When Expert Opinion Evidence Goes Wrong


Abstract

This paper combines three computational argumentation systems to model the sequence of argumentation in a famous murder trial and the appeal procedure that followed. The paper shows how the argumentation scheme for argument from expert opinion can be built into a testing procedure whereby an argument graph is used to interpret, analyze and evaluate evidence-based natural language argumentation of the kind found in a trial. It is shown how a computational argumentation system can do this by combining argument schemes with argumentation graphs. Frighteningly, it is also shown by this example that when there are potentially confusing conflicting arguments from expert opinion, a jury can only too easily accept a conclusion prematurely before considering critical questions that need to be asked.

Key Words: unjust conviction, expert opinion evidence, ad verecundiam fallacy, faulty legal reasoning

1. Introduction

In this paper an example (a test case) that represents a challenge for evidence law is outlined and analyzed in order to try to explain how computational argumentation tools can be applied to real examples of argumentation that are both significant and problematic in evidence law. The example is also highly significant for argumentation theory in general because it not only shows how such arguments can be evaluated as strong or weak in an objective manner, which is no small achievement from a point of view of argumentation theory. It also illustrates how arguments from expert opinion can be used as argumentation tactics that are rhetorically powerful in persuading an audience, such as a jury, to come to accept a conclusion prematurely before considering critical questions that need to be asked.

The example studied in this paper concerns a man who was convicted of the murder of his wife when she was found dead at the bottom of a set of stairs in their house. There was an enormous spattering of blood on her body, in the stairwell and on the wall. She also had serious wounds to the back of her head. Much of the evidence in the trial was based on expert testimony by forensic experts. However, the experts offered conflicting opinions. When new evidence came in after the trial suggesting the woman had been attacked by an owl and ran inside, the verdict was appealed. In a retrial hearing, key bloodstain evidence presented by one of the experts was shown to be dubious. This paper applies argumentation tools to analyze the arguments from expert opinion on both sides to explain what went wrong.

The case is well known to the public. It was the subject of an award-winning French documentary in 2004 entitled The Staircase, has been featured on true crime television documentary shows\(^1\), and there is even a movie about it\(^2\). The Wikipedia page on Michael Peterson (murder suspect)\(^3\) lists eleven TV programs and two radio programs about the case. My interest in it in this paper is that it centrally involved argument from expert opinion, and conflicts

\(^1\) https://the-line-up.com/the-staircase-documentary
\(^2\) http://www.imdb.com/title/tt0901693/
\(^3\) https://en.wikipedia.org/wiki/Michael_Peterson_(murder_suspect)
of arguments from expert opinion, a subject that is taken to be important in argumentation studies (Walton, 1997; Mizrahi, 2013; Seidel, 2014; Koszowy and Walton, 2017).

This paper combines three computational argumentation systems to model the sequence of argumentation in that famous murder trial and the appeal procedure that followed some years later. The first one is version 2 of the Carneades Argumentation System. The second one is version 4.3 of Carneades. The third is the hybrid argumentation system of Bex, a system that combines evidence-based argumentation with script-based stories that take the form of explanations. The paper begins by modelling the argumentation with Carneades 2, and combines it with the hybrid system of Bex. This enables it to represent aspects of the argumentation in the trial that Carneades cannot yet model with its current resources. However, since Carneades could be extended to model evidential stories, the paper shows how future work could take advantage of the possibility of combining the two systems.

It is argued that current formal and computational argumentation systems have the resources to model this kind of argumentation procedure using argumentation schemes and other devices that enable the drawing of a clear distinction between three kinds of tests applied to the evaluation of arguments from expert opinion. It is also shown how these models have the capability of evaluating such arguments to show whether a given instance of this type of argument can be said to fail or not, based on the evidence available in the case in point.

The argumentation studied in the example included a trial and a retrial hearing in which much of the evidence woven through the argumentation connecting both cases was based on the testimony of numerous experts. There is considerable legal literature on the use of expert opinion evidence in trials. The rules it is subject to in the American legal system have evolved over the years (Godden and Walton, 2006). This paper instead is a study of a single case to analyze what went wrong with the evidential reasoning using tools from computational argumentation.

It is argued that the best way to test how well these current computational resources in AI and law are working to help argument analysts evaluate and work with types of argument, such as argument from expert opinion, that have often been highly problematic in the past is to use real examples of arguments from natural language discourse, sometimes even substantial and lengthy ones, to see how well the system can get us past the point where we are now when dealing with such arguments. The purpose of this paper is to take a substantial example of a murder trial where the outcome was subject to an appeal procedure set into motion by new evidence, and where the argument from expert opinion, including several instances of it, was the dominant evidential feature around which the issue of the trial turned. Naturally, using a real example of this kind is an extremely tough test for any formal argumentation model to be subjected to. Even so, the argument presented here is that the laying of some of the groundwork for building this kind of method with the promise of helping to improve the evaluation of the argumentation in such controversial and difficult cases is a useful step. It is part of the interdisciplinary process of feedback and improvement between argumentation theory and computational argumentation resources being developed and applied in AI and law.

Section 2 shows that there has been a continuous use of argument graphs to represent evidential reasoning in legal trials from the time of Wigmore’s evidence charts (Wigmore, 1931). Its use has widened considerably with the advent of formal and computational models of legal argumentation used to evaluate, weigh and invent arguments where the first step is to interpret the natural language argument as a graph structure linking premises and conclusions. The Carneades Argumentation System is a case in point. Argumentation schemes are another tool widely used in AI and law, and now developments are converging toward combining the two
tools. The particular form of argument used to illustrate this way of approaching legal reasoning and argumentation in trials in this paper is that for argument from expert opinion. This scheme is introduced along with the standard set of critical questions matching it.

A fundamental problem in formal argumentation models that combine argument graphs with argumentation schemes is how to represent critical questions matching a scheme in a graph structure. The problem is that the nodes in the graph represent propositions and there is no easy way to represent questions in such a graph, or at least one that has been widely explored so far in AI and law. Section 3 shows how Carneades solves this problem by reformatting each critical question matching a scheme as an additional premise in that scheme that can do the same job that a critical question does. This section explains the nuts and bolts of the solution so that it can be applied to the extensive argumentation from expert testimony in the trial.

Section 4 provides argument graphs to display the argumentation structure of the beginning parts of the trial where six different expert opinions, some of which are in conflict with others, resulting in massive conflicts within the body of evidence at that point.

As shown in section 5, at that point in the trial one expert marshaled a mass of evidence to support a story about how the defendant carried out the murder of his wife. This story proved to be powerfully persuasive to the jury. The reasons his presentation was taken to be so powerful were not only the credentials of the expert and the impressive way he presented his testimony. Another reason was the way his account of the alleged murder held together as a script or story. To analyze this aspect of the argumentation in a trial a different kind of graph is introduced in section 5 to represent the account given by this expert. The tool used here is a hybrid theory that combines arguments with explanations, where the persuasiveness of an explanation is enhanced by how it fits together as a connected sequence of actions that can strongly appear to be persuasive in the common sense manner. In the end, this kind of evidence was enough to convince the jury that the defendant was guilty of murder.

Section 6 describes what happened when new evidence came in to suggest that there could be an alternative explanation. The explanation at first appeared implausible, but more and more evidence built up supporting it, and proved to be persuasive enough to challenge the original theory. This development eventually led to an appeal procedure that was successful in challenging the impressive testimony of the one expert. In this section, the argumentation is represented by two argument graphs. One displays the opposing arguments from expert opinion, and the other is a hybrid graph outlining the opposing story supported by this new evidence.

