

Solving a Murder Case by Asking Critical Questions: An Approach to Fact-Finding in Terms of Argumentation and Story Schemes

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Abstract In this paper, we look at reasoning with evidence and facts in criminal cases. We show how this reasoning may be analysed in a dialectical way by means of critical questions that point to typical sources of doubt. We discuss critical questions about the evidential arguments adduced, about the narrative accounts of the facts considered, and about the way in which the arguments and narratives are connected in an analysis. Our treatment shows how two different types of knowledge, represented as schemes, play a role in reasoning with evidence: argumentation schemes and story schemes.

Keywords Argumentation schemes · Case-study · Evidence · Legal reasoning · Narrative

1 Introduction

In this paper, we propose critical questions for the process of proof, that is, reasoning about the *facts* and the *evidence* in criminal cases.¹ This process involves

¹ We use the term “fact” in its juridical sense, that is, descriptions of states or events the truth of which is currently unknown and has to be proven (cf. *facta probanda* or *facts in issue*, Anderson et al. 2005). With “evidence” we mean the *evidential data*, the primary sources of evidence the existence of which cannot be sensibly denied (e.g. witness statements made in court, forensic expert reports handed to the jury). Evidence and facts should not be confused: the existence of the evidential data does not guarantee the truth of the fact evidenced. For example, that there is a testimony by a witness who saw the suspect jump

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constructing, testing and justifying hypotheses about what (might have) happened in a case. The process is guided by the available evidence (e.g. witness statements, tangible evidence such as a knife or blood) and by general knowledge (e.g. generalizations such as ‘witnesses under oath usually speak the truth’ or scenarios that express typical criminal behaviour).

In other work (Bex 2011; Bex et al. 2010), we have argued that both *arguments* and *stories* (or narratives) are needed in order to do justice to all the relevant reasoning mechanisms as they are recognised and used by decision makers and investigators. Stories—in the sense of coherent sequences of events—are needed to organise the complex mass of facts in a case into one or more hypotheses about “what happened” in the case (Pennington and Hastie 1993; Wagenaar et al. 1993; Pardo and Allen 2007). Arguments consisting of (a chain of) defeasible inferences based on evidence can then be used to support or attack the individual facts in these hypothetical stories (Anderson et al. 2005; Bex et al. 2003; Walton 2002). We have proposed a *hybrid argumentative-narrative approach* to reasoning in the process of proof, in which arguments and narratives can be used in conjunction as well as interchangeably. Thus, the decision about which facts to accept is based on the acceptability of the stories in light of the evidential arguments in the case.

Arguments in the process of proof will often be based on general knowledge expressed as generalizations such as ‘expert statements may usually be believed’ or ‘Analyses of DNA samples have probative value’. These generalizations can take the form of the well-known *argumentation schemes*,² general patterns of reasoning that underlie an argument and that have associated critical questions that point to typical sources of doubt for such an argument. The acceptability of arguments in a case can then be critically analysed using these questions and possible counterarguments can be constructed on the basis of the (unsatisfactory) answers to these questions. Furthermore, argumentation schemes may point to missing parts of the argument. Thus, the argumentative part of the hybrid theory clearly falls within the dialectical (critical rationalist) approach as discussed by, among others, van Eemeren and Grootendorst (1992, Chap. 2).

The stories that occur on the process of proof are based on general knowledge or schematic patterns, the so-called *story schemes*.³ For example, a story scheme for “intentional actions” specifies a pattern of event types that a typical story about some intentional action contains (e.g. motive—action—consequence) and a “restaurant” scheme describes a pattern of events that a typical story about a visit to a restaurant contains (e.g. ordering—eating—paying). These story schemes

Footnote 1 continued

into a car does not guarantee that the suspect jumped into a car (the witness might lie or he might confuse the suspect with someone else).

² The concept of argumentation schemes was introduced by Perelman and Olbrechts-Tyteca (1971). See also Garssen (2001), van Eemeren and Grootendorst (1992), Kienpointner (1992) and Walton et al. (2008).

³ The idea of general patterns of (types of) events that underlie stories stems from literature theory (e.g. Propp 1968) and has found applications in Cognitive Psychology and AI (Rumelhart 1975; Schank and Abelson 1977; Schank 1986). We have previously addressed the role of story schemes in the process of proof (Bex 2009; Bex and Verheij 2010; Bex 2011).

can aid an analyst by, for example, serve a purpose as templates for possible hypotheses about what happened in the case. However, they also serve a dialectical role: as with argumentation schemes, story schemes may point to missing parts of a story and one can ask critical questions associated with a story scheme (Bex et al. 2009).

In sum, in our approach both story schemes and argument schemes are used in a dialectical way. For instance, when the prosecution claims that the suspect has murdered the victim, without providing a motive, the mentioned story scheme for intentional action shows that the prosecution's case can be improved by providing the motive or explaining why it is missing. Similarly, when the prosecution argues that the suspect was at the scene of the crime on the basis of an analysis of a DNA sample, the defence can use an argumentation scheme for the use of a DNA sample analysis to attack the prosecution's argument, e.g. by trying to show that the sample was contaminated.

