe 2003). It aids a user when constructing a diagram of the structure of an argument using a simple point-and-click interface, which may be then saved in a portable format called AML, or Argument Markup Language, based on XML (Reed and Rowe 2002). The user inserts the text to be analyzed as a text document into *Araucaria*. She can then use the cursor to highlight each statement in the text that appears in a left box on the screen. As each statement is highlighted, a circled letter representing it will automatically appear in a right box on the screen. Next the user can draw in arrows from each premise to each conclusion it supports, thus producing an argument diagram connecting all the premises and conclusions in one large diagram that appears in the right box.

In a mass of evidence in a trial, the argumentation on each side consists of many premises and conclusions connected to each other by inferences, all connected together in a chain of argumentation. The final conclusion or ultimate *probandum* is a specially designated proposition that represents the claim to be proved or to be shown doubtful. A set of premises can go together as evidence to support a conclusion in two ways that are commonly distinguished (Freeman 1991). In what is called a linked argument, each premise is dependent on the other(s) to support the conclusion. In what is

called a convergent argument, each premise provides independent evidential support for the conclusion. Let's begin with the linked argument. To cite the simplest type of example, that of an argument with two premises, if one premise is deleted, the other will fail to offer the same evidential support for the conclusion it did before the deletion. That is the criterion for a linked argument pattern. In a convergent argument, each premise can be seen as a separate argument that stands on its own as evidence supporting the conclusion. Even if one premise is deleted, the other still offers the same evidential support it did before deletion. Thus, in principle, the two patterns are distinct types of support.

The following hypothetical case has many of the features of a kind that is very common in legal argumentation.[3]

Facts of the Breach of Contract Case

Alice signed an agreement to deliver a package to Bob on a certain date. The package contained widgets. The widgets were green. She failed to deliver the package to Bob on that certain date. There was a written contract describing the agreement by Alice to deliver the package. Bob kept two copies of the contract in his desk drawer. The contract contained Alice's signature, and showed she agreed to deliver the package by the date indicated.

Bob sued Alice for breach of contract. By doing so he made a charge against Alice, claiming the ultimate *probandum*. "Alice is guilty of breach of contract."

Looking over the facts of the case, we need to judge which facts are relevant to Bob's ultimate *probandum*. A proposition is relevant in the legal sense if it can used to prove or disprove Bob's claim. This means that it is relevant if Bob can use it as evidence to support the claim that his ultimate *probandum* is true, or if Alice could use it to argue that Bob's argument does not hold up to questioning. Looking over the facts in the case, some can be judged to be relevant in this sense, others not. The facts there were widgets in the package, the fact that the widgets were green, and the fact that Bob kept two copies of the contract in his desk drawer are not relevant. They could turn out to be relevant later, but as things stand, they do not provide evidence that could be used to prove or dispute Bob's ultimate *probandum*. These judgments about relevance seem reasonable, but how could we prove them, or at least evaluate them, by some logical method?

The evaluation can be carried out by considering whether each proposition has a place in the chain of argumentation used to provide evidence for Bob's claim. We begin by making a key list representing the propositions at issue in the case.

[3] This example, and the analysis of it continued in section 5 below, can also be found in Walton 2005.

Key List for the Breach of Contract Case

(A) Alice is guilty of breach of contract.
(B) There was an offer made by someone for Alice to carry out some action.
(C) Alice accepted that offer.
(D) Alice failed to carry out the action.
(E) Alice signed an agreement to deliver a package to Bob on a certain date.
(F) Alice failed to deliver the package to Bob on that date.
(G) Bob showed a written contract describing the agreement by Alice to deliver the package.
(H) The contract contained Alice's signature, and showed she agreed to deliver the package by the date indicated.

To begin the analysis of the argumentation in the case, we need to see how inferences drawn from the facts make up a chain of argumentation supporting Bob's ultimate *probandum*. To prove the existence of a contract in law, you have to begin by proving that there was an offer made by one party and an acceptance of the offer by the other. Bob has to prove these facts by showing that he made an offer to pay something for Alice to deliver the package by a specified date, and that she agreed to deliver the package by that date. Then to prove breach of contract, he has to prove that she failed to deliver the package by that date. This chain of argumentation is represented in the *Araucaria* diagram below.

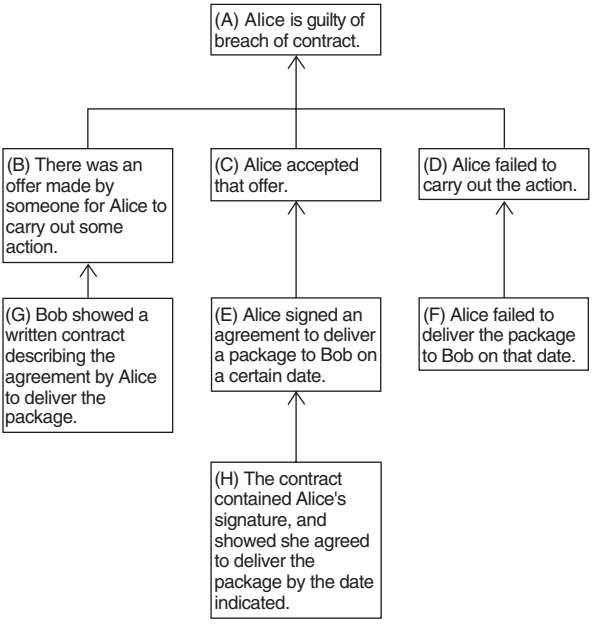

Diagram 1: Full Text Diagram of the Breach of Contract Case

In law, once a charge, like breach of contract, is made, the charge is defined in a standard way. It follows that the elements necessary to prove the charge are specified by the legally accepted definition. There has to be a contract, which means there has to be an offer and an acceptance. For there to be a breach of the contract the complainant has to prove that some requirement of fulfilling the contract was not met. In the *Araucaria* diagram above, there is one proposition at the top, the ultimate *probandum* that there has been breach of contract. Just under it are the three element propositions forming a linked argument. The argumentation in the case fits under each of these three nodes as required, showing how each argument, or part of it, is relevant. Each is relevant because it leads by a chain of connecting argumentation, as displayed on the diagram, to the ultimate *probandum*.

It must be noted however that there is an important distinction to be drawn between logical and legal relevance. According to Wigmore (1931) there is a science of proof (logic) in which logical relevance can be defined, but there are also trial rules that judges use to make determinations of relevance in judicial tribunals. According to an influential passage in Wigmore's *Principles*, quoted by Twining, the trial rules are, broadly speaking, founded on the science, but do not always coincide with them.

