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## WITNESS IMPEACHMENT IN CROSS-EXAMINATION USING *AD HOMINEM* ARGUMENTATION

**Abstract.** This paper combines methods of argumentation theory and artificial intelligence to extend existing work on the dialectical structure of cross-examination. The existing method used conflict diagrams to search for inconsistent statements in the testimony of a witness. This paper extends the method by using the inconsistency of commitments to draw an inference by the *ad hominem* argumentation scheme to the conclusion that the testimony is unreliable because of the bad ethical character for veracity of the witness.

*Keywords:* legal argumentation, character attack, legal analytics, artificial intelligence and law.

### 1. Introduction

This paper extends a practical method for analyzing and evaluating the argumentation that takes place in legal cross-examination dialogues in a finding of inconsistent statements in witness testimony that is used to cast doubt on the credibility of the witness. Trapping the witness into a situation of inconsistent testimony to cast doubt on his/her credibility is commonly called impeachment in law, known as a powerful kind of cross-examination strategy. The present paper extends an argumentation-based tool for cross-examination to cases of impeachment. Walton (2018) set out a formal dialogue structure, a practical method of analyzing cross-examination dialogues and showed, by studying examples of cross-examination, that the underlying argumentation structure of the dialogue can be revealed using this method. The core of the method has two main steps. The first is to represent the dialogue as a table showing the sequence of speech acts put forward by both sides as the cross-examination proceeds. The second step is the mapping of this dialogue onto an argument diagram, a well-established method of interpreting and analyzing argumentation. An argument diagram (usually called an argument map in computing) is defined mathematically as a directed

graph of a kind that argumentation scholars are familiar with in practice and recognize as a useful tool. Such a diagram is called a conflict diagram (Walton 2018: 1) when it visually represents a conflict between two propositions that a witness has gone on record as accepting, based on his or her responses during the examination procedure, or on other kinds of evidence from which evidential inferences about what he or she has accepted can be drawn. The present paper extends the method of Walton (2018) by applying it to some other legal cases of impeachment of a witness.

The art of training a questioner to lead an answerer to a contradiction by asking a connected sequence of questions in a dialogue was described by Aristotle (Slomkowski 1997: 12). In the *Topics* (101a26–30), Aristotle (1939) described dialogue structures of this kind that were supposed to be applicable to both training in disputation, casual conversations and philosophical discussions. Another form of this dialectical approach can be found in the style of examination called the *elenchos*, used by Socrates in the early Platonic dialogues (Robinson 1953).

The central core of this Aristotelian system of dialectical argumentation has been modeled by Krabbe (2013) as a formal dialectical system called  $ACADEMIC_1$  using Hamblin-style rules (Hamblin 1970, 1971) of the kind later used in (Walton and Krabbe 1995). In this formal system, moves in the dialogue are modeled as speech acts, such as the speech act of asking a yes-no question, or the speech act of responding to a question by making a concession or putting forward an argument.  $ACADEMIC_1$  is a purely formal model that stands on its own. It has locution rules, defining the speech acts that can be put forward at every turn, structural rules that define the order of turn taking, and commitment rules that define which propositions go into each argument arguer's commitment set at each move.

A related formal system is the computational model of examination dialogue proposed by Dunne et al. (2005), designed to model sequences of argumentation in which the questioner leads an answerer into conceding a pair of inconsistent statements by means of asking questions in a dialogue exchange between the two parties. The questioner wins if he shows that the answerer has committed to a pair of inconsistent statements. Formal argumentation systems of either of these two kinds can be used to model the inconsistent statements type of impeachment. It will be shown in this paper, however, that there is an additional dimension that makes it impossible to represent the sequence of argumentation in it by using these formal systems as they stand.

The examples studied in this paper are especially interesting with regard to the study of legal argumentation on the issue of whether the use of

impeachment in cross-examinations is an instance of the form of argument well-known in the argumentation literature as the argument of *ad hominem*, or personal attack argument. There are three identifying requirements for something to be an *ad hominem* argument (Walton 1998). First, in order to qualify as fitting this category, there must be two agents involved, and they need to be engaged in some form of structured communication. In the case of cross-examination, these two agents would be the cross-examiner and the witness being examined, and the structure of the communication would be that of a cross-examination dialogue. Second, one of the agents has to have put forward an argument, or have made a claim that can be questioned. Third, the second agent has to attack this argument or claim by questioning the credibility of the first agent. This third requirement brings in the element of character. An *ad hominem* argument is essentially a form of character attack argument. Simply put, it attacks an arguer’s argument or claim by making an allegation that the arguer cannot be trusted because he or she has a bad character, in particular a bad character for veracity. A very simple and common type of example is an argument where the one agent accuses the other of being a liar because there is evidence that he has lied in the past.

Budzynska and Witek (2014) have argued that this type of argumentation, characteristic of the *argumentum ad hominem*, is not purely inferential in nature, and that it is necessary to bring in speech acts in formal dialogues to model the logical structure of such arguments. *Ad hominem* arguments are especially complex because they tend to be based on subtle implicatures that are meant to forestall the risk of retaliation by a charge of defamation that might result from an explicit character attack. For this reason, they are typically put forward using indirect speech acts that depend on implicit assumptions. Reed (2011) showed that in order to model implicit speech acts, we need to use not only argument diagrams, but also dialectical structures that track how speech acts are related to other speech acts in a dialogue where there is an orderly exchange between two or more parties. Budzynska and Reed (2012) have built a formal and computational argumentation system that can display the structure of *ad hominem* dialogues, making it possible in principle to draw a distinction between an *ad hominem* argument and an argument from inconsistent commitments.