Section 7 describes the appeal, which took the form of a retrial hearing in which the cross-examination of the leading expert showed that the argumentation in his initially persuasive testimony proved to be full of holes. It is shown that this rebuttal essentially took the form of using critical questions matching the scheme for argument from expert opinion to cast doubt on the story initially put forward by the leading expert. Section 8 shows how this procedure of challenging the expert’s testimony can be modeled using Carneades version 2.1. Section 8 makes an especially significant advance by also showing how version 4.3 can be used in an even more perspicuous manner to model the argumentation in the trial. In the Carneades graphs used to represent the evidential arguments to this point in the paper, the applications of the scheme for argument from expert opinion are merely indicated manually in the diagram by labeling particular nodes of the graph. Version 4.3 has the scheme hardwired into the system.

It is common knowledge that arguments from expert opinion, and arguments from authority generally, have standardly been treated in the logic textbooks under the heading of informal fallacies, or common errors that can be deceptive and are worth studying in logic. This is been
known since the time of Aristotle. From a point of view of argumentation theory then, one question that is sure to arise is how such an analysis of argumentation in a trial so heavily based on argument from expert opinion relates to this tradition of informal logic.

Section 9 provides a brief discussion of this issue, showing its relevance to the trial. Section 10 is the conclusion of the paper. It proposes four tests that make up the general procedure in outline for determining the strength or weakness of any argument from expert opinion.

2. Argumentation Methods

There is a continuing history of using argument diagrams to represent evidential reasoning in legal trials in a diagrammatic form. Wigmore (1931) used evidence charts to represent the connected masses of evidence on both sides of a case. Wigmore diagrams, which he called evidence charts, have a complex system of notations. Each square or circle in a chart represents some presumed evidential fact, and arrows are used to represent an inference from one fact to another. By this means a Wigmore chart is meant to display the complex structure of the evidential reasoning in a mass of legally admissible evidence in a case at trial. One chart represents the evidence on the prosecution side in a trial while another represents the evidence on the defense side, but the two can even be connected, since the ultimate conclusion of the one is the opposite of that of the other. Twining (1985) and Anderson and Twining (1991) applied a simplified version of this evidence charting technique to build detailed analyses of evidential reasoning in trials. Schum (1994) used comparable diagrams to model evidential reasoning in such classic cases as the Sacco and Vanzetti trial.

The graph-theoretic structure of a Wigmore chart is comparable to that of an argument diagram of the kind used in informal logic. Araucaria, an early system of computer-assisted argument diagramming developed in 2001 by Chris Reed and Glenn Rowe in the Argumentation Research Group at the School of Computing in the University of Dundee, Scotland4, has four pioneering features important for the concerns of this paper. First, it contains a menu of argumentation schemes that the user can apply to an argument diagram he or she is working on and show where a particular type of argument was used within the diagram. Second, it has lists of critical questions matching this scheme. Third, it enables a user to automatically transfer the given argument diagram the user had drawn up from the familiar diagramming format used in informal logic to the format of the Wigmore style diagram resembling a Wigmore chart. Fourth, recent developments in Dundee have engineered technology for groups of argument analysts to collaborate by working together to build an argument graph, adding new arguments and correcting errors found in another contributor’s version.

Bex et al. (2003) argued for the applicability of argumentation schemes and argument diagramming tools originating from Wigmore’s charting method for modeling evidential reasoning. They offered a formal account of Wigmore-style evidential reasoning with argumentation schemes as it applied to the Sacco and Vanzetti case. But this is not the only development of argument diagramming currently used in artificial intelligence and law. The Carneades Argumentation System5 is a formal and computational model of legal argumentation that bases its output on the input by a user of evidential propositions and arguments linked together into a graph structure (Gordon and Walton, 2016). Essentially, the user begins by constructing an argument graph and inserting premises, conclusions and argumentation schemes

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4 http://araucaria.computing.dundee.ac.uk/doku.php
5 https://carneades.github.io/
into the diagrams at nodes specified for the purpose. Once the user has provided input on the
evidence in a particular case in this way, the system provides output that enables the user both to
evaluate the argument and to extend the argument diagram by inventing new arguments.
The Carneades Argumentation System is open source software⁶ that has evolved through four
main versions. Carneades 1 was the first version, implemented in Scheme (2006-2008).
Carneades 2 is the desktop version of Carneades with the graphical user interface, called the
Carneades Editor (2011). Carneades 3 is the web-based version of Carneades, developed in the
IMPACT and MARKOS projects (2010-2015).
Version 2.2 of Carneades allowed the user to choose from a menu of schemes, including the
scheme for argument from expert opinion, and type in the name of the scheme, which then
appeared in the selected argument node in the argument graph. However version 4.3 made a
significant step forward by hardwiring a selected set of twenty-five schemes into the system so
that when the user selects a scheme, the argument is immediately configured in the argument
graph on the computer screen with the nodes representing the premises and conclusion of that
particular scheme, along with its matching critical questions. From a point of view of
argumentation theory, as stated, this capability is a significant step, because it combines
argument graphs, the so-called argument diagrams, with the argumentation schemes, using both
to evaluate a given instance of argumentation. New features of 4.3 include argument validation
by matching arguments to schemes, argumentation scheme validation, checking for syntactic and
semantic errors in a knowledge-base, and implementation of a Constraint Handling Rules (CHR)
inference engine, in Go, for constructing arguments.
The aspect that will be particularly studied in this paper is that of the management of the
evaluation of argumentation in cases where there are conflicting arguments from expert opinion
in a body of evidence, especially where critical questioning of these arguments is vitally
important in the argumentation in a trial setting.
The form of argument specified below represents the argumentation scheme for the argument
from expert opinion (Gordon and Walton, 2006, 202; Walton, Reed and Macagno, 2008, 310).

Major Premise: Source $E$ is an expert in subject domain $S$ containing proposition $A$.
Minor Premise: $E$ asserts that proposition $A$ is true (false).
Conclusion: $A$ is true (false).

There are also other ways of expressing this scheme. In a second way, the major premise is
broken down into three separate premises, one stating that $E$ is an expert, a second one
specifying the subject domain of the area of expertise, and a third one stating that the domain $S$
contains the proposition $A$. However, in some instances, the format of the scheme cited above is
better because it simplifies the drawing of argument diagrams in complex cases by reducing the
number of nodes in the graph. In the argument graphs in this paper, sometimes we will use the
one formulation of the scheme and sometimes the other.
There are six basic critical questions matching the second formulation of the scheme for
argument from expert opinion (Walton, Reed and Macagno, 2008, 310).

*Expertise Question*: How credible is $E$ as an expert source?
*Field Question*: Is $E$ an expert in the domain $S$ that $A$ is in?
*Opinion Question*: What did $E$ assert that implies $A$?

**Trustworthiness Question**: Is E personally reliable as a source?

**Consistency Question**: Is A consistent with what other experts assert?

**Backup Evidence Question**: Is E’s assertion based on evidence?

It is useful here to explain the difference between the expertise question and the trustworthiness question. The expertise question is about the level of the expert’s depth of knowledge in the field. The trustworthiness question asks about the expert’s ethical character (*ethos*). Considerations here are whether the expert might be lying, may have been known to have lied in the past (character for truthfulness), or be biased by having a personal or financial interest on the matter.

If a respondent asks any one of the six critical questions, the original argument is tentatively suspended until the question has been answered adequately. The problem now posed is how this burden of proof should shift back and forth in a dialogue.