In this paper, the dialectical value of stories and arguments is made explicit by providing a list of critical questions. It will turn out that there are three types of critical questions for critically analysing a complex criminal case in a dialectical way: (i) critical questions associated with the argumentation schemes, that can be used to analyse arguments based on evidence; (ii) critical questions associated with the story schemes, with which the hypothetical stories about the facts may be analysed; and (iii) critical questions for a hybrid argumentative-narrative case analysis, which may be used to analyse the case as-a-whole, that is, the combination of stories and arguments supporting or attacking these stories.

We illustrate the role of the different critical questions with a case study, namely the Dutch Nadia van der V. murder case.⁴ The case concerns the killing of student Nadia. She has been killed in her home by several gunshots fired at her head and body from close range. Her landlord, Pascal F., is regarded as the prime suspect. He has been seen fleeing town in Nadia's car and is not to be found until well into the next year. When Pascal is finally apprehended, he is charged with murder and found guilty by the lower courts as well as on appeal.

In our case study, we performed a post-trial analysis by looking at the verdicts in the Nadia van der V. case.⁵ One of our main reasons for analysing these court verdicts was that we wanted to check whether they met the standards of a so-called *explanatory justification* (Nijboer and Senneff 1999): a justification of a decision about the facts which makes sense to not just the reasoner but also to third parties. These types of justifications for verdicts have become important in the current Dutch legal practice, as due to a number of highly publicised miscarriages of justice the political and public pressure on judges and the way they arrive at their decisions has increased.

In our analysis of the case, we drew up a list of critical questions. These critical questions were then systematically applied to the case as presented in the court

⁴ We started our analysis of this case in (Bex and Verheij 2009; Bex and Verheij 2011a), of which the present paper is an extension.

⁵ In the Netherlands the judges are required to provide a written verdict in which their considerations are summarized. Many of these verdicts are available to the public on <http://www.rechtspraak.nl>. The verdicts in the Nadia van der V. case are available (in Dutch): LJN AO3150 (court of Utrecht) and LJN AT5190 (court of appeal Arnhem).

verdicts and for each question it was determined whether and how it had been answered. Our findings are presented in Sect. 4. First, we review the use of the hybrid approach in the process of proof in a semi-formal way (for further formal detail about the hybrid theory, see Bex et al. 2010; Bex 2011) and we discuss argumentation schemes and story schemes as they are used in the process of proof in Sects. 2 and 3, respectively. Section 5 concludes the paper and proposes some research questions for the future.

2 A Hybrid Argumentative-Narrative Theory

In the research on the process of proof, essentially two trends can be distinguished. The first method for analysing evidence focuses on structured *arguments*.⁶ In this approach, arguments are constructed by performing consecutive reasoning steps, starting with one or more items of evidence and reasoning towards a conclusion, usually a fact that has to be proven. The second method for analysing evidence mainly uses *stories* to structure and analyse the available evidence.⁷ This approach involves constructing coherent accounts of the facts about “what happened” in the case that explain the evidence.

The distinction between purely argument-based and story-based approaches as set out in the above paragraph is a slightly artificial one: the concepts of argument and story play an (implicit) role in research on either side of the spectrum. For example, Wigmore and Anderson and colleagues take a primarily argumentative perspective, but do discuss stories (though primarily as rhetorical devices), while several of Wagenaar and colleagues’ central claims in their anchored narratives theory have a more argumentative than story-based flavour (especially the role of generalizations and exceptions to these generalisations).⁸

In addition to differing central concepts (stories and arguments), another aspect that is seemingly different between the argument-based and story-based approach is that the argument-based approach is clearly normative (i.e. it tells us how we should rationally analyse reasoning about evidence and facts in the process of proof) whilst the story-based approach is originally based on more descriptive work (i.e. it tells us how people analyse the evidence and the facts in the process of proof).⁹ However, in

⁶ This approach has its roots in Wigmore’s (1931) evidence charts and has been further developed by “New Evidence Theorists” such as Anderson et al. (2005). Similar argument structures have been discussed by, among others, Freeman (1991), Reed et al. (2007) and Verheij (2005b). Bex et al. (2003) have further discussed the link between Wigmore’s graphs and such argument structures.

⁷ This explanatory story-based approach, the main proponents of which are Wagenaar et al. (1993) and Pardo and Allen (2007), is based on work from cognitive and legal psychology (Bennett and Feldman 1981; Pennington and Hastie 1993).

⁸ Argumentative analyses of the anchored narratives theory by Wagenaar, Crombag and Van Koppen have been given by Verheij (2000), Bex et al. (2006) and Verheij and Bex (2009).

⁹ Anderson et al.’s work, for example, is firmly based on what is called the Rationalist Tradition (Anderson et al. 2005, pp. 78–86), which argues that it is necessary to rationally reason with the evidence in order to establish whether or not our belief in the facts is justified. Conversely, Bennett and Feldman’s (1981) and Pennington and Hastie’s (1993) work was also meant as a descriptive theory of how people reason with masses of evidence in legal cases.

other work Twining (1999) has cautiously agreed that stories are also necessary for rational decision-making (that is, they serve more than a rhetorical function) whilst Wagenaar et al. (1993) and Pardo and Allen (2007) add a specific normative component to reasoning with stories, particularly in the way they define the process of an analysis of the evidence and the burden of proof for explanatory stories, respectively.