It is another problem to differentiate between these two types of argument in real cases of natural language discourse. To appreciate the scope of this problem, we need to consider the argumentation schemes for the different kinds of species of *ad hominem* arguments studied in (Walton 1998). In particular, with regard to studying cases of witness impeachment in law,

we need to use two especially relevant argumentation schemes, argument from inconsistent commitment and the circumstantial *ad hominem* argument.

Argument from Inconsistent Commitments  
(Walton, Reed and Macagno 2008: 337)

*Initial Commitment Premise:* *a* has claimed or indicated that he is committed to proposition *A* (generally, or in virtue of what he said in the past).

*Opposed Commitment Premise:* Other evidence in this particular case shows that *a* is not really committed to *A* (or is even committed to not-*A*).

*Conclusion:* *a*'s commitments are inconsistent.

Circumstantial *Ad Hominem* Argument  
(Walton, Reed and Macagno 2008: 337–338)

*Argument Premise:* *a* advocates argument  $\alpha$ , which has proposition *A* as its conclusion.

*Inconsistent Commitment Premise:* *a* is personally committed to the opposite (negation) of *A*, as shown by commitments expressed in her/his personal actions or personal circumstances expressing such commitments.

*Credibility Questioning Premise:* *a*'s credibility as a sincere person who believes in his own argument has been put into question (by the two premises above).

*Conclusion:* The plausibility of *a*'s argument  $\alpha$  is decreased or destroyed.

The problem for our present concern is posed by the fact, revealed in the next section, that arguments used to impeach a witness in cross-examination typically take the form of the scheme for argument from inconsistent commitments. The question then is whether all these arguments need to be classified as fitting the argumentation scheme for the circumstantial *ad hominem* argument.

## 2. Cross-examination and Witness Impeachment in Law

There is a significant literature on cross-examination in law (Mauet 2005, MacCarthy 2007, Levy 2011) and at least sixteen ways of impeaching the testimony of a witness in cross-examination have been recognized (Mauet 2005: 236). Cross-examination in a trial is an opportunity to question a witness who has testified for the opposed party in a lawsuit. This

opportunity normally arises when the witness has completed his or her direct testimony. The aim of the cross-examiner is to ask questions that will prompt the witness to say something that will support the cross-examiner’s side. Hence it is widely regarded as a hostile procedure. And it is adversarial in nature. The goal of cross-examination is essentially to persuade the judge or jury to come to accept the defendant’s version of the facts as opposed to the view of the witness being questioned (MacCarthy 2007: 4). MacCarthy remarks that lawyers often think that the goal of cross-examination should be to hurt the witness by making him or her look bad, but he also remarks that this negative approach can backfire by making the cross-examiner look bad. He suggests that a better view is to see cross-examination as an opportunity that allows the examiner to persuade, even if the witness is not cooperating (MacCarthy 2007: 4).

Cross-examination is often associated, and confused with, something called impeachment of a witness in law. Commonly people think of impeachment as a political and legal first step by which a legislative body formally presses charges against a government official to effect his or her removal from high office. However, in law, impeachment refers to something different. Mauet (2005: 236) defines impeachment as a form of direct attack on the testimony of a witness, or even on the witness himself, most commonly by the use of prior inconsistent statements. McCarthy et al. (2016: 1) agree that this method of impeachment, which they call “inconsistent statements” is the one most used by trial lawyers, writing that “somewhere in the neighborhood of seventy percent of the time you impeach a witness, it will be with an inconsistent statement”. This method of impeachment is to attack the credibility of the witness by finding an inconsistency between the statement just made by the witness in cross-examination and another statement made by the same witness, such as earlier in the trial or in a prior hearing (240). Other less common forms of impeachment listed by Mauet (2005: 236–262) include bias attack, inconsistency with factual evidence, prior convictions, and in cases of expert witness testimony, citing another expert source containing an opposite opinion. McCarthy et al. (2016: xvi) list sixteen ways to impeach, including not only inconsistent statements and contrary evidence, but also such categories as habits, evidence of sexual behavior, and learned treatises (under a special category of expert testimony). The third example to be analyzed in this paper falls under this category of impeachment of expert testimony.

MacCarthy et al. (2016: xii) write that impeachment is a confusing and difficult thing for those in the legal profession to understand and to execute, even stating that “impeachment is an alien, mystifying, and ob-

trusive area of the law”. Hence the problem is a significant one for anyone attempting to study how impeachment works in law using argumentation methods. Instances of cross-examination involving impeachment such as the ones studied in this paper often use linguistic techniques of Gricean implicature.<sup>1</sup> to make implicit suggestions indirectly in a character attack to cast doubt on the honesty of a witness. These cases cannot be fully analyzed using only inferential methods based on logic (Budzynska and Witek 2014). The strategy of this paper will be to begin with the latter kinds of simpler cases of inconsistent statement that, it will be argued, can be modeled using current argumentation tools, as a basis for helping current research deal with the more subtle kinds of cases involving character attack (*ad hominem*) arguments.

### 3. The Speeding Example

The following example, first analyzed in (Walton 2018) is here used in a simplified form for two purposes. First, it is used to explain to the reader how the method works by applying it to a classic case of cross-examination that is comparatively easy to understand. Second, it is needed to compare to the two following examples studied that are more complex. The dialogue below is a shortened version of the real case examination dialogue given in Mauet (2005: 251–52):

Q: Mr. Hoffman, can you say today that the Chevy was going 30 miles per hour?

A: That’s right.

Q: Was it actually going 50 miles per hour?

A: No.

Q: Let’s turn back to December 1, 2005. You testified that day at what’s called a deposition, right?

A: Yes.

Q: The court reporter swore you in to tell the truth?