3. Assumptions and Exceptions

The problem that led to the distinction drawn in Carneades between assumptions and exceptions as a way of managing critical questions in computational argumentation systems was formulated by Prakken, Reed and Walton (2004). The problem arises from the phenomenon of a shift in the burden of proof in a persuasion dialogue, the kind of argument found in a trial, where there is a need to construct arguments using argumentation schemes. The fundamental question was this. Suppose that an argument instantiating the scheme has been put forward and a critical question matching the scheme has been asked. Does merely asking the question make the argument default, or is there a burden of proof on the questioner to provide evidence supporting the question before the argument is refuted? As shown by Prakken, Reed and Walton (2004, 2) the global burden of proof is fixed during a persuasion dialogue but at the local level the burden of proof, sometimes called the evidential burden in law (Prakken and Sartor, 2009), shifts back and forth. This problem is particularly acute for systems, such as the Carneades argumentation system, that represent the argumentation in a case using a graph structure in which the nodes containing the factual evidence are propositions. For this reason, it is a difficulty to represent questions in such a system without making the formal model more complex.

Using the example of the critical questions matching the scheme for argument from expert opinion, the solution that was provided was to divide the critical questions into two categories, called assumptions and exceptions (Walton and Gordon, 2005). Earlier, in (Prakken Reed and Walton, 2004, 2), the assumptions had been called presumptions, but it was pointed out by Henry Prakken that this latter term at a more specific and sometimes controversial meaning in law. For this reason, the term ‘assumption’ was adopted. The solution to the problem (Walton and Gordon 2005; Gordon and Walton 2006) was to rule that with respect to any critical question classified as an assumption, merely asking the question is sufficient to defeat the argument. With critical questions classified as exceptions, the evidential burden of proof is the other way around. In order to make the exception defeat the argument, additional evidence has to be given to support the claim that the exception holds. Following this classification, the trustworthiness critical question and the ‘consistent with other experts’ critical question were classified as exceptions, and the remaining critical questions were classified as assumptions. An analysis of the argumentation scheme for argument from expert opinion was used in (Prakken Reed and Walton, 2004) to validate this approach.
The Carneades Argumentation System enables the critical questions to be represented in argument diagrams by classifying them into three subtypes called ordinary premises, assumptions and exceptions (Gordon and Walton, 2016). With assumptions, the proponent has the burden of proof. The standard premises of the argument from expert opinion in the argumentation scheme are treated as assumptions, meaning that the proponent of the argument has the burden of proof to support the premise with arguments if such a premise is challenged. The other category is that of exceptions, where the burden of proof is reversed. When a type of critical question representing an exception is posed, merely asking the question is not enough to defeat the original argument from expert opinion. Some backup evidence supporting the question needs to be offered before the argument is defeated.

In the approach of Gordon and Walton (2006; 2016), the critical questions are divided into three categories as the following amplified version of the scheme indicates.

- Ordinary Premise: $E$ is an expert in subject domain $S$ containing proposition $A$.
- Ordinary Premise: $E$ asserts that $A$.
- Assumption: It is assumed to be true that $E$ is a knowledgeable expert.
- Assumption: It is assumed to be true that what $E$ says is based on evidence in field $F$.
- Exception: $E$ is not trustworthy.
- Exception: What $E$ asserts is not consistent with what other experts in field $F$ say.
- Conclusion: $A$ is true.

An ordinary premise is an explicit premise stated in the argumentation scheme. It is assumed to be true and if an opponent claims it is not true, he must back it up with evidence. The burden of proof is on the original arguer to defend her claim if it is questioned. The same allocation of burden of proof applies to the assumptions. The exceptions are different, however. If the opponent claims that one of these premises does not hold, the burden of proof is on him to back up that claim with evidence.

![Fig. 1: Expert Opinion Evidence Defeated by an Exception in Carneades](image-url)
For example, if the opponent says that expert $E$ is not trustworthy, he must give some evidence to back up that claim, or otherwise the proponent can simply respond by saying, “of course this expert is trustworthy – if you are going to impugn his trustworthiness, you had better give some evidence to back up that allegation”.

How a typical Carneades argument graph appears on the screen is shown in figure 1. The propositions shown in the rectangular text boxes are premises or conclusions in a sequence of argumentation. The round nodes indicate pro or con arguments, indicated respectively by plus and minus signs. In Fig. 1 there are only pro arguments, three of them. If a proposition appears in a rectangular box with a green background, it indicates that that proposition has been accepted by the audience. The reader will note that the four propositions shown in green backgrounds in the middle of the diagram are instantiations of the four premises required by the scheme for argument from expert opinion. The name for that scheme appears below the argument on the left. Since all four premises are accepted, and the argument fits the scheme for argument from expert opinion, Carneades automatically calculates that the conclusion needs to be accepted as well. If that were the only evidence to be considered, Carneades would automatically color the proposition on the left with a green background.

However, in this instance there are other arguments that need to be taken into account. A premise joining a rectangular node to a circular argument node indicates that the premise is just an ordinary premise, not an exception or an assumption. An assumption is indicated by a broken line with small dashes. An exception is indicated by a broken line with long dashes. One assumption and two exceptions are shown in this argument. The two assumptions are shown in white, indicating that they are not accepted. The exception however is shown in green because its premise is supported by evidence, namely the statement that $E$ has a PhD in $F$. Because the exception is supported by evidence, it successfully defeats the argument from expert opinion. So in the figure, the proposition that $A$ may be taken to be true is shown with a white background.

Given the scheme and set of critical questions, typical cases where there is a problem about the argument from expert opinion to be dealt with are ones where the source cited is not really an expert, where the expert is not even named, or where the source is an expert but in a different field. In such cases the critical questions can be used to locate the problem and repair the fault by asking further questions. But there are also more complex cases, like the one studied in this paper, where many different arguments from expert opinion are intertwined with each other so that the problem is to see how each one relates to the others within a larger body of evidence. These cases require an approach that combines argument diagrams with argumentation schemes and enables any given instance of argumentation to be evaluated by building an argument graph that is essentially an interpretation of the given argument that enables an evaluation of the validity of each of the arguments in any given sequence that appears in the graph.

The key weakness in any formal and computational argumentation system of this kind is that it requires the user to start by drawing a graph that represents the structure of the argumentation thought to be displayed by the text representing the argument in natural language discourse. The problem, very well known in natural language computing and computational linguistics is that arguments are subject to different interpretations and so arguments can arise at a metalevel about which of several interpretations is the best one to fairly represent the argumentation in the text. This also means that an argument graph of what looks like a fairly simple argument can turn out to be quite complex quite rapidly as six as assumptions and exceptions are taken into account along with unstated premises or conclusions that are necessary for the argument to make sense. This will be illustrated later in the example, which is a very complex case involving not only the
whole trial with all kinds of complex arguments from expert opinion and rebuttals to them, but also involves an appeal in which the original arguments were attacked.

For these reasons we have approached the owl example in a way that will help the reader to interpret the arguments in the case and understand their structure by chopping up the lengthy sequence of argumentation into manageable bits that consist of just a few key arguments where argumentation schemes and simplified argument graphs are used to interpret and explain the structure of the arguments. It is inevitable that such a part by part approach needs to be made because even a moderately simple part can easily have a tendency to explode into a very large argument graph that cannot be visualized on a computer screen.

Let’s take an example to show how this can be done. The Carneades Argumentation System enables the critical questions to be represented in argument diagrams by classifying them into three subtypes called ordinary premises, assumptions and exceptions (Gordon and Walton, 2016). With assumptions, the proponent has the burden of proof. The standard premises of the argument from expert opinion in the argumentation scheme are treated as assumptions, meaning that the proponent of the argument has the burden of proof to support the premise with arguments if such a premise is challenged. The other category is that of exceptions, where the burden of proof is reversed. When a type of critical question representing an exception is posed, merely asking the question is not enough to defeat the original argument from expert opinion. Some backup evidence supporting the question needs to be offered before the argument is defeated.