The somewhat blurry boundaries between the two trends in the literature has led us to believe that there is a need for an integrated, hybrid approach of stories and arguments. Hence, Bex and colleagues (Bex et al. 2010; Bex 2011) proposed a *hybrid argumentative-narrative theory* for Inference to the Best Explanation (IBE). The idea behind the hybrid theory was that both arguments and stories play a role in dialectical and critical decision-making about the facts.¹⁰ In developing this theory, we take sides with van Eemeren and Grootendorst's¹¹ idea that normative idealisation and empirical description should be properly combined in a comprehensive theory of argumentation. Hence, the theory should be based on forms of reasoning that are natural to us and that we actually use, whilst at the same time the theory should impose rational constraints on this reasoning so that mistakes can be avoided.

The basic idea of this hybrid theory is that the observed facts to be explained, the *explananda*, are explained by different stories, alternative explanations of what happened in the case. These stories can then be reasoned about using arguments. For example, arguments can be used to support the story with evidence or to reason about the plausibility of the stories. Ultimately, the explanations in a case should be compared and the best one should be chosen. Below we will briefly review the use of arguments, stories and their combination in light of the process of proof. In Sect. 2.2, we will raise the fundamental issue why to some extent arguments and stories seem to be a kind of communicating vessels.

2.1 Arguments and Stories in the Process of Proof

The process of proof usually starts when some initial evidence is found that involves the possibility that a crime has been committed. On the basis of this preliminary evidence one can formulate one or more explananda, that is, observed facts that have to be explained.¹² In the Nadia case the police found Nadia's body; hence, the most important explanandum in the case was the fact that Nadia died. On the basis of this explanandum, some hypotheses about what might have happened to Nadia will have to be imagined. This may be done by performing *abductive inference*.¹³

¹⁰ The rhetorical role of both arguments and stories, while interesting, has not been explored in the work on the hybrid theory.

¹¹ See van Eemeren (1994) for a concise introduction to this view.

¹² Often, new explananda appear during the investigation or treatment of a case. For example, once a possible suspect has been found a new explanandum could be "why was this man acting suspiciously near the crime scene?"

¹³ Josephson (2002) discusses abductive reasoning in the context of reasoning with narratives and criminal evidence. Walton (2001) provides a more general account, contrasting abductive reasoning with presumptive and plausible reasoning.

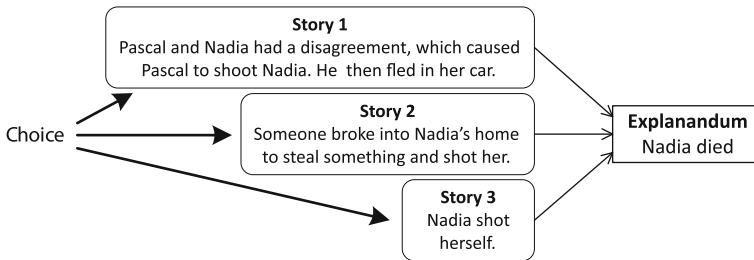


Fig. 1 Alternative stories which explain an explanandum

This type of inference involves “guessing” new hypotheses that explain some observed data: if we have a general rule ‘ c explains e ’¹⁴ and we observe e , we are allowed to infer c as a possible hypothetical explanation of the effect e . This explanation c which is used to explain the effect can be a single state or event, but it can also be a *story*. The usual definition of a story in, for example, literature theory (e.g. Toolan 2001) is that it is a chronological and coherent sequence of events experienced by actors. We will return to this issue of coherence below.

Taken by itself, abductive reasoning can be considered to be the fallacy of affirming the consequent. However, the inferential value of abductive reasoning becomes apparent in the broader context of IBE, where not just a single hypothetical story but also alternative scenarios are considered and the best one is chosen. In Fig. 1, hypothetical stories in the Nadia case are visualised; the open-headed arrows in this figure represent explanatory relations.

Given some hypothetical stories that explain the explananda, we have to find the *best* explanation among the various alternatives. An important criterion when judging how good a particular story is, is the story’s *evidential support*, the extent to which the evidential data in the case supports a story. In the hybrid theory, supporting stories is done by constructing *arguments*, starting with one or more items of evidence and reasoning towards a conclusion, an element in the story (i.e. a state or event or an explanatory link between events). Associated with the reasoning steps in these arguments are generalizations that justify the inferences (cf. Toulmin’s 1958 warrants and the aforementioned argumentation schemes). Take the following example from the Nadia case (Fig. 2): a witness testified that ‘a man who looked like Pascal was in the car’. This statement, together with the generalization that ‘witnesses usually speak the truth’ allows us to infer that ‘a man who looked like Pascal was in the car’. This conclusion can then be combined with other information to infer that it was indeed Pascal who was in the car. Thus, we get the argument tree or diagram (cf. Wigmore 1931; Freeman 1991; Reed et al. 2007; Verheij 2005b) pictured in Fig. 2, which supports story 1 from Fig. 1.

The argument in Fig. 2 uses various generalizations (rendered in the rounded boxes) to warrant the inferences. In addition to generalizations which are often used

¹⁴ Often, c explains e because c is a cause of e and in our other work we mostly model explanation using causal links. However, in order to sidestep the often difficult and subtle discussions about causality, here we simply talk about explanatory relations. This also allows, for example, teleological or intentional explanations (see also Bex et al. 2009; and Bex 2011, pp. 24–31).