A: Yes.

Q: Now look at page 42, line 15. I’m going to read from that page. Question: how fast was the Chevy going when it crashed into the other car? Your answer: “50 miles per hour.”

A: Yes.

This dialogue was called the speeding example (Walton 2018). Here, it is presented in a condensed form. It is configured in a dialogue format in

table 1, using the conventions shown in the key list below. A key list gives a short name for each proposition.

**Key List for the Speeding Example**

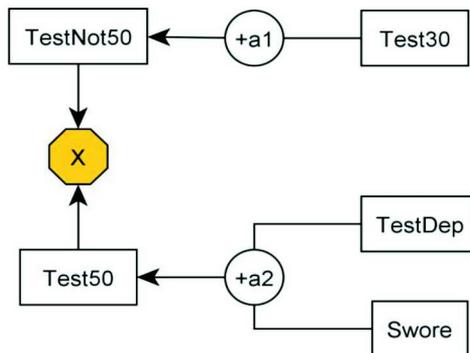
- Test30*: You (Hoffman) now testify that the Chevy was going 30mph.
- TestNot50*: You now testify that the Chevy was not going 50mph.
- TestDep*: You testified in a deposition.
- Swore*: You swore to tell the truth
- Test50*: You testified in the deposition that the Chevy was going 50 miles per hour.
- Impeach*: Impeachment.

**Table 1**

**Dialogue for the Speeding Example**

R	Questioner (Q)	Answerer (A)
1	<i>Question 30?</i>	<i>Yes</i>
2	<i>Question 50?</i>	<i>No (TestNot50)</i>
3	<i>Question TestDep?</i>	<i>Yes</i>
4	<i>Question Swore</i>	<i>Yes</i>
5	<i>Question Test50?</i>	<i>Yes</i>
6	<i>Inconsistency (Test50, TestNot50)</i>	<i>Impeach</i>

Following the method of (Walton 2018), once an examination dialogue of this type has been set up in table format as a dialogue, a conflict diagram can be drawn representing the argumentation in the case as shown in Fig. 1.



**Figure 1.** Conflict Diagram of the Speeding Example

Fig. 1 is displayed in the format of the Carneades Argumentation System, a formal and computational argumentation system that helps a user to draw argument diagrams in the form of bipartite graphs (Walton and Gordon 2015).

The graph shown in Fig. 1 has three different kinds of nodes. The round nodes stand for arguments that can be pro (+) or con (-). The rectangular nodes stand for propositions that are premises or conclusions of arguments. The octagonal nodes (colored orange, or darkened, if no color is available) stand for a conflict, representing a pair of propositions that that are inconsistent with each other.

The argumentation strategy of the cross-examiner in the speeding example is represented in the conflict diagram in Fig. 1. On the left, Hoffman's testimony in the prior deposition where he stated that the Chevy was actually going 50 miles an hour is shown. In the conflict diagram, argument a1 indicates that Hoffman conceded that he has gone on record and is committed to the statement that the Chevy was going 30 miles an hour, implying that the car was not going 50. Below that, it is indicated by argument a2 that Hoffman had previously testified in a deposition that the Chevy was going 50 miles an hour. The conclusion is then drawn that Hoffman is conceding in his testimony in the trial that the Chevy was not going 50 miles an hour or greater. Hence the inconsistent statements type of impeachment is shown clearly on the argument diagram where the testimony at the bottom left of Fig. 1 conflicts with the testimony shown at the top left. The inconsistency between these statements is shown by the conflict symbol represented by the octagonal node containing the X.

A *conflict diagram* is a graphical representation of the sequence of argumentation implicit in a given example of a real examination dialogue once it is put into the format shown in table 1.<sup>2</sup> A graph is defined as a set of vertices (nodes), and a set of edges (lines, arcs, arrows) joining the nodes. Mathematically a *graph*  $G$  is defined as an ordered pair  $(N, A)$ , where the set  $A$  is comprised of the two-element subsets of  $N$  (Harary 1972: 9). A *path* from node  $s$  to node  $g$  is a sequence of nodes  $\{n_0, n_1, \dots, n_k\}$  such that  $s = n_0$ ,  $g = n_k$ , and  $\{n - 1, n_i\} \in A$  (Poole and Macworth 2011: 75). In other words, there must be an arc from  $n - 1$  to  $n_i$  for each  $i$ . A *bipartite graph* is a graph in which the set of points (nodes, vertices) is partitioned into two subsets so that that no two points in the one subset are adjacent to each other and no two points in the other subset are adjacent to each other. In the example in Fig. 1, the rectangular nodes represent propositions that are premises or conclusions of arguments. The rounded nodes (circles) represent the arguments joining premises to conclusions.

The Carneades Argumentation System formalizes arguments as directed graphs (argument diagrams) made up of argument nodes linked to statement nodes. Carneades uses deductive, inductive or defeasible argumentation schemes, such as *modus ponens*, argument from commitment, argument from witness testimony and argument from expert opinion. Carneades uses argument graphs to evaluate arguments depending on the scheme used (Gordon and Walton 2009), but can also be used for argument invention (Walton and Gordon 2017). Carneades is centrally meant to be applied to legal argumentation, but has not yet been extended to accommodate a capability to handle conflict diagrams.

#### 4. The Landscape Example

The dialogue below is an example of impeachment from Mauet (2005: 446).

Q: Ms. Quigley, you claim today that this Thomas Moran landscape painting would sell, at auction, for about \$200,000. Did I hear you right?

A: That’s right.

Q: You wrote an article two years ago called *The Market for American Landscape Artists*?

A: Yes.

Q: Your article was published in *Art World*?