![Figure 2: Example of a Simplified Carneades-style Argument Graph](image)

In this example, the ultimate conclusion of the sequence of argumentation is shown in the proposition in the rectangular node at the far left. Supporting this conclusion is an argument from expert opinion with three premises. The two premises at the top are the premises required to make an argument fit the scheme for argument from expert opinion. The top premise containing the statement that Bob is an expert in ballistics (including bullet matches) fits the major premise of the scheme. The premise just below matches the minor premise describing what the expert said or asserted. The third premise, the one at the bottom, is treated by the Carneades Argumentation System as an additional premise that represents one of the critical questions matching the scheme. For simplification, the field question is omitted.

Here we see how the consistency with other experts critical question is represented in the form of an additional premise of the argument from expert opinion (an exception). A more detailed account of how this procedure works in Carneades is given in section 10. Note that the way this argumentation would be modeled using Carneades, even if all the premises of both arguments are colored green, the conclusion is shown in white, meaning that it is neither
accepted or rejected. That is because argument from expert opinion is a defeasible argument that can be attacked by an undercutter that does not show that the conclusion is false (rejected).

Figure 1 thus shows how a pro argument from expert opinion can be attacked by a con argument from expert opinion. In this instance another expert, Alice, says that the bullet does not match Ed’s gun. So here we have illustrated a common example of a conflict between two arguments from expert opinion. It is this sort of conflict that will be the main feature of the analysis of the argumentation in the owl example pursued in this paper.

Some other current argument diagramming tools are also important for the work of this paper. In addition to schemes and Carneades-style argument diagrams, the paper will use anchored narratives of the kind modeled by the hybrid system of Bex (2011). Pennington and Hastie (1993) applied script-based stories to examples of evidential reasoning in criminal law where argumentation in typical cases can be viewed as putting forward two opposed accounts of what supposedly took place. Wagenaar, van Koppen and Crombag (1993) called these stories anchored narratives because the competing stories can be compared not only according to their plausibility and coherence but also by the amount and quality of evidence supporting (or attacking) each story. Bex (2011) built a hybrid system of argument diagramming that can represent stories of the kind put forward by both sides in a trial along with evidential reasoning used to support or attack the story. This tool provides artificial intelligence with a method for evaluating argumentation in trials by comparatively weighing the plausibility of one story against an alternative story that leads to an opposite conclusion. It is called a hybrid framework because it combines argumentation techniques (argument diagrams) with stories. In a hybrid-style diagram, arguments (evidence) can support or attack a story, enabling an argument evaluator to choose between the two stories on the basis of the existing pro and con evidence.

4. The Trial and the Expert Opinion Evidence

On December 9, 2001 Michael Peterson, a writer who lived with his wife Kathleen in North Carolina, made an emergency call to report that he had just found her unconscious and that he suspected that she had fallen down the stairs. When police officials and paramedics arrived at the Peterson house they found Mrs. Peterson’s body at the bottom of a set of stairs. There was an enormous amount of blood on her body, as well as smears and splatters of blood on the stairs and the stairwell wall. There were serious wounds to the back of her head. A paramedic who arrived at the scene testified that Mr. P’s shirt was blood-soaked and had spatter spots on it (State v. Peterson, 2007, 2). He testified that there was an enormous amount of blood at the scene and that the blood had been smeared along the wall (State v. Peterson, 2007, 3). Mr. Peterson told the paramedics that he has just gone outside to turn the lights off, and when he came back he found his wife lying there at the bottom of the steps.

The autopsy was conducted by Dr. Deborah Radisch, a forensic pathologist in the Office of the Chief Medical Examiner. Her report concluded that Mrs. Peterson had sustained severe injuries, including a fractured neck cartilage and seven lacerations to the top and back of her head, and that she had died from the blood loss caused by these injuries. The report also stated that these injuries were consistent with blows from a blunt object. From this evidence Dr. Radisch concluded that these injuries were caused by a homicidal assault using a light yet rigid
weapon, specifying a blow poke\(^7\) that had been a gift from Mrs. P’s sister. This evidence is summarized in the argument diagram shown in figure 3.

*Figure 3: Arguments from Expert Opinion of the Medical Examiner*

The ultimate conclusion, the statement that her injuries were caused by an assault using a blow poke, appears in the rectangle at the bottom left. Also shown in the diagram are three arguments from expert opinion, all based on the expert testimony of the medical examiner present at the crime scene, Dr. Radisch. Since Mr. P was the only person known to be in the area when the assault was committed, this evidence points to him as the perpetrator.

Much of the evidence in the original trial was also based on expert testimony (State v. Peterson, 2007, 7-80), but not all of it pointed to Mr. P. An expert in forensic neuropathology testified the wounds on the victim’s head were more characteristic of falling on stairs, but injuries from being struck with an object could not be completely ruled out. Another expert witness, a forensic scientist, noted that there were over 10,000 blood drops at the crime scene which appeared to be moving in different directions. He stated that this would be inconsistent with the typical beating. Yet another expert witness, a professor of biomechanics, said that the injuries were inconsistent with being struck by a blow poke, but were consistent with the fall down the stairway. Still another expert witness, a former professor of biomedical engineering, stated that the injuries were not consistent with a fall but were consistent with a beating by a blunt instrument. Here we have conflicting expert opinion testimony of a kind often called “the battle of the experts”. According to the retrial hearing document (State v. Peterson, 2011, 2), “the experts who testified at trial offered diametrically opposed opinions as to whether there had been an accident or a beating”.

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\(^7\) A blow poke is a long poker built as a hollow metal tube. You blow into the hole at the one end to help the embers in a fireplace spark back into flame without getting burned. At the other end is a prong for moving the logs.
As shown in figure 4, we are now presented with six arguments from expert opinion, some of them supporting one conclusion while others support an opposed conclusion. The testimony of the expert in forensic pathology E1 supports the conclusion of death by accident. In contrast, the testimony of E2, a forensic scientist, supports the conclusion of death by beating. The testimony of E3, the expert in biomechanics provides a pro argument from expert opinion supporting the hypothesis of death by accident. But E3 also testified that the injuries were inconsistent with an assault by a blow poke, posing a con argument from expert opinion that goes against the hypothesis of death by beating. E4, an expert in biomedical engineering, testified that the injuries were not consistent with the fall, thereby providing a con argument from expert opinion going against the hypothesis of death by accident. E4 also provided a pro argument supporting the hypothesis of death by beating by claiming that the injuries were consistent with beating by a blunt instrument. So here we have testimony from four expert witnesses, two of them supporting the death by accident hypothesis while the testimony of the other two supports the hypothesis of death by beating.

5. Additional Expert Opinion Evidence in the Trial
One instance of expert testimony evidence was especially important on the prosecution side. Duane Deaver, an agent of the SBI (the North Carolina State Bureau of Investigation, a state-level law enforcement agency in North Carolina), testified as an expert in bloodstain pattern analysis and three incriminating statements were especially important: (1) that Mrs. P was struck a minimum of four times with a blow poke prior to falling down the stairs, (2) that Mr. P had attempted to clean up the scene, including his pants, prior to police arriving (based on Agent Deaver’s bloodstain analysis), and (3) that Mr. P was in close proximity to Mrs. P when she sustained her injuries. Taken together, these three claims, all based on the bloodstain evidence, strongly suggest the conclusion that he had beaten her to death with the blow poke. This evidence appears to corroborate the expert opinion evidence of Dr. Radisch, fitting in with it very well to support the blow poke theory.