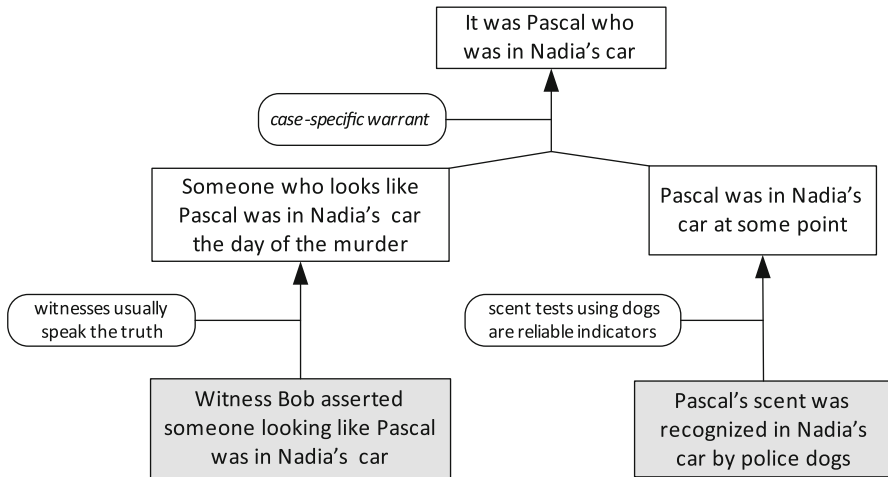


Fig. 2 An evidential argument

in all criminal cases, such as the generalization that witnesses usually speak the truth, more (case-) specific generalizations are also used as inference licences. For example, the top inference is warranted by the generalization ‘if person x was in a car at some time and someone looking like x has been seen in that car at time t , then it is likely that the person in the car at time t was x ’.

Thus, in the hybrid approach, stories can be evidentially supported by arguments. Argumentation is inherently dialectical: not only evidence supporting a conclusion but also evidence against it should be considered and sources of doubt in an argument should be actively challenged by giving counterarguments that attack the argument (e.g. the credibility of witness Bob can be questioned). When such a counterargument is strong enough, the evidence no longer supports the story as the chain of reasoning from the evidence to the element of the story is effectively broken. Furthermore, arguments can also be used to contradict stories: for example, an argument based on Pascal’s statement that he did *not* kill Nadia contradicts story 1 from Fig. 1.

The choice between alternative stories depends not only on the extent to which they conform to the evidence but also on the stories’ *coherence*, that is, whether the story conforms to our world knowledge.¹⁵ Following (Bex 2011), we say that a story is coherent if it is *consistent*, if it is *complete* (i.e. the story completes a plausible story scheme, see Sect. 3.2) and if the individual explanatory relations are *plausible*. For example, a story is less coherent if it is not consistent (e.g. the suspect was at two places at once), if there are relevant parts missing (e.g. no motive is given for a suicide or in a case of theft it is not made explicit what was actually stolen) or if the story is based on implausible causal information (e.g. shooting someone with a toy

¹⁵ Pennington and Hastie (1993) say that a story is coherent if it is consistent and it follows a general motive—goal—action—consequence sequence (see Sect. 3.2) and any individual causal links in the story are plausible. In Thagard (2004) coherence depends on the numerical strength of the explanatory relations between events in the story, which is in turn determined by formal coherence principles.

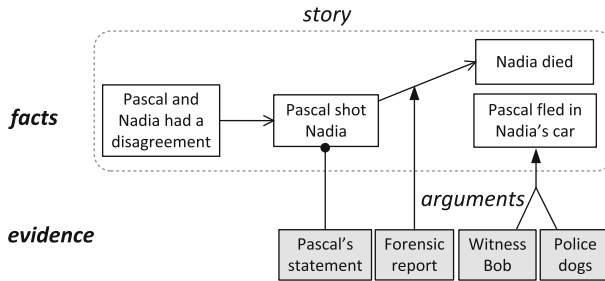


Fig. 3 Reasoning about a story using arguments

gun causes that person to die). The hybrid approach makes it possible to reason about the coherence of a story in a dialectical way: arguments can be given to support or attack explanatory or causal relations in a story. For instance, by arguing that ‘normally, people do not shoot other people because of a simple disagreement’, we attack story 1 in Fig. 1, where the disagreement is given as a motive for Pascal shooting Nadia.

Figure 3 visualises how the facts are organised in a story that explains the explanandum (i.e. “Nadia died”, which is itself part of the story) and how the evidence is connected to these facts using arguments. As in Figs. 1 and 2, the arrows denote explanatory relations and the arrows denote inferential relations. The argument from Fig. 2 supports that Pascal fled in Nadia’s car and an argument based on a forensic report supports the fact that Nadia’s death was caused by a gunshot (though not necessarily Pascal firing this shot). The arrow stands for an attack or conflict relation: recall that before we gave the example of Pascal’s denial attacking the main action in story 1 from Fig. 1.

To summarise, both arguments and stories play important roles in reasoning about the facts and the evidence. Stories are needed as hypothetical scenarios and to fill gaps in the evidence (see Sect. 4.2): whilst abductive and causal reasoning can also be modelled using arguments,¹⁶ it is arguably more natural to model them as stories (Prakken 2011) because this also allows for timelines and more “holistic” rendition of stories.¹⁷ Furthermore, such stories provide an overview and make the case-as-a-whole understandable.¹⁸ If we are to provide useable method for analyzing masses of evidence, we should adhere to the empirical reality, lest we restrict ourselves to what van Eemeren (1994) calls the “world-independent regimentation” of logic. Finally, it can be argued that standards of proof,

¹⁶ See e.g. Walton et al. (2008, Chap. 5).

