'Argumentation and evidence'

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Argumentation is central to legal and evidential reasoning: the prosecution *argues* that the suspect committed the crime, lawyers present their closing *arguments*, the plaintiff *argues* his case by citing a relevant precedent, the court presents concurring and dissenting *arguments*, and so on. There are different interpretations of the term 'argument': an argument can be a single reason for a conclusion but also the combination of the reasons for and against a certain conclusion, or a dialogue between parties trying to convince each other. In the literature on reasoning with evidence, however, a narrower definition is usually adhered to: argumentation is the construction of arguments by performing consecutive reasoning steps, starting with an item of evidence and reasoning towards some conclusion using general rules of inference or generalizations, where not just arguments for a conclusion but also counterarguments against a conclusion have to be considered.

This idea of argumentation was already present in Wigmore's *Principles of Judicial Proof*[1], in which tree-like charts representing inferences from evidence to a conclusion and possible weakening counterevidence are presented. 'Neo-Wigmorians' Anderson, Schum and Twining[2] developed these argument charts, introducing the idea of commonsense generalizations as inference warrants. Douglas Walton has extensively discussed these different types of commonsense generalizations in the form of argument schemes in different contexts, including legal evidence[3]. Furthermore Bex, Prakken and colleagues have shown that Wigmore's charts corresponds to logical models of argumentation[4], adding semantics for formal defeasible reasoning[5]. In this chapter, I will discuss argumentation in the context of legal evidence, presenting general ideas that draw from all of the above authors and on which there is more or less a consensus in the academic community[6].

1. The structure of evidential arguments

The basic idea of an argument is a basic syllogism, where a conclusion is inferred from premises. Evidential reasoning with arguments involves taking the basic evidential data as premises[7] and inferring conclusions using *generalizations*, usually of a conditional if-then form, which justify the inference link between premises and conclusion[8]. The inferences are of an evidential nature: some evidence *e* and an evidential generalization '*e* is evidence for *p*' allows us to infer *p*. For example, a witness' testimony 'I saw someone who looked like John' and the generalization 'if a witness says "*p*" then (this is evidence for) *p*', where *p* is some state of affairs in the world, allows us to infer that the witness saw someone who looked like John get into the car. Figure 1 shows a diagrammatic representation of this argument. The evidence is represented by a grey box, the conclusion as a white box, the inference as an arrow and the generalization as a box with rounded corners.

The evidential generalization for witness testimonies can be phrased in several ways, for example, 'witnesses under oath usually speak the truth', 'if a witness testifies that *p* is the case then usually *p* is the case' and 'If a witness is in a position to know whether *p* is true and the witness asserts *p* then *p* may plausibly be taken to be true'. The exact generalization may be open to debate; do only witnesses under oath speak the truth? If a witness testifies to *p*, is then *p usually* the case, or perhaps sometimes or 80% of the time? However, most people would agree that, in general, conclusions can be drawn from witness testimonies, as in many legal systems a witness testimony is explicitly mentioned as a legitimate item of evidence. This does not mean that witness testimonies are always true. Rather, generalizations are often 'default rules', which means that if we have no reason *not* to believe the witness, we can draw conclusions from their testimony. But such default rules have exceptions – for example, the witness may have bad eyesight, or a reason to lie about seeing John – and evidence for such exceptions can lead to a counterargument

[1] Wigmore 1931.
[2] Anderson, Schum and Twining 2005.
[3] Walton 2002.
[4] Bex, Prakken, Reed and Walton 2003; Bex 2011; Prakken 2020.
[5] Dung 1995.
[6] Parts of this chapter have been adapted from chapter 3 of Bex 2011.
[7] Evidential data are the primary sources of evidence which cannot be sensibly denied (e.g. that a witness statement was made in court, that forensic expert reports were handed to the jury).
[8] The generalization *warrants* the inference, cf. Toulmin 1958.

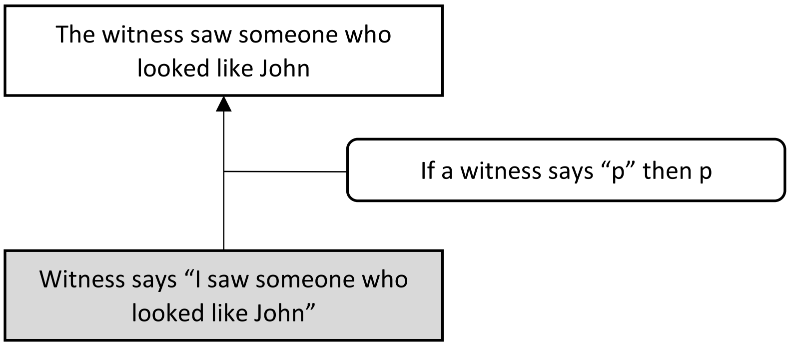

Figure 1: A simple evidential argument

to the argument based on the witness testimony[9]. It should be noted that it is perfectly possible to have conclusive generalizations. For example, 'a person can never be at two places at the same time' or, taking inspiration from classical logic 'if witness A says p and witness B says p then always (conclusively) witness A says p'. Arguments based on such rules are deductive and cannot be attacked on their conclusions.

It is also possible to form more complex arguments based on multiple pieces of evidence, or in which multiple inferences are chained into arguments with intermediate conclusions. Consider Figure 2, where we have a witness who saw someone who looked like John get into a car. In this car, the police later found a hair and shoe prints, which is evidence for the fact that John was in the car at some point. Thus, we can conclude that John was probably the man whom the witness saw getting into the car. In this figure, multiple smaller arguments are combined in a graph- or tree-like structure, which shows many similarities to a Wigmore chart. Thus, the argument consists of several subarguments; for example, the argument in Figure 1 is a subargument of the argument in Figure 2. Furthermore, there are different types of (sub)arguments contained in Figure 2. Inferences are chained, where intermediate conclusions are used to infer further conclusions (e.g. e2 → 2 → 5). In other cases, a conjunction of multiple pieces of evidence or intermediate conclusions is needed to infer a conclusion. For example, statement 3 and 4 are both needed to infer conclusion 5, denoted by the compound arrow. Note that 5 can also be separately inferred from statement 2. So there are essentially two arguments for conclusion 5: one based on e2, and another argument based on e3 and e4. These two arguments corroborate: while the conclusion can be inferred from any of them, the conclusion is stronger if we have both arguments[10].