> The principles of the Science as a whole, cannot be expected to replace the Trial Rules; the Rules having their own right to exist independently (but) for the same reason, the principles of the Science may at certain points confirm the wisdom of the Trial Rules, and may at other points demonstrate the unwisdom of the Rules. (Twining 1985, 156)

The trial rules have their own right to exist independently because they are meant to serve the institution of the fair trial. Legal relevance is a procedural notion meant to be applied by a judge in a trial to determine what evidence should be considered admissible at that time and place. Logical relevance, according to the example above, is determined by using the argument diagram representing the chain of reasoning in a case, to see if the chain connects up with its ultimate conclusion. Park, Leonard, and Goldberg (1998, 125), define logical relevance as follows: "The term *logically relevant* has sometimes been used to refer to evidence that has any tendency in logic to establish a proposition." The distinction between logical and legal relevance is clearly fundamental to grasping argumentation in evidence law. But the history of the subject, chronicled in volume 1A of Wigmore's treatise, *Evidence in Trials at Common Law* (1983, 1004–95), shows how difficult it has been to get the right balance between these two notions.[4] Ball (1980) moved from deductive logic to define relevance in terms of probability. There have been many attempts to define relevance using statistical probability of one sort or another. Tillers (Wigmore 1983, 1013) concluded after his discussion of all

[4] The various theories have been summarized in a set of footnotes written by the editor, Peter Tillers in the 1983 edition of *Evidence in Trials at Common Law*.

the various theories, however, that abstract theories of relevance have had little direct influence on proof-taking processes in courtrooms.

We will not go into all the problems of trying to show how logical relevance relates to the Federal Rules of Evidence, or other trial rules in which the notion of relevance is central (Callen 2003). All we have tried to do, so far, is to show how argument diagramming can be used to analyze a given argument, showing the premises and conclusions in a chain of argumentation, and thus providing a way of displaying logical relevance. But of course the diagram is not the only tool needed. Relevance is a contextual notion, and thus judging whether it holds in a given case or not requires other tools to be applied as well.

2. How to Judge Relevance in Argumentation

This notion of relevance has ancient roots, both in the classical *stasis* theory of Greek rhetoric, and in the Aristotelian theory of fallacies. The problem in the past has been that these notions have been highly unclear. Hamblin (1970, 31) showed that relevance has traditionally been used in logic textbooks as a "rag-bag" category in which to throw defective or fallacious arguments that cannot be diagnosed by any clearer criteria as failed arguments. But now new work in argumentation studies has presented a sharper analysis of the notion, by defining it conversationally. According to the theory of relevance in argumentation presented by Walton (2004), there are two parties in any dialogue called the proponent and the respondent. In the type of dialogue called the critical discussion, classified as a type of persuasion dialogue, there is a conflict of opinions between the two parties. The proponent has a designated thesis (a proposition). To win, she must prove it using rational argumentation based on premises accepted by the respondent. Thus the proponent has a pro viewpoint, meaning she has a positive attitude toward her thesis. The respondent has a contra viewpoint. Either he has an opposite thesis (the negation of the proponent's thesis), or he has expressed doubt about the acceptability of the proponent's thesis.[5] Given this conflict of opinions, each side uses chains of argumentation to try to prove his or her thesis from premises accepted by the other side. Whoever achieves such a proof first wins the dialogue.

In this framework, and in types of dialogue other than the critical discussion as well (Walton 2004), it is fairly easy to give a general characterization of relevance. The thesis of each side provides an aiming point or target for the argumentation used to prove that thesis by a chain of argumentation. In a dialogue, the proponent has the task of constructing a chain of rational argumentation that is rationally binding on the respondent and

[5] In describing dialogues, the general convention is adopted that the proponent is female and the respondent male.

that leads to her conclusion. This analysis of relevance in argumentation is not new. Arguably, it fits the ancient model of *stasis* theory very well, at least insofar as persuasion dialogue is concerned. It can also be extended to other types of dialogue. Persuasion dialogue represents an attempt to get at the truth of the matter by revealing the strongest arguments that can be used to support a viewpoint as well as the strongest criticisms that can be made against it. Negotiation, in contrast, is not truth-oriented. The goal is to divide some contested resources by reaching an agreement that both parties can live with, or "make a deal". Thus the same argument might be relevant in a negotiation dialogue but irrelevant in a persuasion dialogue. The classic example is that of the *argumentum ad baculum*. For example, a threat to go on strike or to cut wages could be a relevant argument when used in negotiation. But the same threat could be outstandingly irrelevant when used as an argument in a persuasion dialogue, like a critical discussion in a philosophy seminar. Used in that context it could properly be judged a fallacious *argumentum ad baculum*.

A general analysis of relevance in the persuasion type of dialogue has been structured by Walton (1999, 121). For an argument to be relevant in this type of dialogue, it must meet all four of the following four criteria.

(R1) The respondent accepts the premises as commitments.
(R2) Each inference in the chain of argument is structurally correct.
(R3) The chain of argumentation must have the proponent's thesis as its (ultimate) conclusion.
(R4) Arguments meeting (R1), (R2) and (R3) are the only means that count as fulfilling the proponent's goal in the dialogue.

In this framework relevance is defined in terms of a chain of argumentation with a starting point and an end point. The starting point is a given argument as represented in the text of discourse of an individual case. It could be represented by an argument diagram. The diagram provides an analysis of all the premises and conclusion, both explicit and implicit, of the argument, and the steps of inference joining each set of premises to each conclusion drawn from them. As the existing chain of argumentation moves forward from this start point, it aims toward an end point, some ultimate conclusion to be argued for, called the ultimate *probandum* in law. It is assumed that this proposition is known, or can be identified. In a trial, it will be clearly identified at the outset. In everyday conversational argumentation, it may be explicitly identified or it may not be. In any event, the argumentation used in any particular case can be judged relevant or irrelevant only if it proceeds from a starting point that can be clearly mapped out, say by an argument diagram, to a clearly identified end point.

How is such a determination made? The method put forward by Walton (2004) is called *argument extrapolation*. To determine relevance, the argu-

mentation given in a text of discourse in a case is extrapolated forward to judge whether it is leading toward the ultimate *probandum* in the case or not. Applying the method begins by using an argument diagram to fill in the missing premises and conclusions needed to get a grasp of the direction of the argumentation as a whole. Another factor to mention is that many legal arguments are based on unstated premises, or even unstated conclusions that need to be made explicit in order to show how the conclusion was arrived at from the given evidence. Arguments with such unstated premises or conclusions are called enthymemes in traditional logic[6] and can be better diagrammed using argumentation schemes (Walton and Reed 2005). Tools useful for helping with analyzing argumentation in order to make determinations of relevance include argument diagramming and argumentation schemes.

3. Argumentation Schemes

Argumentation schemes represent patterns of reasoning of a familiar kind recognizable from arguments in everyday conversational argumentation as well as in special contexts like law and political debates. The ones highlighted below are said to be presumptive, rather than deductive or inductive, in that they are based on defeasible reasoning, a kind of reasoning subject to defeat as more evidence comes into a case (Walton 1996).[7] Arguments fitting presumptive schemes are evaluated on a balance of considerations in a context of dialogue, by the asking of standardized critical questions matching a scheme. A standard example that can be used to illustrate how this process works is the argumentation scheme for argument from appeal to witness testimony.