A: Yes.

Q: [Have article marked as an exhibit, show it to opposing counsel, then to the witness.] In your article you wrote, and I’m quoting from page 26 of that magazine: “Attempting to estimate the price American landscapes will bring at auction is becoming increasingly speculative. The price seems to be based as much on the particular whims of the buyers in attendance as it is on the prices the same artist has recently brought.” Did I read that right?

A: Yes.

Q: That’s what you wrote two years ago?

A: Yes.

In the speeding example there is a direct inconsistency between what the witness said in a previous deposition and what the witness is saying now, also under oath, as testimony. The conflict in this case is one of logical inconsistency between two assertions of the witness, since it is logically impossible for the same car in the same reported instance at the same time to be going both 50 miles per hour and 30 miles per hour. This case is

an instance of the argumentation scheme for argument from inconsistent commitments.

The situation is different in this case. There is a kind of conflict, but it not a direct inconsistency between what the witness said then and what she is saying now, as there was in the speeding example. The conflict brought out in the cross-examination is much more subtle than that. What the examiner has shown is that what the expert witness said then is a generalization that, if true, casts doubt on what she is saying now. There could be said to be a kind of inconsistency here because what the witness said then undercuts the reliability of the statement she is making now. If attempting to estimate the price American landscapes will bring at auction is becoming increasingly speculative it follows that estimating the price of this American landscape painting by Thomas Moran at an exact figure of \$200,000 is extremely dubious. Moreover, it was the witness herself who said as an art expert that the price American landscapes will bring at auction is becoming increasingly speculative because it is based on variable factors, such as the particular whims of the buyers in attendance. So how can we have any confidence in the present claim that this landscape would sell for \$200,000? We can see how the sequence of questioning has cast doubt on the statement of the witness that the landscape would sell for \$200,000, even though it is possible that it could sell for this price, and there is no logical inconsistency between the prior and present statements of the witness.

**Table 2**  
**Dialogue for the Landscape Example**

R	Questioner (Q)	Answerer (A)
1	You claim this Moran landscape would sell for \$200,00?	Yes
2	You wrote an article called M [Market for Landscape Artists] two years ago?	Yes
3	M says prices for landscapes are becoming increasingly speculative?	Yes
4	M was published in <i>Art World</i> ?	Yes
5	M says price is based on whims of buyers as much as recent prices?	Yes

How then does the inconsistency arise in such a way that it effectively casts doubt on her current testimony? It seems to work by means of an implicit premise based on the commonsense background knowledge of the audience that links the prior statement to the present statement.

**Key List for the Landscape Example**

*Claim:* This Moran landscape would sell for \$200,000.

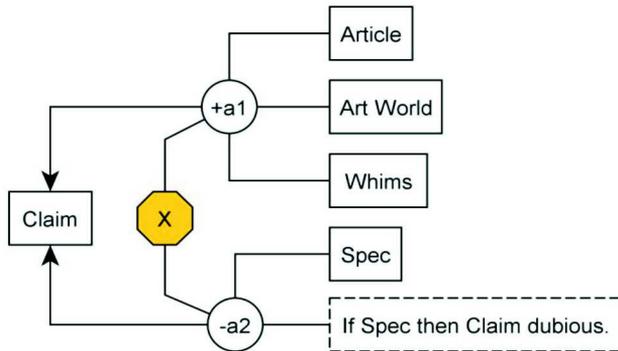
*Article:* You wrote an article called M two years ago.

*Spec:* M says prices for landscapes are becoming increasingly speculative.

*Art World:* M was published in *Art World*.

*Whims:* M says price is based on whims of buyers as much as recent prices.

Fig. 2 shows the conflict between the pro and the con argument.



**Figure 2.** Diagram of Landscape Example

This example represents a different kind of inconsistency. The con argument attacks the pro argument. But it could be classified as a type of impeachment that falls under the category of inconsistent statements, because the pro argument supports the claim while the con argument attacks the same claim.

Still, since no overt attack on the character of the witness was explicitly put forward by the cross examiner, it seems justified to interpret the text as communicated in the dialogue as containing only an argument from inconsistent commitments, as opposed to classifying it as an instance of the circumstantial *ad hominem* argument. The reason for this is that the scheme for the latter type of argument, as set out in section 2, requires the existence of a character attack being made on the witness. Also, it could be pretty easy for the witness in this case to escape from the contradiction by arguing that the market for paintings has changed considerably from two years ago when he made the earlier claim about the market for prices of American landscapes and auctions have changed considerably over the interceding two years. He might argue that the prices American landscapes will bring was speculative at that time but are less speculative now. Or he might argue that the Thomas Moran landscape painting they are currently talking about

can be priced at about \$200,000 even though this is a conservative estimate that takes volatility and market speculation into account.

But there is an important difference between the argumentation in the landscape example and the argumentation in the speeding example. In the landscape example the cross examiner is able to use an article by the answerer stating that prices for landscapes are becoming increasingly speculative. The statement is not exactly logically inconsistent with the answerer's earlier claim that this Moran landscape would sell for \$200,000; but the second claim casts the first one into doubt, undercutting the basis for accepting it, and therefore the argumentation in the example can be categorized as one of opposition between the two statements. The argumentation in both these cases and many others can be modeled using formal dialogue systems that have already been built in artificial intelligence and formal argumentation, such as the Carneades Argumentation System, by modeling, the second statement is part of an argument that undercuts the expert opinion argument that it attacks.