While legal reasoning – reasoning about the legal facts and legal consequences – seems different from evidential reasoning – reasoning about the evidence and conclusions[11], the reasoning mechanisms employed are very much related. More specifically, we can use the facts of the case, as derived from the evidence through arguments (Figure 2) to further derive legal conclusions via the same kind of arguments. Figure 3 shows a legal argument which is itself based on arguments from evidence – in the example, the bottom left proposition that John got into the car is based on the argument in Figure 2. Here, the warrants for inferences in argumentation will be statutes and legal rules, and counterarguments will be based on exception to legal rules[12]. Thus, there is no real boundary between legal and evidential reasoning in argumentation, as legal arguments are based on the conclusions of evidential arguments.

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[9] Counterarguments and generalizations with their exceptions are discussed in Section 1.2 and 1.3, respectively.
[10] Argument strength will be briefly discussed in Section 1.2.
[11] Cf. the dichotomy between a "question of fact" and a "question of law", and Wigmore's separation of factual proof and legal admissibility in evidential reasoning (Wigmore 1931).
[12] See Chapter 26 of Pattaro, Rottleuthner, Shiner, Peczenik and Sartor 2005.

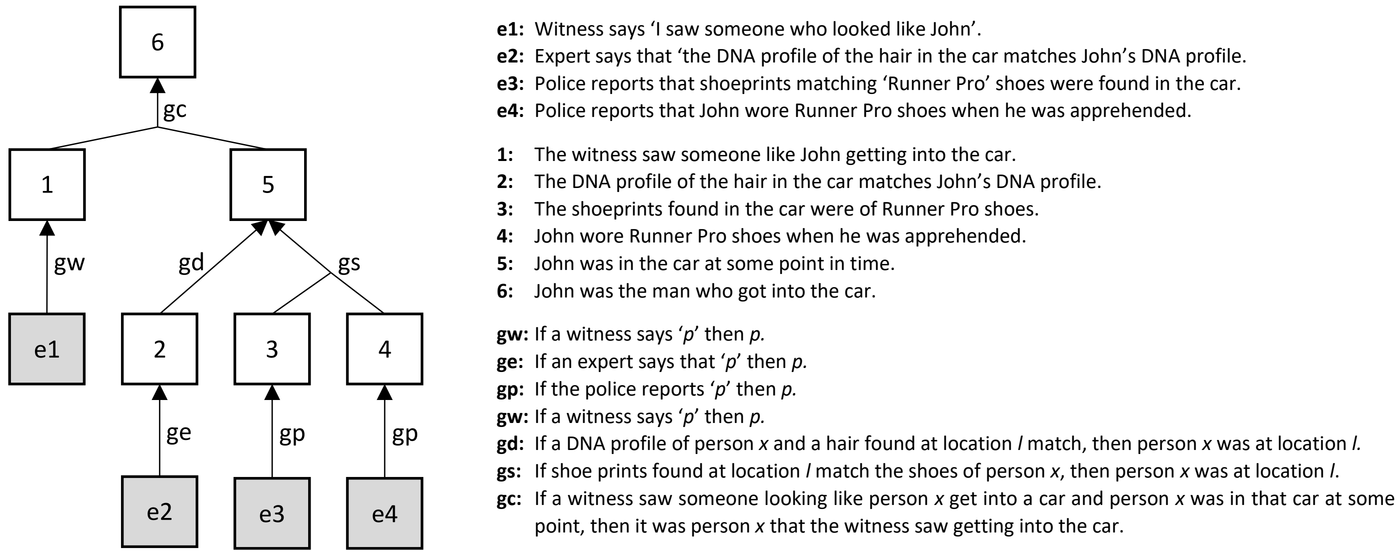

Figure 2: A complex evidential argument

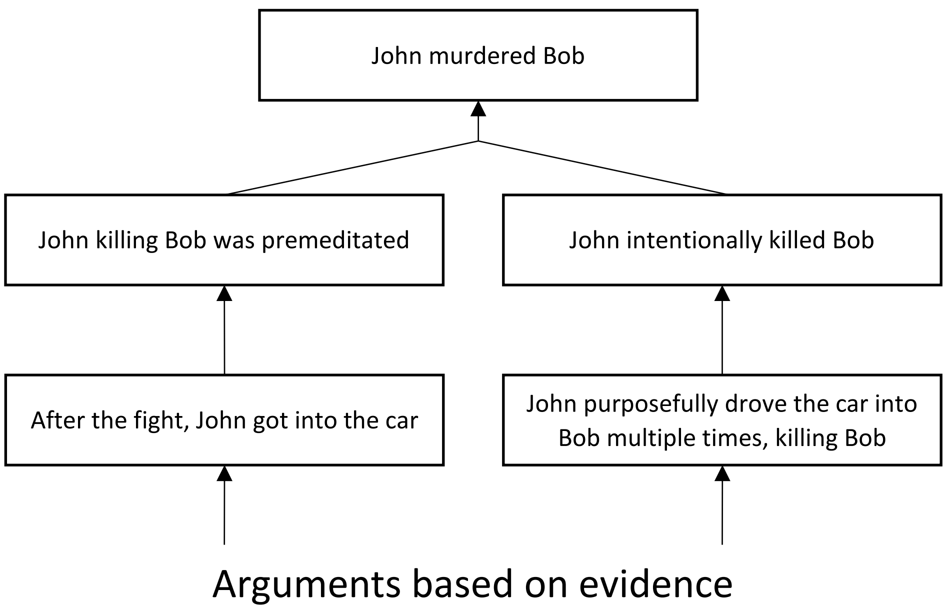

Figure 3: Legal reasoning based on arguments from evidence

2. The dialectical nature of argumentation: attack, defeat and dialogue

In the previous section it was shown how conclusions can be supported by evidential data through arguments of varying complexity. Note that, however, the (intermediate) conclusions cannot be drawn conclusively, as the inferences are based on generalizations with exceptions. In other words, each inference step can be doubted and actively challenged by giving counterarguments that attack the original argument. The possibility of attack involves the *defeasibility* of the inferences: an argument for a certain conclusion can be overturned by new information which leads to, for example, an argument for the opposite conclusion or an exception to a generalization.