![Figure 5: Bloodstain Pattern Analysis Testimony](image)

D gave further testimony in the original trial which was summarized by the prosecutor as presenting a detailed story which supposedly explained the sequence of events in which Mr. P had beaten Mrs. P with an object (State v. Peterson, 2011, 11). D claimed that the assault began by the fifteenth step where she went down and that he struck her at least two more times near the corner. As he described the situation, she was fighting for her life and he was in close proximity to her when at least one impact occurred. D claimed he could tell from the blood spatter evidence that Mr. P stood over Mrs. P and struck her. D testified that the shoe print in blood on her sweatpants meant that he had to be in close proximity to her when these actions took place. In retrospect, it seems incredible that all these detailed conclusions could be drawn by inferences from traces of dried blood. But at the time, because of the difficulty jurors have of evaluating
expert opinion evidence, such a detailed account of what allegedly happened would undoubtedly have appeared to be highly persuasive.

Figure 6, a diagram made following the style of the hybrid theory of Bex, (2011), presents a general outline of D’s story showing it was backed by the evidence he presented. The propositions in the rounded rectangles represent the actions and events. The curved arrows represent the sequence of steps connecting each event in the story to the next. The three propositions in the squared rectangles at the bottom (indicated by the darker borders) contain propositions that represent items of evidence.

Obviously this figure is a simplified representation of the extremely detailed story presented by D and the elaborate evidential claims he made to back it up. But it gives the reader an idea of how the hybrid theory can relate the story and evidence. Below a more detailed account of the murder story and the arguments for and against it will be presented.

D’s story was especially persuasive in the trial because it seemed to corroborate other testimony by expert witnesses supporting the blow poke theory. As pointed out in the retrial hearing (2011, 12), the prosecution, in his closing arguments, stressed the importance of the blood spatter evidence and stated that the testimony of D was central to their case. D even went on to claim that Mr. P’s continuing to assault Mrs. P showed that his attack on her was premeditated. His testimony presents evidence supporting all the elements necessary for the crime of murder to have been committed and offers a story supporting that hypothesis. It is not hard to see then that the claims made by D in his testimony would be highly persuasive in making an argument for conviction. They seem strong enough to break the previous deadlock in the network of arguments from expert opinion pro and con.

On December 20, 2001 Mr. P was charged with first-degree murder by a Durham County Grand Jury (State v. Peterson, 2007, 1). The State contended that Mr. P intentionally killed his wife by striking her repeatedly with a blow poke, causing her to fall down a winding staircase. This was the argument put forward by the prosecution in the murder trial. The defense maintained that Mrs. P died as a result of an accidental fall. The defense argued by claiming that her skull had not been fractured by the blows and that the damage was inconsistent with injuries of the kind that would be caused by a beating death. On October 10, 2003 the jury found Mr. P guilty of murder and sentenced him to life imprisonment without parole. In 2007 Mr. P made
appeals to the North Carolina Court of Appeals and the North Carolina Supreme Court, but both were rejected. He appealed his conviction but the North Carolina Supreme Court re-affirmed the conviction in 2006 (State v. Peterson, 2007, 3).

6. New Evidence and Story

In 2009, T. Lawrence Pollard, one of the Petersons’ neighbors, suggested to the police that an owl might have been responsible after he learned of an evidential finding. A crime lab had found a wooden sliver from a tree limb and a microscopic owl feather entangled in a clump of Mrs. P’s hair. A subsequent examination found two more microscopic owl feathers. The theory that she had been attacked by an owl was ridiculed by the newspapers\(^8\) and Dr. Deborah Radisch, who had conducted Mrs. P’s autopsy, claimed that it was unlikely that an owl, or any other type of bird, could have made wounds as deep as those on Mrs. P’s scalp.

![Diagram](image.png)

**Figure 7: New Expert Opinion Evidence**

However, three other experts offered further evidence that disputed this claim and thereby made the owl theory seem much more plausible\(^9\). Pollard, who was now one of P’s attorneys, filed affidavits to ask the superior court judge to turn over documentation related to Mrs. P’s scalp.

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\(^8\) [Link](http://owltheory.blog.lemonde.fr/2008/09/05/feathers-flying-in-michael-peterson-case-by-bernie-reeves/)

\(^9\) [Link](http://www.newsobserver.com/news/special-reports/article10365449.html)
autopsy. The affidavits included a letter from Robert C. Fleischer, head of the genetics program at the Smithsonian National Museum of Natural History. He wrote that he could conduct a DNA test on the feathers to tell what species of bird they belong to. A second expert, Dr. Alan van Norman, wrote that the lacerations on Mrs. P’s scalp had the shape of a trident. Van Norman was listed as a neurosurgeon and owl expert. He stated that the trident shaped injuries are not consistent with attack by a blunt instrument but with attack by a large bird of prey. Dr. Patrick T. Redig, a professor of veterinary medicine at the University of Minnesota, agreed with the owl theory. Kate P. Davis, executive director of Raptors of the Rockies, wrote that it is not uncommon for owls to attack people. Pollard argued that had the jury been presented with this evidence it would have affected their deliberations and their ultimate verdict.

This new evidence, based on four pro arguments from expert opinion, is represented in figure 7. This new evidence presented a new story that can be contrasted with the original blow poke story of the prosecution. So now we have two different stories on what happened, based on the facts of the case and evidence based on arguments from expert opinion.

The reader will recall that the hypothesis that Mrs. P was attacked by an owl seemed implausible when the news media first reported the story. There are two reasons making this account appear implausible. One is the common knowledge that owls are not dangerous to humans. Most of us have probably never heard of an owl attacking human in this way. The other is that one wonders how an owl would have got into the Petersons’ house. These questions can be addressed by filling out the background circumstances of the story a little further.

According to the account given in the trial, Mr. P alleged that he and his wife had been outside drinking some wine when she decided to leave him there for the time being and go back into the house. What could have happened then is that she was attacked by the owl outside the house and then ran into the house, making it as far as the stairwell before collapsing. The other question of plausibility is addressed by the expert testimony of Kate Davis, who offered evidence supporting the claims that it is common for owls to attack people, and that such attacks can be very dangerous or even fatal.

A hybrid diagram showing how the new evidence brought forward in the expert opinion testimony diagrammed in figure 6 supports the story is shown in figure 8. So at this point the expert opinion evidence is still in a deadlock situation. It started out with expert opinion arguments claiming that Mrs. P was beaten to death, but then once several other expert opinion
arguments were taken into account, there was a deadlock or battle of the experts. At that point the blood spatter evidence of D appeared to break the deadlock by shifting the burden of proof against the murder theory. At the next point new evidence was introduced supporting a different story, the owl theory. The owl theory not only holds together as a consistent story that makes sense, but was also supported by a considerable body of expert opinion evidence. This development suggested the possibility of an appeal.

7. The Retrial Hearing

After a series of newspaper articles were critical of the methods of the SBI agents, Roy Cooper, Atty. Gen., led an investigation that found the work of D among the worst in a series of flawed criminal cases. Pollard filed affidavits to order the state Medical Examiner’s Office to turn over documentation in the Peterson case to P’s attorneys. However, Superior Court Judge Orlando Hudson barred Pollard from filing further motions because Pollard did not represent Peterson. The new motion was filed in August 2010 by David Rudolf, one of Peterson’s original attorneys, who volunteered to act pro bono in further proceedings challenging the SBI testimony. In August 2010, Mr. P, through his counsel Mr. Rudolf, put a motion for appropriate relief before the Court of Justice of the State of North Carolina. A motion for appropriate relief in North Carolina is a plea for a retrial hearing on the basis that the conviction was obtained in violation the defendant’s constitutional rights. Normally an appeal is made in a higher court, but a motion for appropriate relief must be argued in the same trial court in which the person was convicted.