## 5. The Expert Opinion Example

In a case from (Wellman 1919: 21–22) which we will call the expert opinion example, a woman on her way to church one morning had tripped over an encumbrance in the street and as a result had been bedridden for three years. Her lawyer claimed that her spine had been permanently damaged by the incident. Her doctor had been in constant attendance on her over the three years from the time of the incident to the trial. In court, he described her sufferings in great detail. He described her condition as disease of the spinal marrow leading to a “creeping paralysis” that would result in her death. The medical witnesses for the city testified that she could not have contracted such a spinal disease from the slight injury caused by the incident of her tripping in the street.

The lawyer representing the city began his cross-examination by getting the doctor to admit that he had worked in the courts as a medical expert for over thirty-five years. He supported his claim about the woman's physical condition by citing a medical expert. The cross-examination dialogue below is a shortened version of the one in (Wellman 1919: 22).

*Counsel:* Are you able to give us, doctor, the name of any medical authority that agrees with you when you say that the particular group of symptoms existing in this case points to one disease and one only?

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*Doctor:* Oh, yes, Dr. Ericson agrees with me.

*Counsel:* Who is Dr. Ericson, if you please?

*Doctor:* (with a patronizing smile). Well, Dr. Ericson was probably one of the most famous surgeons that England has ever produced.

*Counsel:* What book has he written?

*Doctor:* He has written a book called *Ericson on the Spine*, which is altogether the best known work on the subject.

*Counsel:* When was this book published?

*Doctor:* About ten years ago.

*Counsel:* Well, how is it that a man whose time is so much occupied as you have told us yours is, has leisure enough to look up medical authorities to see if they agree with him?

*Doctor:* Well, to tell you the truth, I have often heard of you, and I half suspected you would ask me some such foolish question; so this morning after my breakfast, and before starting for court, I took down from my library my copy of Ericson’s book, and found that he agreed entirely with my diagnosis in this case.

*Counsel:* (reaching under the counsel table and taking up his own copy of *Ericson on the Spine*), Won’t you be good enough to point out to me where Ericson adopts your view of this case?

*Doctor:* Oh, I can’t do it now; it is a very thick book.

*Counsel:* (still holding out the book to the witness). But you forget, doctor, that thinking I might ask you some such foolish question, you examined your volume of Ericson this very morning after breakfast and before coming to court.

*Doctor:* I have not time to do it now.

*Counsel:* Why there is all the time in the world.

*Doctor:* (no answer).

*Counsel:* I am sure the court will allow me to suspend my examination until you shall have had time to turn to the place you read this morning in that book, and can reread it now aloud to the jury.

*Doctor:* (no answer).

Wellman wrote (22) that after this exchange, the courtroom was in a dead silence for three minutes. The doctor’s testimony was discredited because the jury had drawn the conclusion that unless he could find the paragraph he supposedly quoted from Ericson’s book, he must have been lying. The trial went for ten days, but in the end the jury failed to reach a verdict because they could not forget the collapse of the testimony of the plaintiff’s main witness.

**Table 3**  
**Dialogue for the Expert Opinion Example**

#	Questioner (Lawyer)	Answerer (Doctor)
1	Can you give the name of a doctor who agrees with your expert opinion?	Dr. Ericson agrees with my opinion.
2	Who is Dr. Ericson?	He is a famous surgeon.
3	What book has he written?	He wrote Ericson on the Spine.
4	Why is this book an expert source on this domain?	It is the best-known work on the subject.
5	How did you have the leisure time to look up medical authorities?	I looked in my copy this morning and found that he agreed with my diagnosis.
6	Can you point out where in the book he adopted this view of the case?	I can't point this out right now.
7	Why not?	It is a very thick book.
8	But didn't you just admit that you looked at your copy this morning?	He has to concede that [I].
9	Can you point out where in the book he adopted this view of the case?	I do not have time to do it now.
10	There is enough time.	No reply.
11	The court will allow us to suspend the examination until you have time.	No reply.

Let's call the passage in the book where what Ericson wrote supposedly agreed with the doctor's opinion P. The jury's reasoning can be reconstructed as follows. If P was in the book, D could easily find it because, according to his own statement, he just looked it up this morning. If that is true, D would surely take the book and find P. But when offered a copy of the book, D refuses to take the book and find P. The jury will take D's actions and his performance in the dialogue to imply that his statement that he looked in the book this morning is false. The reason is that there is a conflict in D's testimony. To represent this dialogue, let's begin by writing a key list of the component propositions.

**Key List for the Expert Opinion Example**

*DSpinal*: D's opinion is that this group of symptoms points only to spinal disease.

*DExp*: D is an expert.

*SympSpinal*: This group of symptoms points only to spinal disease.

*EBookAgrees*: In his book, E agrees with his diagnosis.

*EBookBest*: E’s book is the best-known work on the subject.

*DTestLooked*: D testified that he looked in his copy of E’s book this morning and found P where E agreed.

*ShouldBeAblePoint*: D should be able to point out where he found P in the book.

*IfDLooked*: If D looked this morning, he should be able to find P, when presented with a copy now, if P was in the book.

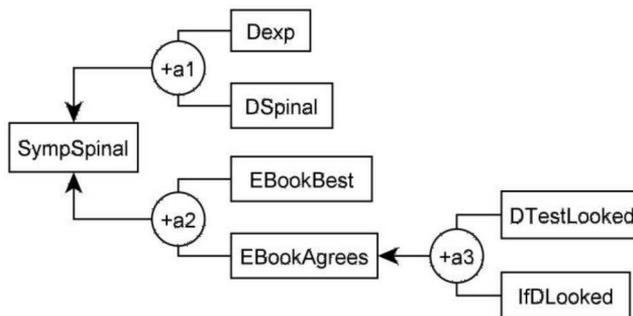
*SaysThick*: D said it is a very thick book.