In the literature, two types of attack are usually distinguished[13]. Firstly, an argument can be *rebut* by giving a counterargument with as its conclusion the negation of a proposition in the original argument. For example, if John

[13] Pollock 1995.

says he did *not* get into the car, we can infer the negation of the conclusion of the argument in Figure 2. Figure 3 shows this attack between the two conclusions as arrows with diamond heads – note that rebuttal is a symmetrical attack relation: an argument with conclusion *p* attacks the argument with conclusion *not p* and vice versa. It is also possible to attack an intermediate conclusion of a subargument – in the example of Figure 2, by arguing that e.g. the DNA profile of the hair does not match John's profile, or by arguing that John has never been in the car.

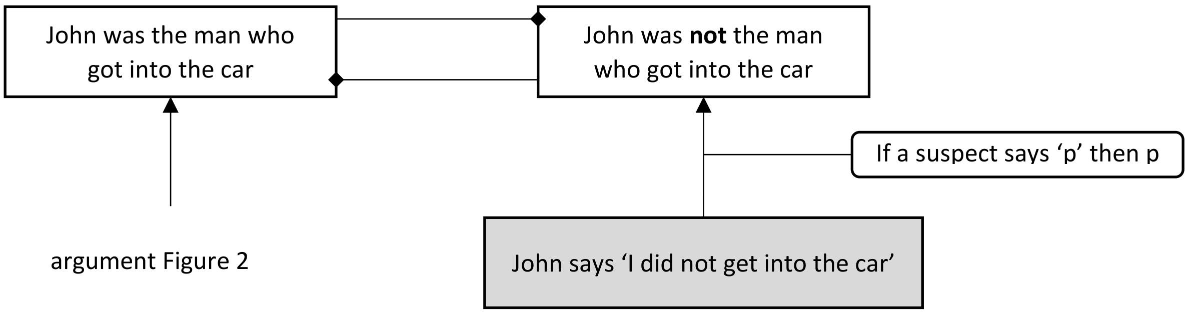

Figure 4: Two mutually rebutting arguments

Note that evidence cannot be attacked. In order to question, for example, a witness statement we can argue for the opposite (Figure 3), or we can *undercut* the argument with another argument for why a particular inference is not allowed. Unlike a rebutting argument, an undercutting argument does not deny the conclusion of an argument, neither does it deny the generalization as a whole (see section 1.3), but rather it denies the inference step by arguing for an exception to the generalization underlying the inference. For example, say we have evidence that the expert who analysed the DNA profiles used obsolete methods. Even though usually we would say that the opinion of experts on DNA can be trusted, in this case we might have an exception, and the argument that the DNA profile of the hair in the car matches John's profile is undercut (Figure 5). Note that here it is not actively denied that the two profiles match, but that the support that the evidence gives to the conclusion is effectively 'broken', as the defeasible inference from the evidence is undercut. The undercut relation is not symmetrical: the undercutting argument attacks the original expert testimony argument but not vice versa.

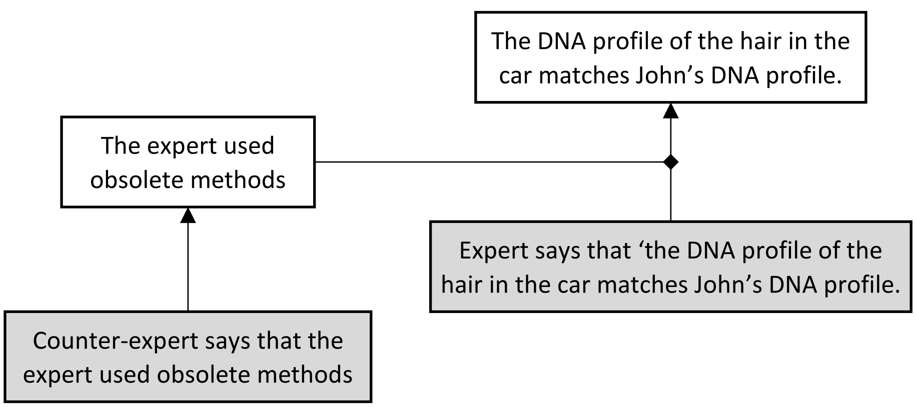

Figure 5: One argument (left) undercutting another argument (right).

Attacking an argument does not guarantee the argument's defeat: for this, the attacking argument has to be stronger than the other argument. With each specific (element of an) argument some measure of its *strength* or *probative force* can be associated. Often, these strengths are indicated as preferences between arguments[14], (e.g. an argument based on a police report is always preferred to an argument based on a citizen eyewitness) and such preferences can be the object of argumentation themselves (e.g. research has shown that police officers are not more reliable witnesses than citizens). There are also various ways to capture the strength of arguments precisely as, for

[14] See e.g. Modgil and Prakken 2013.

example, numerical probabilities[15]. However, the central idea is that argumentation is a dialectical process of argument and counterargument. Accordingly, we can determine the so-called *dialectical status* of arguments. Based on the formal argumentation semantics first proposed by Dung[16], we can assign three different statuses to arguments: the *justified* arguments (those that survive the competition with their counterarguments), the *overruled* arguments (those that lose the competition with their counterarguments) and the *defensible* arguments (those that are involved in a tie)[17]. Consider Figure 6, in which two mutually attacking (e.g. rebutting) arguments for opposite conclusions are shown[18] - for example, the argument from Figure 2 and the attacking argument from Figure 4. Now, if no preference for any argument is defined, they are both defensible. If, however, we say we prefer the left argument for 'John got in the car'[19], this argument is justified and the right argument is overruled.