Appeal to Witness Testimony

Witness *W* is in a position to know whether *A* is true or not.
Witness *W* is telling the truth (as *W* knows it).[8]
Witness *W* states that *A* is true (false).
Therefore (defeasibly) *A* is true (false).

[6] The term "enthymeme" originally meant something quite different. Burnyeat (1994), hypothesized that what Aristotle referred to by the term "enthymeme" is a plausibilistic argument of the kind analyzed in the *Topics* and *Rhetoric*. Based on a warrant that is defeasible, this type of argument corresponds to what is now called a presumptive argumentation scheme.
[7] Prakken (2001) has analyzed interesting cases of defeasible reasoning in legal argumentation.
[8] David Godden pointed out that, if taken literally, this premise implies that *A* is true, showing that a more careful and explicit phrasing of the premise is required. What the premise needs to state is that the witness is not lying, or is being sincere, or is not attempting deceit or deception. The point that needs to be made clear is that such a witness is not lying, and is honestly trying to tell the truth as he sees it, but still may be mistaken.

The following critical questions match this argumentation scheme. Asking any one of the questions temporarily defeats the argument until the question is answered.

Critical Questions for Argument from Witness Testimony

CQ1: Is what the witness said internally consistent?
CQ2: Is what the witness said consistent with the known facts of the case (based on evidence apart from what the witness testified to)?
CQ3: Is what the witness said consistent with what other witnesses have (independently) testified to?
CQ4: Is there some kind of bias that can be attributed to the account given by the witness?
CQ5: How plausible is the statement *A* asserted by the witness?

When the proponent is questioned by the asking of one of these questions, her argument is defeated unless she provides an adequate answer. If she does provide such an answer, however, the argument tentatively stands until the respondent asks another critical question, or otherwise presents suitable reasons for doubting the argument.

Appeal to witness testimony is a special subcategory of an argumentation scheme called argument from position to know. In turn, there are other argumentation schemes that are special subcategories of appeal to witness testimony. One of these is argument from expert opinion. A great many argumentation schemes have now been studied, including the following ones in addition to the three already mentioned. A brief description of each scheme is given, but to see the exact details of a scheme, the reader must consult recent work on schemes like Kienpointner (1992), Walton (1996), or Walton and Reed (2003).

1. *Argument from Popular Opinion*: arguing that a statement is generally accepted, and that therefore it can be accepted tentatively as plausible.
2. *Argument from Example*: arguing that something is true based on an example.
3. *Argument from Analogy*: arguing that something holds in a particular case because it holds in a similar case.
4. *Argument from Precedent*: a form of argument from analogy in which the arguer cites a prior accepted case as providing a guideline for acceptance in a given case at dispute.
5. *Argument from Verbal Classification*: arguing that something has a certain property because it can be classified verbally in a certain way.
6. *Argument from Sign*: arguing that something is present based on a sign or indicator.
7. *Practical Reasoning*: arguing from a goal to an action required to realize the goal.

8. *Argument from Sunk Costs*: arguing for persisting with a course of action on the grounds that considerable costs have already been sunk into it, which might otherwise be lost.
9. *Argument from Ignorance*: arguing that a statement is true on the grounds that it is not known to be false.
10. *Argument from Cause to Effect*: arguing that an event will come about because its cause is present in the data.
11. *Argument from Correlation to Cause*: arguing that one event causes another on the grounds that there is a positive correlation between the two.
12. *Abductive Argument*: arguing from the existence of a data set in a given case to the best explanation of the data set.
13. *Argument from Evidence to a Hypothesis*: arguing from evidence found and verified empirically to a tentative hypothesis that accounts for it, normally by a theory.
14. *Argument from Consequences*: arguing that a course of action is recommended (or not) because it has good (bad) consequences.
15. *Argument from Threat*: arguing that a course of action should be carried because if not, the proponent will see to it that bad consequences happen to the respondent.
16. *Argument from Fear Appeal*: arguing that you shouldn't do something because consequences that are fearful to you will occur.
17. *Argument from Commitment*: arguing from a respondent's prior commitment to some statement or course of action.
18. *Argument from Inconsistent Commitment*: arguing that an opponent has committed himself to both a statement and its opposite (negation).
19. *Ethotic* Ad Hominem *Argument*: arguing against another party's argument by claiming he is a bad person (has some negative quality of character or *ethos*).
20. Circumstantial *Ad Hominem*: attacking another party's argument by claiming his argument is inconsistent with his own practices or commitments, and that this shows bad quality of character (like being a hypocrite).
21. The Situationally Disqualifying *Ad Hominem* Argument: arguing that an opponent has no right to speak on an issue because he is not in a situation to credibly do so.
22. *Argument from Bias*: arguing that one should not pay too much serious attention to a person's argument, or should discount it, because he is biased.
23. *Argument from Gradualism*: gradually proceeding by small steps from premises an arguer accepts through a chain of argumentation to something he doesn't accept.
24. *Slippery Slope Argument*: a negative species of argument from gradualism in which the arguer claims that if one step is taken, it will lead

by a chain of argumentation past a point of no return (that cannot be sharply defined) to a disastrous ultimate outcome.

25. *Argument from an Established Rule*: arguing that the respondent should take a certain action on the basis that it conforms to an accepted rule.

A research project currently underway has collected sixty-five plus of such argumentation schemes with matching critical questions for each scheme. These schemes have been collected from the literature in argumentation studies. However, previous systematic lists of schemes can be found in Kienpointner (1992) and Walton (1996).

As shown in the example above, argumentation schemes can be loaded into *Araucaria* and then used in the construction of argument diagrams. As part of this ongoing research project, a set of fifty-nine schemes, including all of the twenty-eight[9] mentioned above, has been loaded into *Araucaria* as a scheme set. An example illustrating how such a scheme is selected from the set is shown in the screen shot below from *Araucaria*.