¹⁷ As is argued by Schank and Abelson (1977) and Schank (1986), the knowledge that is used when thinking about patterns of action often does not have the form of individual causal or explanatory rules but is more naturally thought of as a collection of coherent and generalized events or event types, see Sect. 3.2.

¹⁸ Experiments by Pennington and Hastie (1993) have shown that stories that explain the facts are closest to how legal decision makers actually think about a case and Wagenaar et al. (1993) hence argue that stories are the only viable way to argue with complex masses of evidence.

particularly that of “beyond a reasonable doubt” are easier modelled using explanatory stories than arguments.¹⁹

A purely story-based approach, however, while it correctly describes people’s reasoning with a mass of evidence, is not enough. Even if used rationally and in a dialectical way (i.e. by explaining the evidence and providing alternative stories), stories are still powerful rhetorical vessels that can be used to convince in a “non-rational” way.²⁰ Hence, stories must be critically analysed.²¹ A good way to analyse both the connection between the stories and the evidence and the commonsense knowledge underlying the story is to use arguments. These arguments can be used in the analysis of the credibility of individual pieces of evidence and their relevance for the stories about the facts. Furthermore, using arguments we can not only argue *with* stories, but also *about* the coherence of stories. Thus, the hybrid approach draws from the extensive philosophical tradition in argumentation to enrich the more psychologically oriented, story-centred approaches.

2.2 Arguments and Stories as Communicating Vessels

In our proposal for the analysis of reasoning about the facts in a criminal case we have combined stories and arguments so as to have a flexible and broad set of analysis tools. Here, it must be remarked that in our hybrid theory, we use specific, “narrow” definitions of argument and story. According to these narrow definitions, an argument is a tree-like structure in which one or more premises support a single conclusion through one or more consecutive inference steps, whilst a story is a coherent sequence of events in chronological order. Thus, arguments and stories are distinct structures.

However, if a more broad definition of the term argument is followed, this distinction fades. For example, if we say that an argument is “any reason given for some conclusion”, we could say that, for example, story 1 in Fig. 3 is an argument for Pascal’s guilt: the coherent set of facts provides a reason for us to believe that Pascal is guilty.²² Thus, we do not need stories; instead, we can analyse a case using just arguments (in the broad sense) that have sets of events as premises. It can also be claimed that a causal or explanatory sequence is an argument (in the broad sense) for the facts to be explained: thus, the story in Fig. 3 is an argument based on the causal argument scheme with as its conclusion “Nadia died”. Even if we accept the terminological convention that any sequence of events is called a story, it is still possible to analyse the facts of the case without utilising these sequences and only using arguments (in the narrow sense): as, for example, Wigmore (1931) and

¹⁹ See Bex and Walton (2010), Pardo and Allen (2007), who have argued that reasoning in trials involves comparing stories about the facts.

²⁰ Twining (1999) and Anderson et al. (2005) argue that stories are “dangerous” because they can, for instance, be based on false generalizations, and Wagenaar et al. (1993) argue that we should be careful not to let a “good” story push away a “true” story.

²¹ This observation was already made by Pennington and Hastie (1993) and Wagenaar et al. (1993), who say that a story *must* explain the evidence and that it *must* be anchored in safe commonsense knowledge.

²² See (Bex and Verheij 2011b) for a further discussion on how sets of facts can be used as reasons for legal conclusions.

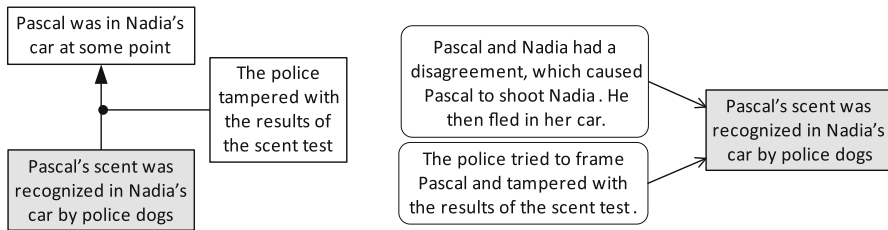


Fig. 4 Stories and arguments as communicating vessels

Anderson et al. (2005) have shown, complex argument trees from the evidence to the facts may be constructed and thus all the individual facts can be analysed.

Similarly, it is possible to incorporate the evidence itself in the story: the fact that someone who looked like Pascal was in Nadia's car (and the fact that a police officer asked Bob what he saw) *causes* Bob to testify that "someone who looked like Pascal was in the car"). Here, the evidence is simply another event in the story which is explained by other events.²³ Stories are not supported by evidence; rather, the story that *explains* the most evidence is considered to be the best.

These remarks suggest that to some extent the roles of stories and arguments in an analysis can be exchanged. Consider, as an example, Fig. 4. In this example, the same piece of evidential data is used in two different ways. On the left side, the successful scent test is used to infer that Pascal was in Nadia's car (which ultimately supports the fact that it was Pascal who murdered Nadia). The inference is attacked by an argument that the police tampered with the evidence. On the right side, the story that it was Pascal who murdered Nadia is used to causally explain the result of the scent test. The counterargument is here modelled as an alternative explanation: a story that the police tampered with the evidence also explains the result of the test.