*SaysNoTime*: D said I do not have time to do it now.

*SaysCan’tPoint*: When presented with a copy now, D claimed that he can’t point to the location of P.

*DLied*: D lied about his having found P in the book.

The first part of the argument, shown in Fig. 3, shows how the doctor supported his own opinion with argument a1 and then backed it up by a2 citing the other doctor’s book.



**Figure 3.** Argument Diagram of the First Part of the Expert Opinion Example

The proposition, shown at the left of Fig. 1, the statement that this group of symptoms points only to spinal disease, is the claim that the lawyer for the plaintiff wants to prove to the jury. To prove this proposition, he uses an argument from expert opinion with two premises: one is the proposition that D is an expert. The other is the proposition that D’s opinion is that this group of symptoms points only to spinal disease. Here we have simplified the argumentation scheme for argument from expert opinion by presenting it as having only two premises. However this simplified version will suffice for our purpose here.

When asked how he had the leisure time to look up medical authorities, he replied that he had looked in his own copy of Ericson’s book this morning and found that Ericson agreed with his diagnosis. An implicit assumption,

based on common knowledge, is that if D looked this morning, he should be able to find P, when presented with a copy now, if P was in the book. This proposition is shown as *IfDLooked* in Fig. 4.

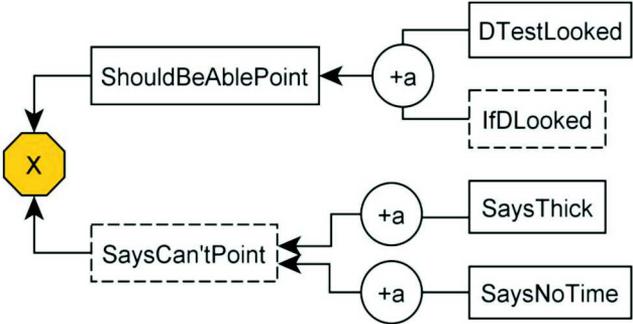


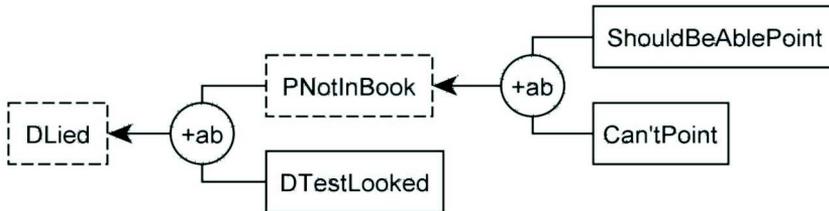
Figure 4. Conflict Diagram of the Second Part of the Expert Opinion Example

Next, let's look at the argumentation in the lower right of Fig. 4. As shown at the bottom right, D can't point P out when asked to do so, and he fails to do so, but gives two reasons for his failure. One is that it is a very thick book. The other is that he does not have time to do it now. Both these arguments are very weak. And in fact one of them is refuted by the examiner, who replied that there is lots of time to do so, and that extra time can be given if required. But even worse, there is a conflict with the argument shown at the top, because D should be able to point out where he found P in the book.

Now the inconsistent statements type of impeachment in the expert opinion example has been analyzed using the conflict diagram method. But in this case there is more to it. There is Gricean implicature to the effect that since E can't point to the existence of P in the book, the best explanation of the inconsistency, given that he should be able to point to P, is that P is not in the book. This could easily be checked by taking the copy of the book offered to E in the trial, and looking to see if P is there. But there is no need. The best explanation, which would be obvious to the jury and anyone else in the audience, is that P is not in the book. The notation *ab* in the node on the right indicates an abductive argument (inference to the best explanation) leading to this implicit conclusion.

This sequence of reasoning is shown in Fig. 5 as an inference to the best explanation to the implicit conclusion that P is not in the book. Other explanations are possible. D might have been mistaken about thinking he saw P in the book when he supposedly looked at it in the morning. But this explanation is not very plausible. After all, D is testifying as an expert

witness, and it would be aberrant for the memory of such an expert to be this fallible. So, in the absence of a better explanation, the conclusion that D was lying is a plausible hypothesis based on abductive reasoning. This argument is represented in Fig. 5 as an abductive argument to the implicit conclusion that D lied.



**Figure 5.** Argument Diagram of the Third Part of the Expert Opinion Example

What is shown is that D’s story doesn’t stand up to examination. It exhibits an inconsistency readily apparent to the jury, who can be assumed to have enough common sense knowledge to know that it doesn’t make sense. Common sense knowledge is primarily exhibited in the premise that if D looked in E’s book this morning and found the passage supporting his view of the matter, he should easily be able to find that passage now when presented with a copy of E’s book. On the contrary, however, D is unwilling to point out the passage in question. When pressed to take the time needed to find the passage, D offers no reply at all. The effect on the jury is immediate. They draw the conclusion that there is no such passage in the book, and even worse, they draw the conclusion that D has lied about even looking in the book.

Based on their exposure to this dialogue the jury, and anyone else reading the cross-examination, will draw an inference about D’s claim that this group of symptoms points only to spinal disease. The inference strongly suggests that D lied, and that therefore he is not a credible witness.

## **6. Getting from Inconsistent Commitments to *Ad Hominem***

The task of displaying the structure of how the cross-examiner guided the answerer to an inconsistency through the use of a sequence of questions in the speed example was complete once the inconsistency was arrived at in the dialogue represented in table 1. This was a simple case of inconsistent statements. Once the questioner had led the answerer to conceding both a particular statement and later its opposite, the job was done. As shown,

the thread of argumentation leading to the inconsistency through the dialogue in table 1 can be modeled by the argument diagram in Fig. 1. It simply reveals the inconsistency between the two instances of testimony by the same witness, one of which is clearly inconsistent with the other, since there is quite a considerable difference between saying that the car was going 50 miles an hour and saying that it was going 30 miles an hour.