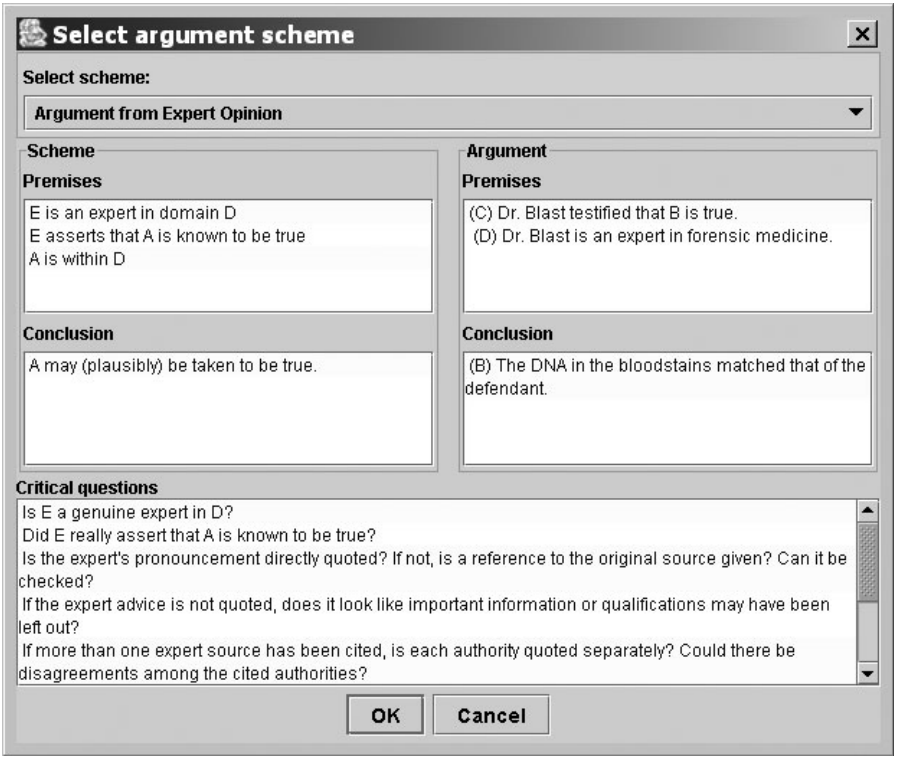

Diagram 2: Screen Shot of Scheme Selection

[9] There are twenty-five in the list above, and three not on the list were previously mentioned.

This argumentation scheme selection illustrates how the scheme for argument from expert opinion is applied to an example (see below), shown on the right. When constructing an argument diagram, the user can scan through the list of schemes, and then pick the one that fits the inference shown on the argument diagram. The use of schemes is very helpful in constructing a diagram of the kind that can be used to aid in a determination of relevance. Applying the schemes to premises that represent the facts (given statements) in a case, argumentation chains can be built up that can potentially be used to prove the ultimate *probandum* in the case. If such a chain either arrives at the ultimate *probandum* as its end point, or at least seems to be moving toward it, then the argument that started out as part of the chain is relevant. The problem is to take individual cases, and make some judgment whether the chain of argumentation is (or seems to be) leading towards the ultimate conclusion to be proved or away from it.

In law, the judge is supposed to use the trial rules to make such determinations (Morgan 1929). But there are serious theoretical problems in applying rules, like the Federal Rules of Evidence, to make such determinations. One is the problem of conditional relevance (Ball 1980; Friedman 1994; Tillers 1994; Nance 1995), further described in section 5 below. This problem is very similar to the problem of enthymemes in logic (Ennis 1982; Burke 1985; Hitchcock 1985; Walton 2003; Walton and Reed 2005). Both concern missing premises in an argument. How you diagram an argument is typically subject to interpretation and analysis (Friedman 1986), and whether a premise can be inserted as an implicit assumption is often a problem (Gough and Tindale 1985).

Some cases are harder to evaluate than others. As always, there are the easy cases and the hard cases. In many of the hard cases, the argument is still at an initial stage of a discussion. And so it is very hard to judge, at that point, where it might lead. It often happens in legal argumentation in a trial that the argument to be evaluated occurs at an early stage, before each side has had a chance to present much of its evidence. In such a case the judge is not yet in a position to determine where the lawyer's argument is likely to go. In such cases, there are problems about conditional relevance. An argument might be conditionally admitted as relevant on the assumption that one of its required premises can later be proved as the trial proceeds. But there are also lots of easy cases, where an argument is clearly relevant or irrelevant. In some cases of forensic evidence used in trials, the structure of the argumentation is fairly clear (Keppens and Zelezniknow 2002). For example, expert testimony could be relevant if DNA was found at the crime scene, and a forensic scientist who has tested the DNA sample is called to testify.

Consider the following example, a case of expert testimony in a murder trial. The expert testimony is relevant.

The Bloodstains Example

In a murder case, bloodstains found at the crime scene were tested, and the DNA in them was found to match that of the defendant. An expert in forensic medicine, Dr. Blast, testified that the DNA in the bloodstains tested matched that of the defendant.

Why is Dr. Blast's testimony relevant, and how can it be proved that it is relevant? The method is to construct an argument diagram exhibiting the argumentation schemes. We begin by identifying the premises and conclusions of this argumentation in the following key list of propositions.

Key List

(A) Bloodstains found at the crime scene were tested.
(B) The DNA in the bloodstains matched that of the defendant.
(C) Dr. Blast testified that B is true.
(D) Dr. Blast is an expert in forensic medicine.
(E) The defendant committed the murder.

In this case, the ultimate *probandum* is E. The relationship of the other propositions to E in the bloodstains example can be shown in the following argument diagram.

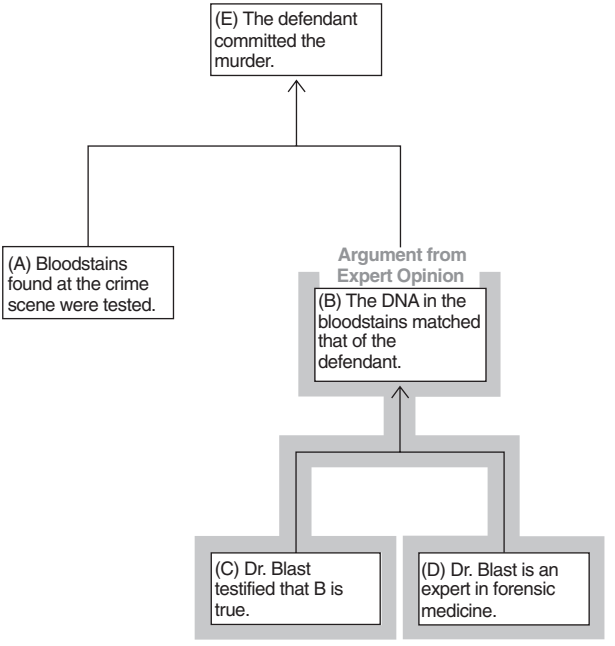

Diagram 3: Full Text Diagram of the Bloodstains Example

In this diagram, the argumentation scheme for argument from expert opinion is displayed in the subargument from premises C and D to conclusion B. The chain of argumentation displayed in the diagram shows that this subargument is relevant. It also shows that Dr. Blast's testimony (the premise represented as proposition C) is relevant evidence in the trial. This diagram may not be the only way to analyze the argumentation in the case. But it does offer a plausible analysis that links up C to E in a chain of argumentation.

Here then is a clear case in which an argument is shown to be relevant. This case is a relatively easy one to decide, but it does admit of some potential refinements. Any case in which a judgment of relevance or irrelevance is made will depend on the analysis of the argumentation in the case. This case is no exception. We can go on to ask, for example, why the bloodstain is relevant. The reason is that it places the defendant at the crime scene around the time the crime was committed, and shows he shed some blood there. The best explanation of why the defendant was present and shed some blood there may be that he committed the crime. Filling out such an explanation may require more details of how the crime was committed. This is just the sort of argumentation that the prosecution needs to put to the trial judge or jury. Thus further analysis of such a case can potentially prove the relevance of the blood evidence and the expert testimony of Dr. Blast, as well as the relevance of other evidence that might come into the case. Despite these complications, and the possibility of providing a more detailed analysis of the argumentation in the case by inserting implicit premises, the very simple diagram above does make a good case for relevance. It at least shows us how diagramming and schemes can be used to provide evidence of relevance of argumentation.