The situation in Fig. 4 shows that, in a purely argumentative approach, alternative interpretations of the evidence lead to counterarguments and in a purely narrative approach, such alternative interpretation lead to different explanatory stories. So it would seem that in the hybrid approach, an alternative story can also be expressed as a counterargument. This specifically occurs when the stories actively contradict each other. For instance, in Fig. 1, the "suicide" claim is raised as an alternative hypothesis, an alternative story. However, from the claim that "Nadia shot herself", we could argumentatively infer the conclusion that "Pascal did not shoot Nadia", which is a counterargument to the claim in story 1, that Pascal shot Nadia (cf. Fig. 3, Pascal's statement).

Since it is possible to emphasize either argument-oriented elements or story-oriented elements in a case analysis, one could say that arguments and stories behave as "communicating vessels": a change in an argument-oriented version of a case analysis requires a matching change in a story-oriented analysis. As a consequence of this "communicating vessels" property it is possible to choose what works best when performing an analysis: some cases or aspects of a case will more

²³ This is the case in, for example, Pennington and Hastie's (1993), Josephson's (2002) and Thagard's (2004) approaches.

conveniently be modelled in terms of arguments, others in terms of stories. For example, if the decision whether the suspect is guilty or not hinges on a single fact (e.g. whether the suspect was at a particular location at a particular time), alternative stories are less important and the main analytical technique is to carefully consider all the arguments for and against this fact. In other cases, certain facts might not necessarily be justified because they are supported by strong evidence but rather because they are part of the most coherent story. Take, for instance, a case with multiple contradicting claims based on different testimonies. Simply considering these claims as counter-arguments to each other does not tell us which one, if any, is true. Rather, we should look which claim is part of the most coherent story that is supported by the most additional evidence, that is, which claim is compatible with the totality of the evidence.

We believe that the fact that arguments and stories to a certain extent behave as “communicating vessels” indicates that there is room for a deeper understanding of the relation between arguments and stories in reasoning about evidence, in such a way that they are treated in a genuinely integrated way, instead of in the hybrid way proposed here. Both similarities and differences should be more succinctly emphasized in such an integrated approach. A requirement of an integrated approach would be that it explains how and to what extent argumentative and narrative elements of a case analysis can be exchanged, and when their differences make this impossible. Furthermore, whether there are principles or heuristics to choose between the different analytical tools is as yet an open question.

3 Argument and Story Schemes: The Knowledge Involved in the Process of Fact Finding

Evidence is the pivotal source of knowledge in evidential reasoning; the knowledge gained from sources of evidence provides the case-specific “ground” on which all other reasoning about a case can be built (Fig. 3). However, evidential reasoning also involves a large amount of *knowledge about the world* we live in. This knowledge is not based on direct evidence, but rather it is stored in what is metaphorically called a stock of knowledge, a repository of general knowledge about the world that is “stocked” in the reasoner’s mind (Cohen 1977). Parts of this knowledge are commonsense (“Murders normally involve a murder weapon”), others require specific expertise (such as knowledge about the justificatory force of a forensic report, e.g. about a DNA match).

Our knowledge of the world allows us to assume or infer new information in a way that is as reliable as is needed in the context. This type of knowledge, whilst often accepted in a wide community, has varying degrees of reliability and for every general scenario or generalization, there is at least one example of a situation in which it does not hold. The reliability of the knowledge we use depends on context. For instance, in the beginning of the investigative phase, it may be useful to accept some slightly implausible hypothetical scenarios and generalizations in order not to constrain the investigation too much by setting high standards. Later on, in the actual decision-making process, more reliable knowledge corresponding to a stricter

burden of proof ('beyond a reasonable doubt' as opposed to 'possibly') will be used. As such, the use of our knowledge can have exceptions, its use involves the risk of getting it wrong and depends on context.

In the hybrid approach, knowledge about the world is used in two pivotal ways. First, good and effective reasoning with evidence requires knowledge of pragmatic (not necessarily formal) rules of inference, generalizations which warrant inferences from premises to conclusions. Second, knowledge of relevant scenarios or clusters of events is needed. Generalizations and scenarios can be seen as argumentation schemes and story schemes, respectively, schemes that encode general patterns of reasoning and knowledge. For example, a witness testimony argumentation scheme is a general scheme for particular arguments based on witness statements. Similarly, a murder story scheme is a general scheme for particular murder stories. In this section the two types of schemes will be discussed.

3.1 Argumentation Schemes

The first kind of knowledge about the world that is needed in our hybrid approach to reasoning with evidence concerns the inference warrants underlying the reasoning steps from evidence to some conclusion. In the research on argumentation theory, these are often referred to as *argumentation schemes* (Walton 1996; Walton et al. 2008). Argumentation schemes can be thought of as a semi-formal generalization of the rules of inference found in formal logic (cf. Bex et al. 2003; Verheij 2003).²⁴ They are closely related to Toulmin's notion of warrants.

Argumentation schemes can be abstract or specific. For example, the standard Modus Ponens inference rule can be seen as an abstract argumentation scheme. An example of a more specific argumentation scheme is that for Argument from Witness Testimony (Bex et al. 2003):

Witness w asserts that p is true (false).