Notice, however, that this finding as displayed in Fig. 1 makes the witness look pretty bad with regard to his character for veracity. Unless he admits that he was mistaken, and gives some reason for this, such as that he forgot, he comes across looking pretty bad. When you have a contradiction between one claim and another, the problem is that both claims cannot be true, unless, for example, the claimant can make a qualification to one of the claims or the other. But in this case, it seems hard to see how the witness could do that without running into problems trying to maintain his character for veracity.

Next let's go on to consider the expert opinion example. In Fig. 4 it was shown how the conflict diagram method can represent the inconsistency in the expert opinion example by displaying a conflict using the conflict diagram method. But the cross-examination argumentation in this example went beyond the finding of a pair of inconsistent statements. It went on to use this inconsistency to arrive at the ultimate conclusion that D lied, as shown in Fig. 5. The argumentation used in the final step, as shown in the discussion of the expert opinion example, rested on the inference to the best explanation suggested by Gricean inference that D lied. To connect up the chain of reasoning required to make the argumentation in this case into an *ad hominem* attack on the witness, abductive reasoning had to be used. So there is an important point of difference between this example and the two prior ones. You have to connect the argument diagrams shown in figures 3, 4 and 5 together to bring out the character attack.

This example can be classified, according to the argumentation schemes in section 2, as an *ad hominem* attack on the answerer, a personal attack alleging that the witness has a bad character for veracity, evidenced by the inconsistency. In this example as well, there may be various kinds of explanations that can be used to remove the fault of having committed to inconsistent statements. It might have been simply an error or confusion of some sort, perhaps because of a verbal ambiguity in one of the statements making up the set of allegedly inconsistent statements. However, making an allegation that the person is a liar is an altogether different form of attack because it directly attacks the ethical character (*ethos*) of the person.

## 7. Conclusions

The objective of this paper was to extend the applicability of the conflict diagram technique of (Walton 2018) to two new examples, each of which poses certain problems of interpretation in applying the two new real legal examples of impeachment in cross-examination. The objective was to take more subtle examples of expert witness testimony cross-examination not covered by the earlier paper, in order to raise questions for further research by studying important limitations on the scope of the conflict diagram tool. Because the method of this paper depends on the mapping of a dialogue structure into the graph structure of an argument diagram, its theoretical importance is of considerable significance to the argumentation community. Argument diagrams and argumentation schemes, when combined, make up a powerful method of analyzing real examples of arguments, but they need to be supplemented with formal dialogue models in order to take factors such as Gricean implicature (Grice 1975) into account.

This paper has shown why cases of cross-examination of this type are classifiable as *ad hominem* arguments, a type of argument that has been studied in argumentation, and that is common in legal argumentation (Macagno and Walton 2012), but has not yet been studied in relation to cross-examination dialogue. To begin with, it was shown how the argumentation in the simplest example of cross-examination of the inconsistent statements type can be analyzed using conflict diagrams; but then it was shown why analyzing the more subtle conflict of the second and third examples requires formal dialogue models. This type of example requires (1) an analysis of *ad hominem* argumentation that can distinguish between argument from inconsistent commitments and the circumstantial *ad hominem* argument. Beyond that, it requires (2) understanding of how Gricean implicature works as applied to speech acts in formal dialogue settings, and (3) a dialectical analysis of an arguer’s ethotic character suitable for argumentation studies. Because, as indicated, these resources are available, a way for modeling cross-examination dialogues in law using argumentation tools has been opened.

Evidence was given that bears on the hypothesis that not only should many of the most common forms of impeachment be classified as having the *ad hominem* form of argument, but also that some of them should not be. The evidence drawn from the three examples of cross-examination studied in this paper is that while the inconsistency alleged by the cross-examiner may be fully evident, the inference drawn from it to the effect that the

witness has bad character for veracity can only be drawn indirectly using dialectical tools such as Gricean implicature.

Finally, it was shown how the technique of conflict diagrams can be enhanced by using formal and computational argumentation systems of the kind currently being used in computer science. This was shown to be possible using the Carneades Argumentation System. Carneades is built around a graph structure for modeling argumentation, and contains twenty of the most familiar argumentation schemes, including a scheme for argument from commitment, a scheme for the circumstantial *ad hominem* argument, and a scheme for inference to the best explanation (abductive reasoning). Carneades also has a specific computational tool for argument invention which can be used to extrapolate an argument graph forwards to show lines of argument that can be used to reach the conclusion that the user wants to prove based on a given knowledge base of premises and conclusions (Walton and Gordon 2017). For this reason, Carneades can also be used to help a cross-examiner search through a knowledge base to find arguments based on the commitments incurred by a witness engaged in a dialogue with the cross-examiner that lead to an inconsistency. Since this capability is not unique to Carneades, but is also possessed by other formal argumentation systems (Prakken 2011) such as ASPIC+ (Prakken, 2010) and DefLog (Verheij 2003, 2005), the results of this paper should be conducive to the stimulation of further research in artificial intelligence on impeachment in cross-examination dialogues.

#### N O T E S

<sup>1</sup> According to the Gricean theory of implicature, a hearer's ability to understand something a speaker has said relies on the hearer's ability to understand the intended communicative purpose of the utterance (Grice 1975). The speaker grasps the communicative intention by realizing that there has been a failure of communicative expectations because of a violation of one of four conversational rules (Macagno and Walton 2013: 204).