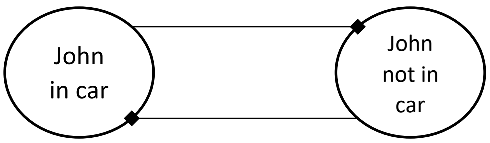

Figure 6: Two mutually attacking arguments

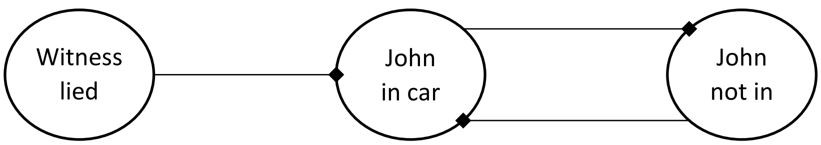

Figure 7: The leftmost argument defends the rightmost argument by defeating its only attacker.

The dialectical status of an argument depends on its interactions with all other available arguments. An important phenomenon here is *defence*: suppose that argument *B* attacks argument *A* but that *B* is itself defeated by a third argument *C*; in that case *C* defends *A*. In the example, say that we have a new argument that the witness who saw John get into the car lied. This argument undercuts the inference e1 → 1 in the argument from Figure 2, and thus attacks the complete argument for the conclusion that it was John who got into the car, see Figure 7[20]. Because the new argument is itself not attacked, it is justified and defeats the argument for 'John in car', which is in turn overruled. The right argument for 'John not in car' is now justified because its only attacker is overruled. A set of arguments that defends itself against incoming attackers can hence be seen as a coherent and defendable position.

Note that while these semantics for determining argument acceptability are dialectical in spirit[21], they do not explicitly incorporate the dialectical *process*, where an argument can be accepted if it cannot be successfully challenged in a properly conducted *dialogue*. Toulmin[22] (2003) presents his view of 'logic as generalized jurisprudence': a logic for arguments should provide the essentials of a general rational process for analysing arguments just as jurisprudence provides the essentials of the legal process. The procedural and dialogical component of argumentation has been presented more explicitly in the literature, where various protocols or sets of rules for a

[15] See e.g. Zenker 2012; Anderson et al. 2005 p. 230. For a more general account on Bayesianism and evidence, see Taroni, Biedermann and Bozza (this volume).

[16] Dung, *On the acceptability of arguments*.

[17] See Prakken and Vreeswijk 2002.

[18] Following Dung 1995, Figure 6 only shows the overall arguments and the attack relations between them – the internal structure of the arguments is abstracted away from.

[19] After all, this was based on DNA evidence, shoeprints and a witness, whereas the other argument was based on just John's denial.

[20] Note that there are really two arguments for 'John got in the car' in Figure 2, one based on evidence e1, e2 and another based on evidence e1, e3, e4. Recall from the discussion of Figure 2 that there are two separate arguments for proposition 5, and each of these can be combined with the inference from e1 to form an argument for 6: John got in the car. Both these arguments are attacked by 'Witness lied', as the witness testimony is always required to conclude 'John got in the car', so for simplicity, Figure 6 and Figure 7 show just one argument for 'John got in the car'.

[21] Dung implicitly assumes some sort of process in which 'The one who has the last word laughs best' (Dung, 1995, 2).

[22] Toulmin 1958.

properly conducted rational argumentative discussion are provided[23]. For example, van Eemeren and Grootendorst's *obligation-to-defend rule* states that 'discussants who advance a standpoint may not refuse to defend this standpoint when requested to do so' and the *relevance rule* states that 'standpoints may not be defended by non-argumentation or argumentation that is not relevant to the standpoint'. Such protocols serve not only an analytic function (is the discussion rational in that it follows the rules?) but also a heuristic function (what are our options if we want to conduct a rational discussion?). In a legal setting, dialogue protocols will be partly determined by the legal procedural rules that tell us, for example, which types of evidence can be brought forward by whom and at which point in the proceedings, or whose turn it is to meet the burden of proof[24].

The basic idea of using a dialogue as a means of rationally analysing arguments is best explained by taking an example of a *dialogue game*, where a simple game is played between two players, a proponent and an opponent. The proponent starts by moving an argument that needs to be tested and each subsequent move (by either the proponent or the opponent) contains an argument that attacks an argument of the other player. The rules of the game determine, for example, whether a player may repeat his earlier moves or whether a player may move only undercutters or rebuttals. Say, for example, that we have a game in which the proponent starts by moving an argument and may not repeat his moves, all of the arguments in the opponent's move must defeat the proponents move and the arguments in proponent's subsequent moves must undercut the opponent's arguments in the previous move. The proponent starts by moving the argument 'John not in car'. The opponent must attack this argument and hence moves 'John in car'. The proponent must undercut this argument; this can be done by moving 'witness lied'. There are now no more arguments and the opponent has no more valid moves so the proponent wins. Thus, the argument game essentially provides a dialectical proof theory for arguments: the initial argument can be said to be (defeasibly) provable if the opponent can attack (and defeat) each move the opponent makes.

3. Generalizations and general knowledge in evidential reasoning

Generalizations play a pivotal role in reasoning with evidential arguments. They can warrant inferences from the evidential data to conclusions and can be seen as the 'glue' that keeps an argument together[25]. However, generalizations are not always true or valid, and can change over time. This is why Twining call them 'necessary but dangerous'[26]: we need generalizations in order to analyse and argue about evidence, but these generalizations can also encode biases, stereotypes and prejudices. These dangers of generalizations can be lessened by specifying exactly which generalizations we use, how we use these generalizations and from which sources the generalizations stem. The more explicit the knowledge, the more it is open to analysis and criticism in the dialectical process of proof.