Therefore, p may plausibly be taken to be true (false).

This scheme is essentially a conditional version of the generalization 'witnesses usually speak the truth' from Fig. 2 (see Verheij 2005a for how generalizations can be rewritten as a conditional scheme). Because argumentation schemes range from abstract to specific, we can envisage hierarchies of schemes ranging from abstract, domain independent rules (Modus Ponens) to more domain-specific and contextual schemes (Witness Testimony, Expert Testimony), where some specific schemes are instances of abstract schemes. For example, Witness Testimony and Expert Testimony schemes are instances of the general Position to Know scheme (Walton et al. 2008). Sub-schemes of the Witness Testimony scheme are, for example, schemes for specific "types" of witnesses, such as witnesses under oath or witnesses in a particular legal system.

²⁴ In Walton's treatment, argumentation schemes do not only occur as generalized rules of inference, but also as (generalizable) small derivations or pieces of dialogue (Verheij 2003). Cf. also Prakken (2010) who argues that some argumentation schemes are compressions of more complex types of defeasible reasoning and Verheij (2009), who shows how argumentation schemes have been incorporated into more formal models of argumentation.

Argumentation schemes may come from a number of sources such as, for example, logic or epistemology (e.g. Pollock's 1987 rules for reasoning from perception or memory).²⁵ They represent stereotypical ways of reasoning about which there is a consensus, at least in the relevant (philosophical) community. The law may also point us to oft-used patterns in our reasoning: 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 (articles 339 and 342 Dutch Code of Criminal Procedure). This means that it is highly unlikely that the legislator believed the witness testimony generalization to be false by default.

One of the main points of looking for stereotypical patterns of reasoning is that for each scheme some typical sources of doubt can be given. For argumentation schemes, these sources of doubt are expressed as *critical questions*. For the Witness Testimony scheme, we can ask, for example, 'Does witness *w* accurately remember *p*?' and 'Does *w* have a reason for lying about *p*?' Critical questions show where possible weak spots in an argument from Witness Testimony might be, and they can be used to analyse such an argument.

3.2 Story Schemes

In the 1970s, the fields of cognitive science and artificial intelligence took an active interest in stories. This research mainly focused on developing formal grammars for describing the structure of a typical story (e.g. Rumelhart 1975). These story grammars divide stories into episodes, which consist of a beginning, development and consequences. In later research, in particular Schank and Abelson (1977), more specific story-patterns called scripts or explanation patterns are given, which help in story understanding. For example, the 'restaurant-script', which contains information about the standard sequence(s) of events that take place when somebody goes to dine in a restaurant, helps us understand a simple story about someone who goes to dine in a restaurant because it fills the gaps, the events which are not explicitly mentioned in the story (e.g. the person reading the menu). Scripts and explanation patterns can also be used to explain an event (Schank 1986), as they connect the event with an explanation that has been used to explain the event before.

Episodes, scripts and explanation patterns can be seen as instances of something which we call *story schemes*, general patterns of (types of) events that can serve as a background to particular stories. Like argumentation schemes, story schemes range from abstract to specific. For example, a scheme *beginning—middle—end* is a very abstract scheme for stories. Pennington and Hastie's (1993) episode scheme for intentional actions, a pattern of the form *motive—goal—action—consequences*, is more specific. Even more specific schemes mention not only a sequence of events, but also other information important in a story of that particular type. Take, for example, the story scheme for 'murder':

1. *Anomaly that the scheme explains*: person *y* is dead.
2. *Central action of the scheme*: person *x* kills person *y*.

²⁵ See Hitchcock (2010) for an exposition of how logicians or epistemologists might go about constructing (new) argumentation schemes.

3. *Other relevant information*: the motive m , the time of the killing t , the place of the killing p , the weapon w .
4. *Pattern of actions*: person x has a motive m to kill person y —person x kills person y (at time t) (at place p) (with weapon w)—person y is dead.
5. *More specific kinds of murder*: assassination (e.g. liquidation), felony murder (e.g. robbery murder), killing of one's spouse.

In addition to a pattern of actions, this scheme also contains other information, such as what the central action is and which other, more specific schemes might be applicable. The story about Nadia fits this scheme with, for example, motive m being the disagreement and the weapon w a gun.

Like argumentation schemes, story schemes are hierarchical in that specific schemes can be seen as instances of abstract schemes. For example, a murder is an instance of an intentional action (where, e.g. the *action* is *person x kills person y*), which is in turn an instance of the standard *beginning—middle—end* scheme for stories. Story schemes are also hierarchical in that an element of one scheme may itself be comprised of a scheme. For example, the motive of a murder may be another murder: x 's motive for killing y may be that y killed x 's brother.

An argumentation scheme denotes an inferential relation between propositions and (the sequence of events in) a story scheme denotes coherence relations between events or event types. Hence, a particular story and its corresponding scheme can be rendered in a way similar to a particular argument and its corresponding scheme(s). As an example, see Fig. 5, in which the explanatory relations from the murder story scheme are expressed in natural language in the same way as the (inferential) relation expressed by the Witness Testimony argumentation scheme in the argument in Fig. 2 is expressed in natural language.