<sup>2</sup> The term 'conflict map' from dispute resolution (Wehr 1979) is not the same as a conflict diagram in the sense of the term defined above.

#### R E F E R E N C E S

- Aristotle (1939). *Topics* (trans. E. S. Forster). Cambridge: Harvard University Press.
- Bench-Capon, T. J. M., Doutre, S. and Dunne, P. E. (2008). Asking the Right Question: Forcing Commitment in Examination Dialogues. *Computational Models of Argument: Proceedings of COMMA 2008*, ed. P. Besnard, S. Doutre and A. Hunter. Amsterdam: IOS Press, 49–60.

- Budzynska, K. and Reed, C. (2012). *The Structure of Ad Hominem Dialogues. Computational Models of Argument: Proceedings of COMMA 2012*. ed. B. Verheij, S. Szeider and S. Woltran. Amsterdam: IOS Press, 410–421 (*Frontiers in Artificial Intelligence and Applications*, Vol. 245).
- Budzynska, K. and Witek, M. (2014). Non-Inferential Aspects of *Ad Hominem* and *Ad Baculum*, *Argumentation*, 28 (3), 301–315.
- Dunne, P. E., Doutre, S. and Bench-Capon, T. J. M. (2005). Discovering Inconsistency through Examination Dialogues. In: *Proceedings IJCAI-05* (International Joint Conferences on Artificial Intelligence), Edinburgh, 1560–1561.
- Gordon, T. F. and Walton, D. (2009). Legal Reasoning with Argumentation Schemes, 12th *International Conference on Artificial Intelligence and Law*, ed. Carole D. Hafner, New York, Association for Computing Machinery, 2009, 137–146.
- Grice, H. P. (1975). Logic and Conversation, *Syntax and Semantics*, vol. 3, ed. P. Cole and J. L. Morgan. New York: Academic Press, 1975, 43–58.
- Hamblin, C. L. (1970). *Fallacies*. London: Methuen.
- Hamblin, C. L. (1971). Mathematical Models of Dialogue. *Theoria*, 37(2), 130–155.
- Harary, F. (1972). *Graph Theory*. Menlo Park: Addison-Wesley.
- Krabbe, E. C. W. (2013). Topical Roots of Formal Dialectic, *Argumentation*, 27(1), 71–87.
- Levy, E. J. (2011). *Examination of Witnesses in Criminal Cases*. Toronto: Thomson Reuters.
- Macagno, F. and Walton, D. (2012). Character Attacks as Complex Strategies of Legal Argumentation, *International Journal of Law, Language and Discourse*, 2(3), 59–117.
- F. Macagno and D. Walton (2013). Implicatures as Forms of Argument, *Perspectives on Pragmatics and Philosophy*, ed. A. Capone et al. Berlin: Springer, 203–224.
- MacCarthy, T. F. (2007). *MacCarthy on Cross-Examination*. Chicago: American Bar Association.
- MacCarthy, T. F., MacCarthy, S. P. and MacCarthy, T. F., Honorable (2016). *MacCarthy on Impeachment*. Chicago: American Bar Association, 2016.
- Mauet, T. A. (2005). *Trials: Strategy, Skills, and the New Powers of Persuasion*. New York: Aspen Publishers.
- Poole, D. L. and Macworth, A. K. (2011). *Artificial Intelligence: Foundations of Computational Agents*. Cambridge: Cambridge University Press.
- Prakken, H. (2010). An Abstract Framework for Argumentation with Structured Arguments. *Argument and Computation* 1, 93–124.
- Prakken, H. (2011). An Overview of Formal models of Argumentation and their Application in Philosophy. *Studies in Logic*, 4(1), (2011): 65–86. <http://www.cs.uu.nl/groups/IS/archive/henry/china11.pdf>.

- Reed, C. (2011). Implicit Speech Acts Are Ubiquitous. Why? They Join the Dots, Zenker, F. (ed.). *Argument Cultures: Proceedings of the 8th International Conference of the Ontario Society for the Study of Argumentation (OSSA)*, May 18–21, 2011. Windsor, ON (CD ROM), 1–15.
- Robinson, R. (1953). *Plato's Earlier Dialectic*, 2nd edition. Oxford: Clarendon Press.
- Slomkowski, P. (1997). *Aristotle's Topics*, Leiden: Brill.
- Verheij, B. (2003). Dialectical Argumentation with Argumentation Schemes: An Approach to Legal Logic, *Artificial Intelligence and Law*, 11, 167–195.
- Verheij, B. (2005). *Virtual Arguments. On the Design of Argument Assistants for Lawyers and Other Arguers*. The Hague: TMC Asser Press.
- Walton, D. (1998). *Ad Hominem Arguments*, Tuscaloosa: University of Alabama Press.
- Walton, D. (2018). Conflict Diagrams for Cross-examination Dialogues, *Argumentation and Advocacy*, 4(3), 199–218.
- Walton, D., and E. C. W. Krabbe. (1995). *Commitment in Dialogue*. Albany: State University of New York Press.
- Walton, D. and Gordon, T. F. (2015). Formalizing Informal Logic, *Informal Logic*, 35(4), 2015, 508–538.
- Walton, D. and Gordon, T. F. (2017). Argument Invention with the Carneades Argumentation System, *ScriptED: A Journal of Law, Technology and Society*, 14(2), 2017, 168–207.
- Walton, D., Reed, C. and Macagno, F. (2008). *Argumentation Schemes*. Cambridge: Cambridge University Press.
- Wehr, P. (1979). *Conflict Regulation*. Boulder: Westview Press.
- Wellman, F. L. (1919). *The Art of Cross-Examination*, 2nd ed. New York & London: The Macmillan Company.