There are quite a few generalizations that, in one way or another, are consistently used by all kinds of reasoners when reasoning with evidence. Looking at evidential reasoning (or indeed at reasoning in general), it can be seen that many arguments, as well as the attacks on them, are instances of recurring patterns, such as inferences from witness or expert testimonies. In this sense, *argumentation schemes* play an important role in reasoning with evidence[27]. Argumentation schemes are forms of argument that represent stereotypical patterns of human reasoning in a conditional form, just like generalizations. The idea of defining recurring patterns of reasoning through argumentation schemes or generalizations is the subject of much study in argumentation theory, artificial intelligence and law.

As an example of an argumentation scheme, take the well-known scheme for argument from expert opinion[28]:

Source *E* is an expert in domain *D*.
E asserts that proposition *A* is known to be true (false).
A is within *D*.
Therefore, *A* may plausibly be taken to be true (false).

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[23] See e.g. Walton1998; Van Eemeren and Grootendorst 2004; Tuzet (this volume). For more formal approaches from artificial intelligence, McBurney and Parsons 2005.
[24] See e.g. Prakken and Sartor 2009; Bex and Walton 2012.
[25] Anderson et al. 2005.
[26] Twining 1999. See also Dahlman 2017; Allen and Pardo (this volume) for an in-depth discussion on generalizations and the ways I which they may be dangerous or unacceptable.
[27] For a discussion on argumentation schemes in the context of reasoning with evidence, see Walton 2002*;* Bex et al. 2003. For a general overview of argumentation schemes, the reader is referred to Walton, Reed and Macagno 2008.
[28] Walton et al. 2008. Also see Hahn (this volume).

The notion of argumentation schemes is obviously very closely related to the notion of generalizations: argumentation schemes are conditional rules based on world knowledge which can be used to draw inferences. The above argumentation scheme is a slightly more general version of the DNA expert generalization given in Figure 2, where the domain *D* would be 'DNA analysis' and it is assumed that 'profiles *a* and *b* match' is a statement within the domain of DNA analysis.

Looking at Figure 2, it can be seen that each type of evidence essentially has its own associated generalization which allows us to draw inferences from that particular type of evidence. In this way, the various types of evidence point to generalizations that are often used in reasoning with evidence. Above we already saw the generalizations for witness testimony and expert testimony. Another example is the generalization for inference from police reports. In this way, we can accept stereotypical ways of reasoning about which there is a consensus, at least in the legal and philosophical community, and thus accept that there are certain valid generalizations that can be used in rational reasoning about evidence. Because each type of evidence has its own associated generalization, the law may also point us to generalizations which are accepted by default; for example, in Dutch law witness testimonies are explicitly stated as a species of evidence on the grounds of which a judge can form his decision[29]. This means that it is highly unlikely that the legislator believed the witness testimony generalization to be false by default. In this way, we can include the *source* of the generalization in our argument – consider Figure 8, where the witness testimony generalization is (defeasibly) derived from source 'evidence', namely the Dutch Code of Criminal Proceedings[30].

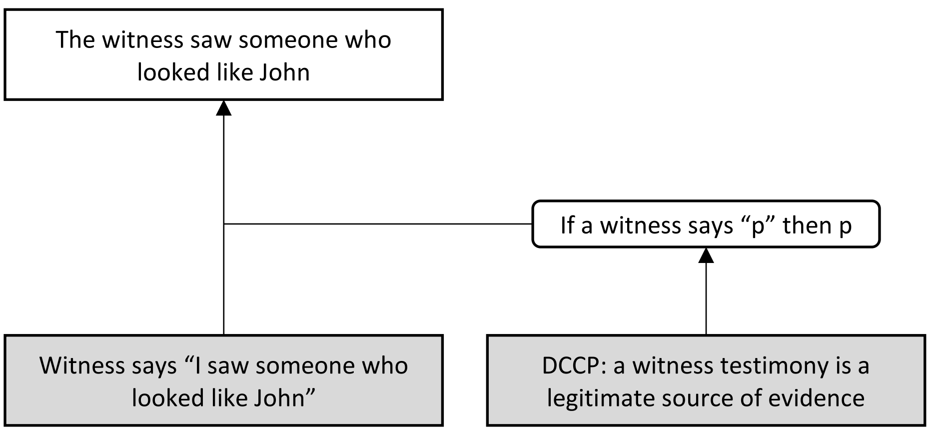

Figure 8: An argument for a generalization

Ideally, a generalization comes from a clearly defined source, such as an expert, scientific literature or a legal document, so that if we are doubtful about whether the generalization should be believed we can check the original source. However, many generalizations that are not tied to specific types of evidence are often backed by experience or general knowledge. Such experience-based generalizations seem to be based on a commonsense counterpart of scientific induction and reasoning from a 'general knowledge source' can be formulated as a new generalization: 'It is general knowledge that '*p*' is evidence for *p*'[31]. Possible undercutters of this generalization are that a piece of general knowledge is infected by prejudice or value judgement. An example of a generalization backed by general knowledge is shown in Figure 9. Notice that the premise from which the generalization is concluded is rendered as a white box, which means that it is not considered to be evidential data but rather a general knowledge assumption which can itself be called into question (i.e. attacked by an argument).

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[29] Article 339 paragraph 3 and article 342 Dutch Code of Criminal Proceedings.

[30] Note the similarity between Figure 8 and Toulmin's argument scheme (Toulmin 1958). The witness testimony is what Toulmin calls the *datum*, which is the basis of the *claim* that the witness saw someone who looked like John. The generalization acts as the *warrant* and the DCCP as the *backing*, showing why the warrant holds.

[31] Bex et al. 2003.