The main rationale behind the motion was that the experts who had testified at the trial offered diametrically opposed opinions on whether there had been an accident or a beating (State v. Peterson, 2011). In particular, Rudolf cited some dubious aspects of D’s expert testimony. The SBI Bloodstain Pattern Analysis unit, trained by D was operating without any written policy from 1988 until 2009. The North Carolina Attorney General suspended operations of the unit in 2010 expressing doubts about their training (State v. Peterson, 2011, 6). The district attorney argued in his opening statement that the testimony of D, the blood spatter expert from the SBI, was critical. Rudolf argued in the hearing that the critical testimony about how the bloodstain patterns supposedly proved that Mr. P had beaten his wife to death came from D. When D was cross-examined at length about his opinions, the answers he gave were unconvincing, often relying on interjecting irrelevant and false information to distract the jury (State v. Peterson, 2011, 12). D’s testimony as an expert was also discredited because of his previous work in a large number of flawed criminal cases. An audit found that he had falsely represented evidence in thirty-four cases. The findings of this investigation led to D’s suspension as an SBI analyst.

For an appeal such as a retrial hearing of this kind to be granted, new evidence has to be brought forward that was not available at the time of the original trial. The finding and investigation of the owl feathers was obviously one candidate as a new body of evidence to meet this requirement, but Rudolf, an experienced and highly trained lawyer focused on another point of attack – the expert opinion testimony in the original trial. He opened the retrial hearing by warning of the danger of relying too heavily on expert opinion evidence in trials. Jurors are generally not experts, so they face problems in evaluating complex expert testimony because they can only rely on their personal knowledge, life experiences and common sense (State v. Peterson, 2011, 3). Rudolf cited a study of forensic sciences by the National Academy of Sciences in 2009 that specifically pointed out certain limitations on bloodstain pattern analysis,
even suggesting that the opinions of bloodstain pattern analysis are more subjective than scientific (State v. Peterson, 2011, 4). The danger is that some experts can extrapolate beyond what can be supported by the evidence, and that juries may be unable to determine when an inference drawn by an expert has gone too far.

Rudolf argued that the bloodstain pattern analysis testimony presented by D in the original trial was a case in point. D had made three claims that were not corroborated by the evidence of the other experts. He claimed that blood spatter nine feet up from the floor in a hallway outside the stairwell indicated the point where the assault had started. He claimed that an area of impact on one of the steps was too forceful to be the result of a fall. He claimed that he had found that both Mr. P and Mrs. P were moving when blood spatters were deposited on Mr. P’s sneakers. Moreover, under questioning, D steadfastly refused to concede that any of the claims he had made could possibly be mistaken or inaccurate (State v. Peterson, 2011, 9). Such a pattern of dogmatic refusal to admit the possibility of being open to error is especially characteristic of an expert adopting a strategy of shielding off critical questioning in an inappropriate way by failing to admit the defeasibility of scientific evidence.

Apart from D’s testimony, there was no other evidence that Mrs. P was beaten to death with a blunt instrument (Rudolf, 2003, 13). Thus in the trial hearing Rudolf presented a review of a series of cases where D had testified showing a pattern of ignoring the truth in order to get a prosecution (2011, 15). D had even been cited for contempt of court for giving false and misleading testimony to a panel reviewing a wrongful conviction. There were numerous instances of this kind of misconduct found over a period of twenty years. This body of evidence was the reason for his termination by the SBI in 2011.

Another weakness in D’s expert testimony was that it was based on subjective criteria that were not validated or confirmed by other experts. When the defense tried to impeach D by citing treatises on bloodstain analysis, he simply denied the validity of the statements made in these treatises (Rudolf, 2003, 26).

D made a number of claims that were very specific (Rudolf, 2003, 8). He claimed that an impact on one of the steps had been too forceful to be the result of a fall, and that it was the result of Kathleen Peterson’s head being intentionally slammed into the step. This testimony carries the story outline shown in figure 4 into a much more detailed story explaining what happened. Supporting this story with detailed evidence, D testified at great length about a number of experiments he had made claiming that these experiments showed that both Mr. and Mrs. P were moving when blood spatters were deposited on Mr. P’s sneakers and that his shorts had been in close proximity to an impact on Mrs. P’s head.

According to the description of the trial given in the hearing, D was cross-examined at length about his opinions, but during his explanations he interjected irrelevant and false information to distract the jury, and had to be admonished by the court several times. To pursue his line of argument about the central important of the evidence presented by D, Rudolf built his case on attacking this aspect. The prosecution in its closing argument had also stressed the central importance of the blood spatter evidence provided by D (2011, 11).

It was revealed in the hearing that SBI agents had fabricated evidence by using their laboratory reports to tailor their testimony in court to fit the requirements of the police and prosecutors (2011, 13). It was stated that the most notable among the SBI agents who had committed these violations of due process was D. In a previous case, D had been cited for contempt of court for giving false and misleading testimony. A report cited investigating D’s activities concluded that he was willing to ignore the truth by writing false and misleading lab
It was even stated that this pattern of providing misleading information to courts was not limited to a single incident, but existed the entire time he was with the SBI (2011, 16). As a result of the finding that D had viewed his job as helping to convict whoever had been arrested, rather with making an effort to determine what had actually happened in a series of cases spanning a period of 20 years. After this information had been published, D was suspended by the SBI (State v. Peterson, 2013).

This extended critical questioning of the evidence supplied in the original trial, along with the agreement of everyone, even the prosecution, of the central importance of this evidence, was sufficient to support the Alford plea to a charge of voluntary manslaughter. Under an Alford plea, a defendant can maintain his or her innocence while acknowledging prosecutors have enough evidence for a conviction.

Despite the new evidence challenging the original trial finding, and the success of Rudolf’s arguments in the retrial hearing casting doubt on the arguments from expert opinion in the original trial, in the end Mr. P had to plead guilty to voluntary manslaughter of his wife. However, because he had already served more time than the sentence at that point, he was released from prison. Even though he was free, he still had a criminal record. The case was re-opened and there was a new trial in 2016, but this finding has not changed.

8. Applying Carneades Versions 2.1 and 4.3

If we examine the second paragraph in section 5, it is possible to see how the faults in D’s testimony can be divided can be divided into two categories. The second category will be covered in section 8. The first category has to do with the critical questions matching the scheme for argument from expert opinion. This first category is covered in section 6. Concerning the compatibility of his claims with claims made by other experts, Rudolf pointed out that D had made three claims that were not corroborated by the evidence of the other experts. He claimed that the blood spatter nine feet up from the floor indicated the point of the start of the assault. He claimed that an area of impact on one of the steps was to forceful to be the result of a fall. He claimed that both Mr. P and Mrs. P were moving when blood spatters were deposited on Mr. P’s sneakers. Rudolf also pointed out that apart from D’s testimony there was no other evidence that Mrs. P was beaten to death with a blunt instrument. Using these indications it can be argued that D’s testimony can be faulted on the ground that it did not agree with the testimony of the other experts.

Fig. 9: An Exception Based on Supporting Evidence
This part of the argumentation can be analyzed using the argumentation scheme for argument from expert opinion along with the critical questions revealing weak points where the argument can be criticized. In the third paragraph of section 5, Rudolf cited several faults that might be taken to indicate a bias in D’s testimony. Rudolf presented a review of a series of cases showing a pattern of ignoring the truth in order to get a prosecution. This kind of bias is sometimes associated with prosecutorial tunnel vision (Findley and Scott, 2006). It would come under the heading of the trustworthiness critical question. Still other faults cited by Rudolf indicating numerous instances of misconduct that could be used to attack D’s character for truthfulness, relating to the trustworthiness critical question of whether the expert is personally reliable as a source. How this kind of fault is modeled by Carneades is shown in figure 1, where an undercutter is used as an exception to defeat an argument from expert opinion.