3. Failures of Relevance

Consider an argument that only appeals to pity or other emotions but does not give any evidence that the accused party is guilty of the crime alleged. The argument may lead to a specific conclusion, but not the one that is supposed to be proved. The classic example is the following one cited in a widely used logic textbook as an instance of the fallacy of *ignoratio elenchi* (ignorance of refutation).

The Horrible Crime of Murder Example

In a law court, in attempting to prove that the accused is guilty of murder, the prosecution may argue at length that murder is a horrible crime. He may even succeed in proving that conclusion. But when he infers from his remarks about the horribleness of murder that the defendant is guilty of it, he is committing the fallacy of *ignoratio elenchi*. (Copi 1982, 110)

The fallacy of *ignoratio elenchi* or irrelevant conclusion (wrong conclusion) is equated with failure of relevance in the logic textbooks, following the Aristotelian tradition. According to Aristotle's account (Aristotle 1939, 162a13–162a16), an argument commits this fallacy when it proves something other than the conclusion it is supposed to prove. The idea is that an argument is supposed to prove a designated conclusion, but in some cases, the argument actually proves a different conclusion that may appear similar to the one to be proved, and easily be confused with it.

Fallacies of relevance do not always conform to the Aristotelian model however. In some cases the failure can be diagnosed by showing that the chain of argumentation in the case leads to the wrong conclusion (one other than the one that is supposed to be proved). In these cases, the correct diagnosis is that the fallacy of wrong conclusion has been committed. In other cases, the chain of argumentation leads away from the conclusion to be proved, and the interval provides a distraction, but the argumentation does not prove any specific conclusion that is other than the one to be proved. In this latter kind of case, the failure is called the red herring fallacy. This term means that the chain of argumentation leads anywhere away from the conclusion to be proved, thus taking the hounds away from the real path the fox took by dragging a red herring across it. Yet both red herring and wrong conclusion are failures of relevance because the path of argumentation leads away from the real conclusion to be proved. Thus both wrong conclusion and red herring are species of misdirected argumentation—arguments directed other than along the path leading towards the conclusion to be proved (Walton 2004, 243). Accordingly, the general structure underlying both fallacies of irrelevance can be visualized using the diagram below.

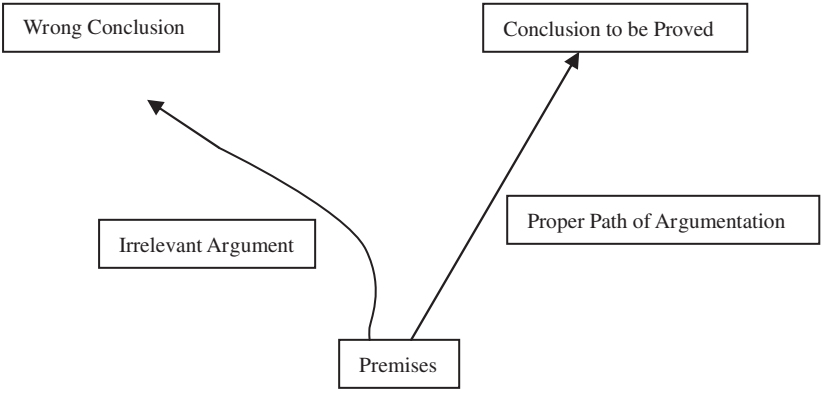

Diagram 4: Misdirected Argumentation

How can one distinguish in a given case which of the fallacies has been committed? If the chain of argumentation has as its end point a specific conclusion that is a proposition other than the conclusion to be proved, but that looks similar to it, the fallacy committed is that of wrong conclusion. If the chain of argumentation leads in a different direction that is distracting, and that provides a diversion, but does not have a specific proposition that can be identified as its end point, a proposition other than but similar to the proposition to be proved, the fallacy committed is that of the red herring.

The classic case of the red herring fallacy is another example taken from a widely used logic textbook.

The Parking Example

Professor Conway complains of inadequate parking on our campus. But did you know that last year Conway carried on a torrid love affair with a member of the English department? The two used to meet every day for clandestine sex in the copier room. Apparently they didn't realize how much you can see through that fogged glass window. Even the students got an eyeful. Enough said about Conway. (Hurley 2003, 132)

Relating the incident in the copier room is meant to excite the interest of the audience by interjecting an account of clandestine sex involving Conway that is stimulating. The account involves Conway, and so it is topically relevant, but doesn't really lead to any conclusion about the parking issue, one way or the other. It could perhaps be classified as an *ad hominem* argument meant to attack Conway's good character. But the main strategy is one of distraction. It leads away from the issue of inadequate parking by providing a diversion to a more exciting issue. Thus we can classify the argumentation in this example as committing the red herring fallacy rather than the fallacy of wrong conclusion.

The distinction between these two kinds of fallacies has to be made on a case-by-case basis, and it is to be understood that there will be borderline cases that are hard to classify as one or the other. It is the difference between two types of strategies that mark the distinction (van Eemeren and Houtlosser 2002). You have to ask whether the strategy is one of arguing for a wrong conclusion or one of mere diversion without leading to a specific wrong conclusion. What is important is that both fallacies are failures of relevance as defined above, and it may not be so crucial to worry too much about which specific type of failure of relevance is exhibited in a given case. What is important is to recognize that even though an argument may be valid, and may otherwise be a good argument that meets standards as sound or inductively strong or whatever, it may be irrelevant.

4. Components of Argument Invention

Any system of argument invention will have to be built on several basic components, so judgments about the rationality of arguments can be constructed out of them. Basically, there will have to be a target proposition that is supposed to be proved or refuted, a given base of premises, and a tool for constructing chains of arguments that move forward from the premises toward proving this target proposition. Such systems have been attempted, but not in a formalized way, from ancient times onward. In modern times, formal systems have been constructed, called theorem-proving machines. However, these systems work only for deductive logic, and systems designed to use defeasible argumentation schemes have not yet been attempted. But it is the defeasible schemes that would prove most useful for inventing arguments in everyday reasoning, for example, in forensic debating, and in legal argumentation.

The older systems recognized the practical usefulness of working with defeasible argumentation schemes, called "topics" in the ancient tradition. According to Kienpointner (1997), systems of argument invention in antiquity, medieval and early modern times, shared the following three distinctive characteristics.

1. The purpose of the system is to find new arguments, where an argument is taken to be a statement brought forward to confirm or attack a controversial claim (Kienpointner 1997, 225). Central to this characteristic is that all the arguments sought are meant to be useful to support or attack this central claim.
2. The finding process looks not for all conceivable arguments, but only all plausible ones (ibid.). A plausible argument is one in which the audience accepts the premises, and accepts some general rationale for drawing a conclusion from these premises.
3. Different kinds of systems can have stronger or weaker requirements on what counts as an argument that fits the requirements in characteristic 2. For example, a system with very strong restrictions might require that all conclusions must follow from a set of premises by valid deductive reasoning only. A weaker system might admit defeasible forms of argument like argument from analogy, or argument from expert opinion, that are not deductively valid.