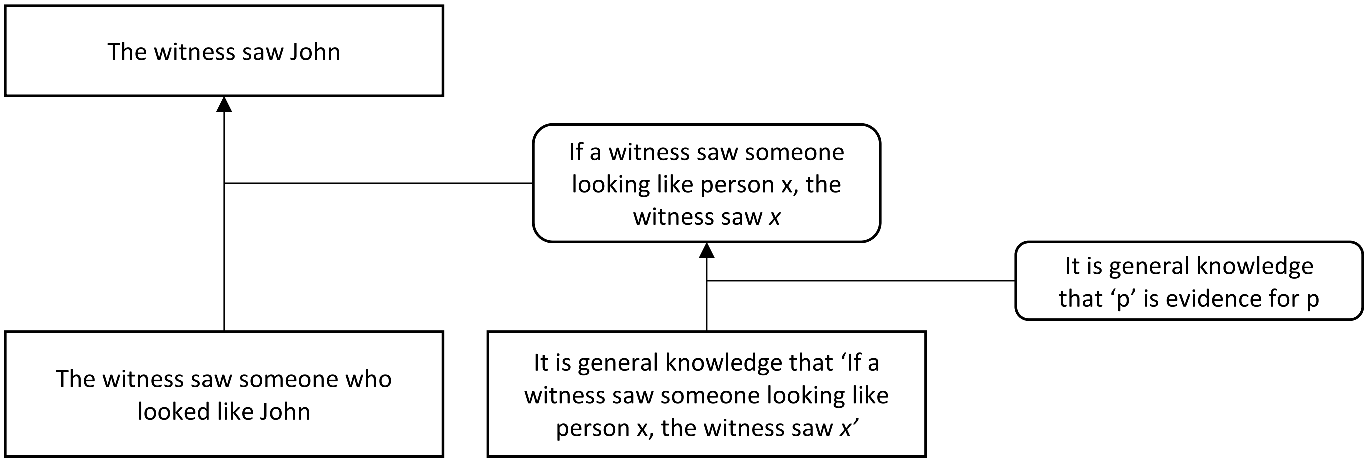

Figure 9: A generalization in an argument backed by general knowledge.

One of the main points of looking for stereotypical patterns of reasoning is that for each generalization, some typical sources of doubt can be given. For example, the witness testimony generalization can be undercut with arguments questioning the witness’ veracity, objectivity and observational sensitivity[32]. For example, a standard undercutter for a generalization about perception is as follows: ‘the present circumstances are such that having a percept with content *p* is not a reliable indicator of *p*’, which can be used to question a witness’ observational sensitivity[33]. In the same way, the expert testimony generalization has several typical sources of doubt. Argumentation schemes capture these sources of doubt with a number of *critical questions*, which point to possible sources of doubt in an argument based on the scheme. Critical questions fit into the dialectical view on argumentation as they can be used in a question-and-answer dialogue. The following six basic critical questions are associated with the expert opinion scheme[34]:

1. *Expertise Question*: How credible is *e* as an expert source?
2. *Field Question*: Is *e* an expert in *d*?
3. *Opinion Question*: What did *e* assert that implies *a*?
4. *Trustworthiness Question*: Is *e* personally reliable as a source?
5. *Consistency Question*: Is *a* consistent with what other experts assert?
6. *Backup Evidence Question*: Is *a*’s assertion based on evidence?

Answers to these critical questions can lead to various types of counterarguments. For example, a negative answer to the ‘field question’ would undercut an argument from expert opinion and a negative answer to the ‘consistency question’ points to a possible rebutting counterargument with an opposite conclusion[35]. In general, there are essentially four ways to attack a generalization[36]:

1. *Attacking the validity of the source of the generalization*: it is not general knowledge that ‘If a witness saw someone who looks like person *x*, then the witness saw *x*‘.
2. *Attacking the defeasible derivation from the source*: it is indeed general knowledge that if a witness saw someone who looks like person *x*, then the witness saw *x*, but this particular piece of general knowledge is based on a belief from folk psychology that people are always accurate at recognizing faces.
3. *Attacking application of the generalization in the given circumstances*: Usually it is true that ‘If a witness saw someone who looks like person *x*, then the witness saw *x*’. However, in this case we cannot conclude that the witness saw John as John has a very common appearance.

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32 See Anderson et al. 2005, 67-70.
33 Pollock 1987.
34 Walton et al. 2008.
35 The undercutting attack in the example in Figure 5 is an answer to another critical question of the form ‘Did the expert use the right method to determine the truth of *A*?’.
36 Bex et al. 2003.

4. *Attacking the generalization itself*: it is not the case that 'If a witness saw someone who looks like person *x*, then the witness saw person *x*'.

Note that the first type of attack is only possible if the source of the generalization is not evidential data but rather general knowledge. For example, it is not possible to deny the source from Figure 8 by arguing that 'a witness testimony is not a legitimate source of evidence'. In this case it is possible to attack the derivation from the source. The main difference between attacks of the third and the fourth kind is that the third kind of attack accepts the generalization as a general rule but denies its application in the case at hand, while the fourth kind of attack denies the generalization as a general rule ("it is not the case that usually...").

4. Summary and evaluation

This chapter has introduced arguments for reasoning with evidence in legal cases. It has been shown how arguments based on evidence to conclusions in a case can be built, how these arguments can be attacked and defended against counterarguments, and how generalizations can be used and analysed in argumentation. The main ideas on argumentation presented in this chapter are logically and conceptually well-developed in the literature and a tradition of research on informal and formal argumentation provides the argument-based approach with the necessary academic grounding. The argument-based approach to evidential reasoning has a number of oft-cited strong and weak points[37], which will be briefly discussed below, starting with the strong points.

Arguments allow us to explicitly link the evidence to (legal) conclusions. In this way, the relevance of the evidence for a particular conclusion can be shown, and the attack relations between arguments allow for clear identification of points of disagreement. By reasoning with arguments and counterarguments, one explicitly takes a so-called dialectical stance[38]: in argumentation, anything can be questioned: a conclusion, a generalization, the source of a generalization, and so on. These can all be tested in multiple ways and thus argumentation allows for a discussion not only of the evidential data but also of the general knowledge underlying the inferences.