Rudolf pointed out another weakness in D’s testimony - it was based on subjective criteria not validated or confirmed by other experts. This can be modeled by Carneades as well, using the consistency critical question, along with the backup evidence critical question. Finally there is one more criticism that relates to the consistency question: when the defense tried to impeach D by citing treatises on bloodstain analysis, he simply denied the validity of the statements made in these treatises. So far then, the faults can be detected, analysed and evaluated using the scheme for argument from expert opinion and the critical questions.

You can try Carneades 4.3 online using the Carneades server. It supports cyclic argument graphs, cumulative arguments, issue-based information systems (IBIS) and multicriteria decision analysis. Argument graphs can be represented in AGXML, AIF, LKIF, CAF and YAML and exported to DOT, GraphML, PNG, SVG and YAML. The easiest way to make an argument graph similar to the ones above that used Carneades version 2 is to input the scheme that you are choosing to use to represent the particular argument you are trying to analyze as a YAML file using a text editor (such as Notepad++ for Windows) as illustrated by the example below. Then you can export the document to the format of your choice, such as GraphML or PNG.

Here is an example of one of the arguments in the owl example using the scheme for argument from expert opinion as programmed in version 4.3. The first seven lines are not part of the scheme that is actually used by the system, but are merely there for the information of the user. Id represents the identifying name given to the scheme (expert_opinion) in the system. W represents the expert witness, D represents the domain of expertise, and S represents the statement made by the expert. A reference is also given to the argumentation literature citing the source of the scheme. The rest of the scheme states the variables used and the premises and conclusion of the scheme.

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Here we illustrate one way to represent the OWL example using the argumentation schemes of Doug Walton, including critical questions. A reference is also given to the argumentation literature citing the source of the scheme. The rest of the scheme states the variables used and the premises and conclusion of the scheme.

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asserts/2: "%s asserts that %s is true."
based_on_evidence/1: "The assertion %v is based on evidence."
expert/2: "%s is an expert in the %s domain."
inconsistent_with_other_experts/1: "%s is inconsistent with what other experts assert."
in_domain/2: "%s is in the domain of %s."
untrustworthy/1: "%s is untrustworthy."

argument_schemes:
- id: expert_opinion
  meta:
    title: Argument from Expert Opinion
    source: >
      Douglas Walton, Appeal to Expert Opinion, The Pennsylvania University Press,
  variables: [W,D,S]
promises:
  - expert(W,D)
  - in_domain(S,D)
  - asserts(W,S)
exceptions:
  - untrustworthy(W)
  - inconsistent_with_other_experts(S)
assumptions:
  - based_on_evidence(asserts(W,S))
conclusions:
  - S

statements:
  blood_supports: "The blood spatter evidence supports the murder story."
  expert(d,blood_spatter): "D is an expert in blood spatter evidence."
  in_domain(blood_supports,blood_spatter): "That blood spatter evidence supports a murder story is in the domain of expertise in blood spatter evidence."
  asserts(d,blood_supports): D asserts that the blood spatter evidence supports the murder story.
  based_on_evidence(asserts(d,blood_supports)): "The assertion that the blood spatter evidence supports the murder story is based on evidence."
  untrustworthy(d): "D is untrustworthy."
  priorityProsecution_over_truth: "D showed a pattern of ignoring the truth in order to get a conviction."
  lacks_truthfulness_character: "Instances of D's misconduct showed a lack of character for truthfulness."

arguments:
a1:
  conclusion:
    untrustworthy(d)
  premises: [priorityProsecution_over_truth]
The reader can see that the way the scheme is formalized in Carneades has some apparent differences in format from the way the scheme for argument from expert opinion was represented in section 2. In the latter version of the scheme, there were only two premises, whereas in the Carneades version there are three premises. In the way the scheme was represented in section 2, there were six critical questions. The way this scheme is formalized in Carneades, there are only two exceptions and one assumption. However, the Carneades version covers all the six critical questions cited in the version given in section 2. For example, Carneades accounts for the field question by representing it as the premise $\text{expert}(W,D)$, where the variable $D$ stands for what is called the field of expertise in the original version of the scheme.

In the statements section, the scheme is applied to the particular example, in this instance one of the arguments in the owl example so that each of the premises, conclusions and assumptions are coded. When this has been done, the document, once put into YAML format is put into the 4.3 menu on the screen, and then Carneades produces an argument graph in one of the chosen formats. The argument graph shown in Fig. 10 is the output for this particular example.

![Fig. 10: A Carneades 4.3 Graph](image-url)

When the user inputs the argumentation scheme, in this instance the scheme for argument from expert opinion, the system automatically puts in the assumptions as well as the ordinary...
premise and the conclusion, showing how all these components are linked together according to the requirements of the scheme. As with version 2, the user also inputs which ones of these propositions are accepted, rejected, or neither accepted or rejected. For example in this instance, seven of the rectangular nodes are shown with a green background, showing that the audience accepts them. If that was all the information given, the conclusion, the proposition that the blood spatter evidence supports the murder story, would also be shown in green. But there are also the two undercutting arguments a3 and a4 shown at the top right that need to be taken into account. An argument a3, with the premise that D is untrustworthy is shown as accepted. Therefore this argument does not successfully undercut argument a3. a3 is supported by a1 with two convergent premises. Importantly, this proposition is supported by evidence because it is supported by the arguments a1 and a2, and both of these propositions are accepted. Therefore a2 is undercut and the ultimate conclusion shown at the right is rejected.

The underlining of a proposition in rectangular node indicates that this proposition has been accepted by the audience (input by the user). So what is shown on figure 11 is that Carneades calculates that the conclusion of arguments a1 and a2 is accepted. But once that information is taken into account, the conclusion of these two arguments is automatically accepted, which means that argument A3 is undercut. For this reason, the conclusion of the ultimate issue, the proposition that the blood spatter evidence supports the murder theory is shown with a red background. It is rejected because of the undercutter a3.

9. Two Kinds of Failures of Argument from Expert Opinion

Walton (1997, Chapter 8) concluded that there were two types of faults characteristic of the ad verecundiam fallacy, based on a survey of the accounts of this fallacy given in the informal logic textbooks. The textbooks typically label this fallacy as an improper use of argument from authority mainly carried out in instances of argument from expert opinion. The one fault can be dealt with using the argumentation scheme for argument from expert opinion along with its matching critical set of critical questions. For example, an argument from expert opinion might cite an expert in a different field into which the claim at issue fits. The error here is one of an inference that jumps too quickly to acceptance of the conclusion while overlooking missing assumptions indicated by the scheme and the critical questions. It is this type of error that has been analyzed and illustrated by applying Carneades to the owl example.

The second fault is dialectical rather than inferential in its primary makeup. This sort of ad verecundiam fallacy is committed by the dogmatic arguer who presses forward with the argument from expert opinion too aggressively by refusing to answer critical questioning, blocking the procedure with irrelevant replies, or even by preventing critical questions or counter-arguments from being put forward. It is this type of failure that was analyzed by Koszowy and Walton (2017) using the profiles of dialogues tool. The profiles method works by comparing a descriptive graph with a normative graph. The descriptive graph represents how a dialogue sequence actually went in the natural language text of the example chosen for analysis. The normative graph represents an analysis of how the sequence should ideally proceed, according to the protocols (rules) for this type of dialogue. The descriptive graph is mapped into the normative graph, so that a comparison can be made to diagnose the fault in the sequence displayed in the descriptive graph and repair it.