These three features of the traditional systems indicate that they were meant for inventing arguments for different contexts of argument use, and therefore that they were meant to include defeasible arguments of the kind that lead to plausible conclusions. Such systems could be based on argumentation schemes, like argument from expert opinion, that are not

deductively valid, but utilize plausible reasoning. Such a system, based on the third characteristic above, could also be flexible, and be used in different contexts. For example, argument invention could be used in legal argumentation in the preparation stage for a trial by building a case on the evidence and devising proof strategies. Or it could be used in everyday conversational argumentation, or in forensic debates. It could also be used in science, in the kind of experimental abductive reasoning employed to discover new hypotheses at the discovery stage of a scientific inquiry. Each context could be quite different, depending on how strong an inference must be to derive a conclusion from a set of premises, and on what are regarded as acceptable premises.

A system of invention of this kind is built on three basic components. The first is a set of statements *S* that are regarded as acceptable premises for arguments. The second is a set of rules of inference *R* used to draw conclusions from these premises. The third is a device *Ch* for constructing chains of argumentation recursively from the first two components. How such a chaining device works can be illustrated as follows. To use the chaining device, the argument inventor takes the set of premises *S* and applies *R* to them generating a conclusion. This conclusion is then added to the set *S*. The argument inventor repeats the process, each time using the new conclusion as one of the premises in the new inference. Following this recursive procedure, the statement once drawn as a conclusion now becomes a premise in the next inference drawn to a new conclusion. Hence this process is recursive. The diagram below represents this process of argument invention by chaining. Only the first few steps in the procedure are indicated in diagram 5 below.

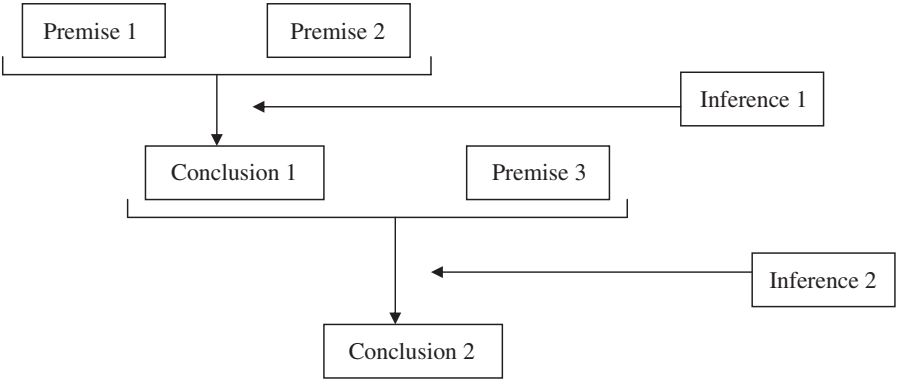

Diagram 5: First Few Steps in Argument Invention

As shown in the diagram, inference 1 uses premises 1 and 2 to derive a conclusion. In the next step, conclusion 1 is used as a premise, along with premise 3, to derive a second conclusion 2. As the example illustrates, in this recursive procedure rules of inference can be applied over and over again both to the set of original premises and to the expanding set generated as the new conclusions are added. Chaining forward of this kind is typical of the kind of search procedure used in knowledge-based technology (Russell and Norvig 1995; Bench-Capon 1997). New conclusions are added to the knowledge base, and then rules of inference can be re-applied to the expanded set of premises so produced.

Given that sophisticated automated techniques of searching for a designated conclusion from a given set of premises in a knowledge base are now so widely employed in computing, a system of argument invention can easily be constructed. We can easily take any one of the many search engines now employed in artificial intelligence and apply it to any given argument. Once the premises and the conclusion of the argument have been identified, we can apply the search engine, and it will recursively apply all the rules of inference to the premises, chain forward, and either hit the designated conclusion or not. In principle, argument invention is simple. But there are several problems that need to be solved before any useful system can be developed, especially a system that could be used for argument invention in proof preparation of legal argumentation. One problem is that the rules of inference need to be comprehensive enough to include widely used forms of legal argumentation, like argument from witness testimony, and abductive arguments based on forensic evidence. This problem is being solved by the development of codified argumentation schemes. Another problem is that in many of the most common cases, the chain of argumentation from the premises may not prove the conclusion, but may still be seen to go some way toward proving it. This kind of result can be extremely useful nonetheless, because it can tell an arguer what she needs to progress along the route toward proving the conclusion.

5. Relevance as the Basis of Invention

We now turn to providing a solution for the second problem. How could an argument inventor deal with the kind of case where the arguments she can construct so far go only part of the way toward proving the conclusion? The answer proposed here is that she should broaden the search to include arguments that are relevant, even if they do not go all the way. She begins a first search using the set of propositions given explicitly as premises, and tries to use all the different argumentation schemes she has that takes these propositions as premises. Each time, she will take an argumentation scheme, and apply it to the premises, one at a time, pairwise, or whatever is required to make the scheme fit the premises available. When she gets a fit, she will

take the new conclusion and put it in the set as a premise. She will apply this recursive procedure until she either proves the conclusion or not. But even if this method does not prove the conclusion, it may take her close to it, leaving gaps that could be filled somehow. The gaps may consist of propositions that are not in the set of given premises, but if added, would provide premises needed to fit into the argument required to complete the chain (Walton and Reed 2005). Such missing propositions might be quite easy to prove, or may even be assumptions that the audience of the argument already accepts, or would not contest.

In real cases, this process of filling in gaps in the chain may not be that difficult for the argument inventor to carry out. To carry out this task, implicit premises will need to be inserted in both chains of argumentation. There may be information available on how the ultimate conclusion needs to be proved. For example, if the case is from contract law, it may be known that in order to prove that contract between two parties exists in the given case, there needs to be an offer from the one party and an acceptance by the other. This can be included on the diagram representing the argument by chaining backward from the ultimate *probandum* to determine which other statements are needed to prove it. The method suggested is to combine chaining backward with chaining forward.

The method of chaining both forward and backward to get the chain of argumentation to match up in the middle was used by Walton (2004) as a device to help to determine the relevance of argumentation. In chaining forward, the argument inventor's goal is to find a chain of argumentation leading from the given premises to the ultimate *probandum*. But to supplement this search, she could also search backward, if she knows which kinds of premises are needed to prove this ultimate *probandum*. By searching forward and backward, she can try to match up the two chains of argumentation in a region somewhere in the middle. The key to carrying out such a double search procedure is relevance. The argument inventor may not be able to prove the ultimate conclusion by hitting it exactly as the last point in the forward chaining from the given premises. But the search may indicate a direction, showing relevance. This finding can be encouraging, especially if filling in the gaps required to get to the conclusion is not that hard a job, given what the respondent of the argument would be willing to accept as additional premises and arguments. Getting part of the way could be highly significant.