More formal semantics for determining argument acceptability[39] can help in determining how the various pieces of evidence interact and why a particular combination of arguments can be believed. As the example in Figure 7 shows, the status of one argument may depend on attack relations between other arguments. Thus, we can determine which arguments need to be defeated if we want the arguments supporting some conclusion to be justified. For example, it might be that, for example, the testimony of one witness is important because it defends a large number of other arguments for a particular conclusion. Recent formal work also proposes algorithms for determining whether a certain conclusion is *stable*, meaning that no amount of new evidence will change the acceptability status of the argument[40]. Related to this, it can then be determined, for example, what the effect would be of finding some new piece of evidence on the main conclusions in a case.

Argumentation is often characterized as *evidential reasoning* – most of the inferences and schemes used are of the form '*e* is evidence for *c*'. This type of reasoning seems to be consistent with how many decision makers publicly justify their decisions – many motivations of decisions in Dutch criminal cases include phrases of the form 'the event can be inferred from evidence e_1', 'this event is based on (or supported by) evidence e_1'[41]. Evidential reasoning also seems to be the most natural way to think about inferring conclusions from evidence. For example, Van de Braak et al. showed that in the case of 'testimonial knowledge', that is, information from testimonies and evidential documents, people find it significantly harder to interpret causal relations like 'John bought a weapon **causes** the witness to testify that they saw John buy a weapon' than they find it to interpret evidential relations like 'The witness testified that they saw John buy a weapon **is evidence for** the fact that John bought a weapon'[42]. Finally, the connection between evidential and legal reasoning a case is best captured by reasoning from the evidence via the facts to legal conclusions.

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[37] Verheij, Bex, Timmer, Vlek, Meyer, Renooij and Prakken, 2016; Prakken 2020.
[38] Bex and Walton 2019. A stance is the level of abstraction on which certain concepts, decisions or behaviour is judged. Cf Dennett's intentional stance, which views the behaviour of an entity is judged in terms of the mental properties (intentions) of the entity (Dennett 1996).
[39] Dung 1995.
[40] Odekerken, Borg and Bex 2020.
[41] Stevens 2014; Bex and Verheij 2012.
[42] Van den Braak, Oostendorp, Vreeswijk and Prakken 2008.

The above discussion leads us to the first weakness of the argumentative approach, namely that it does not allow for reasoning with and about (explanatory) scenarios in a case. In criminal cases issues like the cause of death, but also the relations between motives and actions, are often expressed with causal generalizations of the form ‘c is a cause for *e*’. While it is perfectly possible to construct a causal argument based on a scheme from cause to effect, it cannot capture the exact causal structure of a (hypothetical) scenario in a case, and the causal relations between the various the elements of this scenario (e.g. the motives and actions). Furthermore, the conclusion of an evidential argument is usually a single element of a scenario, an individual state or event (e.g. ‘John got into the car’). Thus, the overview of the case tends to be lost in a purely argument-based approach. In a case, the various hypotheses about what (might have) happened are usually not single conclusions but rather detailed scenarios or stories, coherent sets of events. These stories can explain the evidence and need to be compared to find the best explanation of the evidence. Often, when faced with evidence people will start to construct stories about what might have happened, and the police as well as decision makers such as judges increasingly employ so-called “scenario-based” reasoning[43]. Recognizing the role of both stories and arguments, Bex has proposed a hybrid approach, in which stories about what (might have) happened in a case can be constructed and compared, and arguments based on evidence can then be used to support and attack these stories[44]. Figure 3 already hints at the use of scenarios or stories in a case: the two bottom claims together essentially form a short ‘story’ about what happened – John and Bob were in a fight, which made John so mad that he drove into Bob.

Another weak point of argumentation that is often mentioned is the lack of a systematic account of degrees of uncertainty in argumentation[45]. However, one of the clear advantages of argumentation over more Bayesian approaches – in which assumptions and generalizations are encoded as (conditional) probabilities – is that discussions can take place in natural language. Bayesian analyses of a case are hard to understand for people less familiar with probabilistic reasoning (e.g. judges, jurors), and the assumptions the analysis makes might not be explicitly represented but rather included in the underlying probabilistic inference mechanisms. Recently, there has been quite some work that has compared, integrated and discussed argument-based, story-based and probability-based accounts to evidential reasoning[46]. This work shows that in many different approaches, ideas from argumentation, in particular dialectical processes, play an explicit role.

Bibliography

Allen. R. and Pardo, M. (2021). “Generalizations and Reference Classes”, this volume.

Anderson, T.J., Schum, D.A. and Twining, W.L. (2005). *Analysis of Evidence, 2nd ed.* Cambridge: Cambridge University Press.

Taroni, F., Biedermann, A. and Bozza, S. (2021). “The Bayesian Approach to Legal Evidence”, this volume.

Bex, F.J. (2011). *Arguments, Stories and Criminal Evidence: A Formal Hybrid Theory*, Springer.

Bex, F.J., Prakken, H., Reed, C. and Walton, D.N. (2003). “Towards a formal account of reasoning about evidence: argumentation schemes and generalisations”. *Artificial Intelligence and Law*, 11: 125 – 165.

Bex, F.J. and Walton, D.N. (2012). “Burdens and Standards of Proof for Inference to the Best Explanation: Three Case Studies”. *Law, Probability and Risk* 11 (2-3):113-133.

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[43] See a.o. Pennington and Hastie 1992; Wagenaar, Van Koppen and Crombag 1993 for psychological evidence that a scenario-based approach is often used. More recent work that further develops scenario- or narrative-based accounts is Pardo and Allen 2007; Pardo and Allen (this volume); Mackor and Van Koppen (this volume).
[44] Bex 2011.
[45] Though there has recently been work on integrating probabilistic, Bayesian approaches with argumentation, see e.g. Zenker 2012; Hahn and Hornikx 2016.
[46] See Verheij et al. 2016; Prakken, Bex and Mackor 2020.