The owl example illustrates how the profiles method can be applied to argumentation cross-examination in a legal framework illustrating this blocking technique by an expert witness. The
profiles method begins by building a dialogue reconstruction of the selected text of the example composed of the connected sequence of moves (speech acts, mainly questions and replies) where the fault supposedly occurred. It then maps the dialogue into a modified argument diagram structure designed to reveal the essential mechanism of the failure. This type of fallacy is the harder of the two methods to unravel in a way that exhibits it as a logical failure that can be objectively diagnosed and evaluated. It requires going beyond the scheme to consider not just a single argument but a sequence of dialogue moves that may be lengthy in some cases. Carneades does specifically allow for extension to formal dialogue settings of this kind, but that part of the system has not been developed yet. There is no space in this paper to do this work.

However, both kinds of ad verecundiam fallacy were shown to be abundantly illustrated in the owl example by reconstructing the web of interconnected arguments from expert opinion woven throughout the argumentation in the case as a whole. Sixteen arguments from expert opinion structured by the scheme for expert opinion and fitted into argument diagrams (comparable to Wigmore-style legal argument diagrams) and two hybrid narrative diagrams revealed the argumentation structure of connected threads of the expert opinion evidence. As indicated above, this paper extends the work of the research project on arguments from expert opinion (Koszowy and Walton, 2017) where the profiles tool was applied to analyze the evidence in a legal deposition where the second type of fallacy was involved. Readers can be referred to the application of Carneades to a legal case of cross-examination in a deposition where this blocking technique of the argument from expert opinion was fully illustrated and analyzed.

As was shown in the present paper, some of Rudolf’s critical questions about D’s testimony fall under the category of assumptions, but more of them fall under the category of exceptions. Thus it is appropriate and even required that he should back them up with evidence if they are to fulfill the requirements of burden of proof, according to the argumentation scheme specifying the logical requirement for evaluating an argument from expert opinion. So now we can see that using the argument from expert opinion scheme as part of a formal and computational argumentation system such as Carneades, the first problem with analyzing the ad verecundiam fallacy can be solved.

However, other criticisms brought forward by Rudolf fit better with the second variant of the ad verecundiam fallacy. First, D steadfastly refused to concede that any of his claims could possibly be mistaken. This is evidence of a failure to be open to contravening evidence, a recurring fault that can only be diagnosed and supported as an error by examining how D responded to questioning. As noted in the second paragraph of section 6, this failure is characteristic of adopting a strategy of shielding off critical questions by failing to acknowledge the defeasibility of scientific evidence. This defense strategy is characteristic of the species of ad verecundiam fallacy studied by Koszowy and Walton (2017) using the example of a cross-examination of an expert during a legal deposition.

Carneades does not yet have sufficient resources built into it to deal with this second type of ad verecundiam fallacy to enable it to model the profiles of dialogue technique. The second type of fallacy represents a more serious challenge to argumentation technology given the present state of the art. To analyze this part of the case we would have to look at how this strategy of shielding off critical questions instead of answering them properly was exhibited in the evidence presented in the information we have about what happened in the trial. Presumably D was cross-examined after presenting the evidence in the trial, but we do not yet have the evidence regarding exactly what happened during this cross-examination by checking the details of how it went. Nevertheless, Rudolf’s report of what happened in that trial provides some evidence that the
second type of *ad verecundiam* fallacy was committed. We are told that when D was cross-examined at greater length about his testimony he continually interjected irrelevant and false information to distract the jury. The repeated use of this tactic is a highly precise indicator of the existence of the second type of *ad verecundiam* fallacy, the type of fallacy committed by the dogmatic arguer who presses forward with the argument from expert opinion too aggressively by blocking the procedure with irrelevant replies, preventing critical questions and counter-arguments being raised, or dismissing them unanswered.

10. Conclusions

Now that we have interpreted a large number of clashing arguments from expert opinion that played a role in the eventual outcome of the argumentation in this case, it might be tempting to think that we could put them all together and evaluate the whole network of argumentation using Carneades to make one big graph. Such a project is possible in principle, but it easily happens that even in fairly brief examples of the kind studied in this paper, the argumentation can rapidly become quite complex once critical questioning, counterarguments and supporting arguments are all properly accounted for. Putting them all together to try to represent the whole network of argumentation in this example would produce a huge graph. The outcome would be that all the manageable groups of component arguments would have to be dealt with separately anyway, and only a very large outline map could indicate how they should all be fitted together. Also, it may not be, at this stage of the state-of-the-art that such a large argument graph would be all that useful in predicting an outcome representing the evidential reasoning in the case. Nevertheless, I think it can be fairly concluded that the paper has taught us a few things about expert opinion testimony concerning how it is used, and how it should be criticized in real cases.

It remains a subject of controversy in the field of informal logic whether arguments from expert opinion are weak or strong (Mizrahi, 2013; Seidel, 2014; Hinton, 2015; Mizrahi, 2016). This paper has resolved the controversy by presenting a method that can be used to test whether a given instance of argument from expert opinion in natural language discourse is weak or strong. There are four tests that make up the testing procedure, and as each individual test is applied to the given argument, the determination of its strength or weakness can be supported by more and more evidence. The first test is to interpret the argument using a graph structure. The second is to determine whether the premises of the given argument are acceptable and whether the argument fits the argumentation scheme for argument from expert opinion. The third test is to determine how well the given argument stands up to critical questioning by seeing whether it can answer the critical questions matching the scheme. The fourth test is to go to a deeper level to judge how well the argument from expert opinion can stand up to cross-examination. Cross-examination goes beyond determining whether the argument can answer the specific critical questions matching the scheme. In cross-examination, the weak points in the argument are probed into by counterarguments that typically need to be backed up by evidence collected by the cross examiner. The third level of testing typically requires the collection of evidence from a knowledge base, or from several knowledge bases, containing evidence relevant to the testing of the argument from expert opinion.

It is argued that current formal and computational argumentation systems have the resources to model and to apply the first two tests to the evaluation of arguments from expert opinion such as those used in legal cases. By this means it has been shown how these models have the
capability for evaluating such arguments to show whether a given instance of this type of argument can be said to fail or not, based on the evidence available in the case in point.

The paper has also been shown to have some implications that are of interest with respect to a current research project on arguments from expert opinion that are specifically directed to solving the problem of finding objective criteria useful for analyzing cases where it is suspected that the traditional fallacy of the argumentum *ad verecundiam* (the fallacy of illicit appeal to authority) has been committed. The paper shows how Carneades can formalize one type of *ad verecundiam* fallacy, but to properly analyze the other type, formal dialogue structures are needed, especially dialogues for cross-examination. Although Carneades does introduce the notion of dialogue into the system, it does not have the advanced formal dialogue capability necessary to use profiles of dialogue to analyze the *ad verecundiam* fallacy. Even so, the owl example strongly suggests that the two types of fallacy need be distinguished beyond the current research on this fallacy using the resources currently available.

It remains a subject of controversy in the field of informal logic whether arguments from expert opinion are weak or strong (Mizrahi, 2013; Seidel, 2014; Hinton, 2015; Mizrahi, 2016). This paper resolves the controversy by presenting a method that can be used to test whether a given instance of argument from expert opinion in natural language discourse can be tested in order to apply criteria to show that it is weak or strong. There are three tests that make up the testing procedure, and as each individual test is applied to the given argument, the determination of its strength or weakness can be supported by more and more evidence. The first test is to determine whether the premises of the given argument are acceptable and whether the argument fits the argumentation scheme for argument from expert opinion. The second test is to determine how well the given argument stands up to critical questioning by seeing whether it can answer the critical questions matching the scheme. The third test is to go to a deeper level to judge how well the argument from expert opinion can stand up to cross-examination. Cross-examination goes beyond determining whether the argument can answer the specific critical questions matching the scheme. In cross-examination, the weak points in the argument are probe into by counterarguments that typically need to be backed up by evidence collected by the cross examiner. The third level of testing typically requires the collection of evidence from a knowledge base, or from several knowledge bases, containing evidence relevant to the testing of the argument from expert opinion.

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