Those cases where the given set of premises lead to the conclusion only if additional premises not in the original set can be inserted correspond to what is called conditional relevance in law (Nance 1995; Callen 2003). In such cases, a missing premise that would establish relevance if proven needs to be added in to the argument given. Without this premise, the argument is not relevant. But with it, the argument becomes relevant. Rule 104(b) of the Federal Rules of Evidence says that relevance can be "conditioned on

fact". This means that evidence can be admissible even if it is relevant only when taken together with additional statements not yet proven.

When the relevancy of evidence depends upon the condition of a fulfillment of fact, the court shall admit it upon, or subject to, the introduction of evidence sufficient to support a finding of the fulfillment of the condition.

A famous example of Ball (1980, 437) provides a simple illustration of a case of conditional relevance.

If a letter purporting to be from Y is relied upon to establish an admission from him, it has no probative value unless Y wrote or authorized it.

The letter could be conditionally relevant as evidence on the assumption that it might be possible to prove later that Y wrote or authorized it. Conditional relevance of a proposition can be met even if that proposition is not be relevant by itself, but could be relevant if, taken together with another proposition that could be proved later. Relevance in this sense is conditional, because it depends on a further assumption as part of the chain of argumentation that can be added in as a missing premise.

As noted in section 3 above, conditional relevance is a highly problematic and controversial notion in law. Without being drawn too far into the controversy, it is possible to give a relatively simple example of how the system of argument invention works. To do this, we return to the breach of contract case in section 1. We expand the case by adding another premise to it. An acquaintance of Alice, named Cassie, said that Dragut, a known gangster, threatened to burn down Alice's shop if she did not sign the agreement. Let's say that Alice did not dispute any of the facts alleged in Bob's argument above. She agreed that she failed to deliver the package by the specified date. This new premise provides a relevant line of argumentation for Alice's lawyer. An implicit premise can be added that as a rule of law, a contract is not valid if one of the parties was forced to sign it.[10] Another is that if Cassie would testify to this effect in court, such testimony would be considered evidence relevant to Bob's claim that there was a valid contract. These facts are relevant, but how could a system of invention construct a chain of argumentation to build on them? In the analysis below, it is shown how a system of invention can be do it, using defeasible argumentation schemes and *Araucaria*.

To construct the chain of argumentation required for invention in *Araucaria*, we add a new premise to the old case.

(I) Cassie said that Dragut, a known gangster, threatened to burn down Alice's shop if she did not sign the agreement.

[10] This statement, listed as J in the key list, is a generalization in the sense of Anderson and Twining 1991, as classified by Anderson 1999.

We also add a premise in the form of a rule, called a conditional statement in logic.

(J) If one of the parties was forced to sign a contract, it is not valid.

To invent the chain of relevant argumentation, we insert some additional implicit premises, that would both be regarded as plausible assumptions in law.

(K) If Dragut, a known gangster, threatened to burn down Alice's shop if she did not sign the agreement, then Alice was forced to sign the contract.

(L) Alice was one of the parties to the contract.

(M) Cassie is a witness.

Based on the argumentation scheme for argument from witness testimony, another conclusion can be drawn from premises M and I.

(N) Dragut, a known gangster, threatened to burn down Alice's shop if she did not sign the agreement.

From the chain of argumentation built up so far, a new conclusion can be drawn.

(O) Alice was forced to sign the contract.

From J and O, a further conclusion is generated.

(P) The contract is not valid.

Now, note that the argument invention has been successful, as P is the negation of Bob's ultimate *probandum* in the case. It has been proved that there is a chain of argumentation, displayed in the *Araucaria* diagram below, that refutes Bob's claim that Alice is guilty of breach of contract.

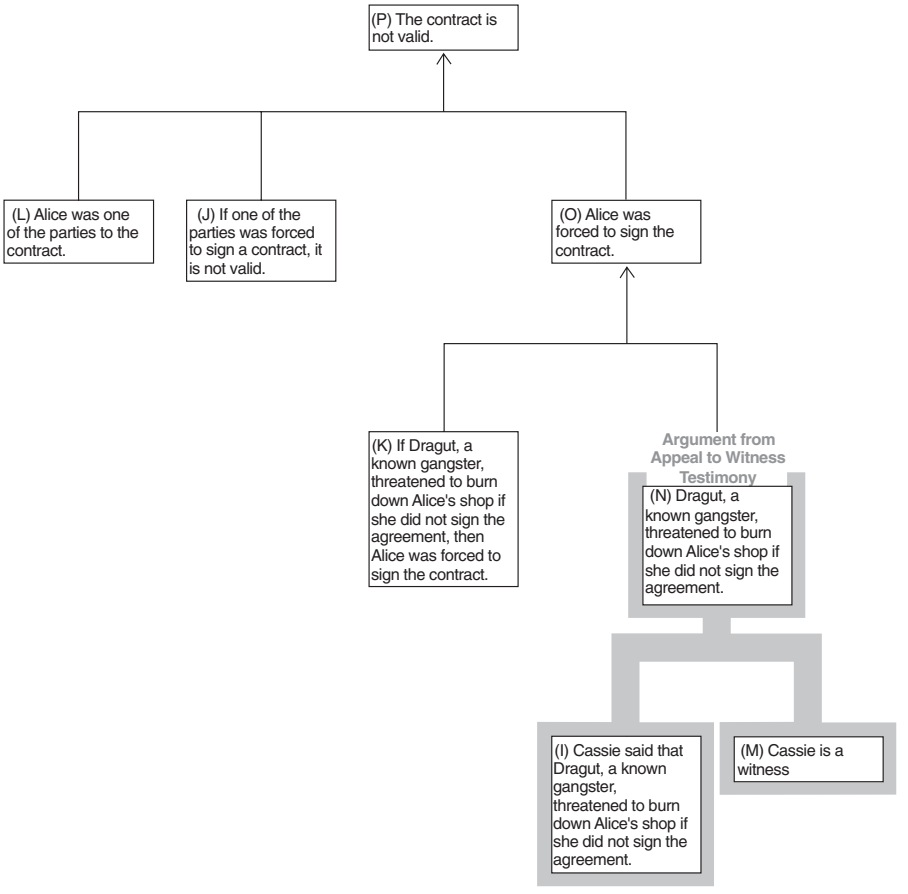

Diagram 6: Expansion of the Breach of Contract Case

To complete the chain of argumentation comprising all the evidence in the expanded case, all the reader needs to do is to join the two diagrams. In the resulting large diagram, P is shown as a refutation of A. At the top of the large diagram, P and A are joined by a double arrow. Under P the argumentation in the diagram just above will be shown, and under A the diagram in section 1 above, will be shown.

In the new method of argument invention using forward and backward chaining, the defense invents its argument by searching among the premises to find a chain of argumentation that refutes the prosecution's claim. The generalization J is the missing premise needed to move the search

forward, along with the additional premise about the threat that was made.[11] Once the argumentation has been chained forward to this point, supporting evidence to prove the threat was made can then be searched for as well. There was a witness who said this, and thus the argumentation scheme for argument from appeal to witness testimony can be applied to the expanded set of premises. This procedure results in the chain of relevant argumentation represented in the diagram just above.