Bex, F.J. and Walton, D.N. (2019). Taking the Dialectical Stance in Reasoning with Evidence and Proof, a comment on R.J. Allen & M.S. Pardo, Relative Plausibility and Its Critics, *International Journal of Evidence and Proof*, 23(1–2): 90–99, Sage Publications.

Bex, F.J. and Verheij, B. (2012). Solving a Murder Case by Asking Critical Questions: An Approach to Fact-Finding in Terms of Argumentation and Story Schemes" *Argumentation*, 26:3, 325-353.

Dahlman, C. (2017). "Unacceptable Generalizations in Arguments on Legal Evidence", *Argumentation*, 31:83-99.

Dennett, D.C. (1996). The Intentional Stance. Cambridge, MA: MIT Press.

Dung, P.M. (1995). "On the acceptability of arguments and its fundamental role in nonmonotonic reasoning, logic programming and n–person games" *Artificial Intelligence* 77:2, 321 – 357.

Hahn, U. (2021). "Source Reliability and Appeal to Expert Opinion", this volume.

Hahn, U. and Hornikx, J. (2016). "A normative framework for argument quality: argumentation schemes with a Bayesian foundation". *Synthese* 193.6:1833-1873.

Mackor, A.R. and Van Koppen, P.J. (2021). "Scenario Theory and Anchored Narratives", this volume.

McBurney, P. and Parsons, S. (2005). "Dialogue games for agent argumentation" in I. Rahwan and G. Simari (eds), *Argumentation in Artificial Intelligence*, Springer.

Modgil, S.J. and Prakken, H. (2013). 'A general account of argumentation with preferences'. *Artificial Intelligence* 195: 361-397.

Odekerken, D., Borg, A. and Bex, F. (2020) "Estimating Stability for Efficient Argument-based Inquiry", *Computational Models of Argument. Proceedings of COMMA 2020, Frontiers in Artificial Intelligence and Applications* 326:307-318, IOS Press.

Pardo, M.S. and Allen, R.J. (2007). "Juridical Proof and the Best Explanation". *Law and Philosophy*, 27: 223 – 268.

Pardo, M.S. and Allen, R.J. (2021). "Reasoning to the Best Explanation" [2021], this volume.

Pattaro, E., Rottleuthner, H., Shiner, R.A., Peczenik, A. and Sartor, G. (2005). *A Treatise of Legal Philosophy and General Jurisprudence*, Springer.

Pennington, N. and Hastie, R. (1992). "Explaining the evidence: Tests of the story model for juror decision making". *Journal of Personality and Social Psychology* 62:2, 189 – 206.

Pollock, J.L. (1987). "Defeasible reasoning". *Cognitive Science* 11:4, 481 – 518.

Pollock, J.L. (1995). *Cognitive Carpentry: A Blueprint for How to Build a Person*. MIT Press.

Prakken, H. (2020). "An argumentation-based analysis of the Simonshaven case", *Topics in Cognitive Science*, 12:4, 1068-1091.

Prakken, H., Bex, F.J. and Mackor, A.R. (2020) *Models of Rational Proof in Criminal Law, special issue of Topics in Cognitive Science* 12:4, Wiley.

Prakken, H. and Sartor, G. (2009). 'A logical analysis of burdens of proof'. In H. Kaptein, H. Prakken, B. Verheij (Eds.) *Legal Evidence and Proof: Statistics, Stories, Logic*, p. 223-253, Ashgate Publishing.

Prakken, H. and G Vreeswijk (2002). “Logics for defeasible argumentation”. In R. Goebel and F Guenthner, *Handbook of Philosophical Logic*, 219 – 318, Kluwer Academic Publishers.

Stevens, L. (2014). “Bewijs waarderen. Hoe doen strafrechters dat?” *Nederlands Juristenblad,* 89(40): 2842–2850. In Dutch (Evaluating evidence: how do judges in criminal cases do this?).

Toulmin, S.E. (1958). *The Uses of Argument*, Cambridge University Press.

Tuzet, G. (2021). “Pragmatic Aspects of Evidence Discourse”, this volume.

Wining, W.L. (1999). “Necessary but Dangerous? Generalizations and Narrative in Argumentation about Facts in Criminal Process” In J.F. Nijboer and M. Malsch (Eds.), *Complex Cases: Perspectives on the Netherlands Criminal Justice System*, p. 69 – 98, Thela Thesis.

Van den Braak, S.W., Oostendorp, H. Vreeswijk, G. and Prakken, H. (2008). “Representing Narrative and Testimonial Knowledge in Sense–making Software for Crime Analysis” *Proceedings of JURIX 2008: The 21st Annual Conference*, 160 – 169, IOS Press.

Van Eemeren, F.H. and Grootendorst, R. (2004). *A Systematic Theory of Argumentation. The Pragma–dialectical Approach*. Cambridge University Press.

Verheij, B., Bex, F.J., Timmer, S.T., Vlek, C., Meyer, J.J.-Ch, Renooij, S. and Prakken, H. (2016) “Arguments, Scenarios and Probabilities: Connections Between Three Normative Frameworks for Evidential Reasoning”. *Law, Probability & Risk*, 15, 35-70.

Wagenaar, W.A., Van Koppen, P.J. and Crombag, H.F.M. (1993). *Anchored Narratives: The Psychology of Criminal Evidence*, St. Martin”s Press.

Walton, D.N. (1998). *The New Dialectic: Conversational Contexts of Argument*, University of Toronto Press.

Walton, D.N. (2002). *Legal Argumentation and Evidence*, Penn State University Press.

Walton, D.N., Reed, C. and Macagno, F. (2008). *Argumentation Schemes*, Cambridge University Press.

Wigmore, J.H. (1931). *The Principles of Judicial Proof or the Process of Proof as Given by Logic, Psychology, and General Experience, and Illustrated in Judicial Trials, 2nd ed*. Little, Brown and Company.

Zenker, F. (Ed.) (2012). *Bayesian Argumentation: The Practical Side of Probability*, Springer.