A critic might allege that the chain of argumentation used to invent the relevant argument in this case is obvious, and that the argument invention is trivial. This objection is reasonable, because the automated system of argument invention is not doing anything that a human could not do, and fairly easily at that. What we would like to see is a case where the system came up with some striking new lines of argumentation that the human user wouldn't have thought of. The case is similar to the use of expert systems technology in automated systems of medical diagnosis. Generally, the expert system will not do any better than a physician in fairly simple or routine cases, especially where the diagnosis is one that is familiar in the physician's experience. Still, expert systems for medical diagnosis have proved to be quite useful. The same can be said about automated systems of argument invention for proof preparation in trials. They will never replace lawyers. Still, they could prove to be useful. Exactly how useful remains to be seen.

Here we have not tried to apply the system to any real case that would involve a mass of evidence requiring large numbers of propositions as premises and a large set of argumentation schemes. In any event, providing the large diagrams that would be needed to map the evidence in a realistic case is a task far beyond the scope of this short paper. All we have tried to do is to state the basic components required for a system of argument invention, and to show how they need to be tied together and implemented in a technology that can perform the recursive procedure needed to invent arguments. We have also indicated some of the limitations and problems inherent in building and applying the technology to legal tasks like proof preparation. In particular, it has been shown how any workable system has to deal with problems like unexpressed premises, and therefore must cope with the quite difficult problem of conditional relevance. By building the technology around the notion of relevance already studied in argumentation theory, a direction for coping with this problem has been laid out.

6. Conclusions

The key to solving the problem of bridging the gulf between argument evaluation and argument invention has been shown to rest in large part on the

[11] The importance of generalizations in legal argumentation as means of supporting inferences should be stressed here—see Twining 1999.

development of defeasible argumentation schemes. The schemes are the engine used to draw the inferences from the given facts and legal rules to build up chains of argumentation aiming at proving or refuting the ultimate *probandum*. These chains of argumentation provide heuristic search procedures of a kind that have been well studied in computing (Pearl 1984), and applied to tasks like playing chess. Generalizations, both legal ones and other kinds of common-sense generalizations of the kinds studied by Anderson (1999), as well as schemes, need to play their part in generating conclusions by inferences from the given set of facts and rules. It is clear that two things are needed for invention. One is a set of defeasible schemes that represent the kinds of arguments commonly used in law and that can be formalized and inserted into a search engine. The other is the system presented in this paper that builds the application of such a set of schemes into a recursive search procedure to a set of facts and laws. These are the basic tools needed for the job. The system also needs to build on the method of argument analysis used to fill in missing premises creating a chain of argumentation that can be visualized by marking it up using an automated method of argument diagramming. It is this method of argument diagramming that enables the argument inventor to chain the given set of facts and rules forward toward the target conclusion to be proved in a case.

Even with such heuristic tools, the task of discovering new arguments that can be used as evidence to prove a conclusion is not easy in legal cases. The kinds of arguments studied so far in everyday argumentation tend to be relatively simple ones with only a few premises and conclusions, with perhaps one or two missing premises. These cases can be problematic to be sure, but the existing methods have proved to be helpful, even if the task of analyzing the argument by identifying the premises, conclusions and inferential links is a substantive skill that has to be developed. There can often be more than one way of interpreting a text of discourse, requiring two diagrams representing two different interpretations. Still, the method of diagramming has proved to be helpful. The automated system is best seen as an interactive assistant to aid the human user invent new arguments, based on input from the user on how to analyze a given argument.

It is well to repeat some of the limits of what this device can do to aid in performing argument invention tasks in real and moderately complex legal cases. In any realistic case, as the two cases Wigmore (1931, 62–71) worked out to illustrate his chart method show, there will be a large mass of evidence making for quite large diagrams. Also, to usefully represent such argumentation, the system will have to contain large numbers of generalizations and legal rules. Many kinds of arguments can be used, and hence the set of argumentation schemes to choose from may also have to be quite large. The system will have to do a lot of computation to build chains of argumentation from such a mass of data with such a potentially large number

of rules. Lengthy case studies of evidence trials, like those presented by Anderson and Twining (1991) need to be worked up. Developing a formal theory of invention, or a software package that could be used to aid invention in these kinds of cases, are projects that lie in the future. In this paper, we have made no pretense of trying to build a realistic system with this capacity, or of trying to apply it to a real case of argument invention of a kind that was used or could be used in a trial. The main problem is to cut down the avenues of potentially useful chains of argumentation to those that are most promising, given the evidence currently known in a case. Thus relevance is the key.

It has been argued here that the most useful and promising way of approaching the task of invention is to utilize the notion of relevance. Relevance can guide the process by cutting down the search procedure, winnowing the irrelevant facts and rules not needed to prove the conclusion from the needed premises that are relevant. Relevance is a notion already central to evidence law, and is prominent in widely adopted rules of evidence like the Federal Rules of Evidence. Relevant arguments, as defined above, are those fitting into argumentation chains that move toward the target conclusion to be proved. Irrelevant arguments are those that show little promise of moving along such a line of advance, or even move away from any chain of argumentation leading toward the ultimate conclusion, in some cases leading to a different one that may resemble the one to be proved. Thus, according to the system proposed here, the way to discover productive lines of argumentation, that are likely to prove useful to prove a conclusion that has been designated in advance, is to judge alternative chains by relevance.

Apart from applying to very large cases of a mass of evidence in a trial, the method can also be used in a more modest and limited way for selecting arguments that can be used to apply to a smaller part of the argumentation in a case. Or it could be used to sum up the main outline of an argument in a case, presenting it in a simple diagram to highlight the main argument to a judge or jury. An attorney could do this by helping a team to decide which arguments a group of attorneys in a firm should use to support their client's position, based on premises that she thinks the court would find acceptable. This more limited task can easily be carried out with a relatively small database.

The question asked and answered in this study represents the big interdisciplinary leap from logic to rhetoric, two subjects that have in the past often been at loggerheads. Despite this gulf between the two subjects, and the size and scope of the question, it was argued that there are resources for offering a solution to the problem. Although *stasis* theory is well established in traditional rhetoric (Hohmann 2001), there has never been any theory of invention based on it that is well enough structured to be developed into a precise formal model used in computing, or for constructing software for

argument invention.[12] That such a system is feasible demonstrates that there is a close connection between rhetoric, seen as a method of argument invention, and dialectic, seen as a method of argument identification, analysis and evaluation. It has been shown that even though the purpose of the one field is different from that of the other, the two share many components and techniques of argumentation. It has been also shown how a method of argument invention and discovery is possible, building on tools and techniques already widely in use for identifying, analyzing and critically evaluating argumentation, and heuristic search procedures well studied in computing. Steps have been taken in the new method of argument invention to argue that the leap from the one discipline to the other is not any longer as big as it once looked.

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[12] It might be noted here that stasis theory had its origins in the study of legal argumentation (Hohmann 1989; 1990).

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