Story schemes are important in reasoning about the facts because they serve as possible templates for the hypotheses in IBE. Schank (1986) argues that there are three ways of performing abductive reasoning when we want to explain some explananda. The first way is to look at specific similar cases; for example, if we want to explain why Pascal fled in Nadia's car we can look at other situations in which Pascal behaved in a similar way. This way of reasoning uses *case-specific scenarios* and is hence similar to argumentative reasoning with case-specific generalizations (cf. the top inference in Fig. 2). The second way to explain an explanandum is to find an explanation for an event in the form of an existing story scheme. For example, faced with Nadia's body we invoke the murder scheme. The third, and arguably the hardest way to explain an event happens when there is no particular story scheme that seems to fit the current case; we then have to build a

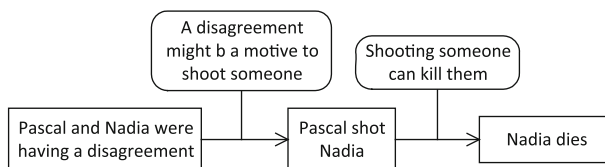


Fig. 5 A story with causal relations expressed as generalizations

new scenario from scratch. Very often, however, there will be some kind of story scheme that can be recalled from memory. In our informal contacts with the Dutch police force, they repeatedly insisted that when faced with some initial evidence, they have a range of standard scenarios (i.e. story schemes) they turn to.

In addition to aiding abductive inference, story schemes can also be used to critically analyse existing stories and, in particular, the coherence of stories. For example, if a story does not fit a particular scheme because some of the elements of the scheme are not in the story (for example, no mention is made of the motive in a murder story or the causal link between the murderous action and the victim's death is not made clear), the story's coherence diminishes. Additionally, the critical questions associated with the story scheme may be asked. Bex et al. (2009) give a list of critical questions for the intentional action scheme, a few of which we mention here.

1. Can there be another motivation which is a deterrent for doing the action?
2. Can the action be induced by some other motive?
3. Is the motive a legitimate motive for the action?
4. Can the action have the stated consequences?

For example, for the story in Fig. 3 we need to determine whether Pascal might have some other motivation that deterred him from shooting Nadia (e.g. the motivation not to get into trouble with the police), whether Pascal could have had some other motive (e.g. self-defence), whether a disagreement is a valid motive for shooting Nadia and whether shooting Nadia might have killed her.

Story schemes have been examined in the field of Case Based Reasoning (e.g. Schank and Abelson 1977; Schank 1986). Pennington and Hastie (1993) and Wagenaar et al. (1993) both use the relatively simple intentional action scheme and they do not further examine specific schemes in evidential reasoning. There is a recent rise in attention for the computational modelling of the role of narrative in cognition (Finlayson et al. 2010). Our use of story schemes in argumentation is, as far as we are aware, quite novel. There have been attempts at systematising story schemes, mostly with regards to fictional tales (e.g. Propp's 1968 systematisation of the structure of Russian folk tales). Exactly which schemes are often used in a (criminal) legal context and which critical questions can be associated with these schemes remains an open question.

4 Critical Questions for the Hybrid Theory: The Nadia van der V. Case

On the 1st of October 2002, the police find student Nadia van der V. in her home, dead. She has been killed by several gunshots fired at her head and body from close range. Her landlord, Pascal F., is regarded as the prime suspect. He has been seen fleeing town in Nadia's car and is not to be found until well into the next year. When Pascal is finally apprehended, he is charged with murder and found guilty by the lower courts as well as on appeal. Looking at the verdicts of the case, it is not hard to see why the judges chose to believe the prosecution's story: Pascal is an ex-soldier who is known for his volatile behaviour and there are numerous witnesses

who testify about Pascal's flight from the police on the day of the murder. The defence, on the other hand, is less fortunate: the only alibi Pascal provides is a vague story about him being abducted and taken to Poland by people he did not know; later, Pascal even admits he fled from the police because he was afraid he would be "framed".

Even though at first glance the prosecution's story is more coherent, and thus more plausible, we must be careful not to accept it too readily, as psychological research has shown (Bennett and Feldman 1981; Pennington and Hastie 1993) that a good story need not necessarily be a true story. Our hybrid argumentative-narrative approach gives rise to a number of critical questions that can be asked to unearth sources of doubt in a total case (i.e. the combination of arguments, stories and evidence) in the same way as critical questions for argumentation schemes point to sources of doubt regarding a single inference and critical questions for story schemes point to sources of doubt in a particular story. These critical questions can essentially be asked during any stage of the process of proof (i.e. pre-trial, during trial and post-trial). As was already mentioned, we performed a post-trial analysis by looking at the publicly available verdicts in the Nadia van der V. case.

4.1 Insufficiently Specific Accounts of the Facts

The starting point of a well-supported opinion about the facts is a concrete story about what happened, that is, a sufficiently specific and coherent account of what (might have) happened in a criminal case. By presenting the story separately from any arguments about its coherence and the evidence, the coherence of the story can be best appreciated and investigated. In a sense, one can say that this story is the *conclusion* of the total argument about the case (here, we use the term "argument" in the broad sense, cf. Sect. 2.2). Which stories can be the conclusion of a legal verdict is often restricted by formal constraints; for instance, in the Netherlands the factual account of a conviction should match the indictment presented by the prosecution. Here we abstract from such constraints.²⁶

Thus, the first critical question for rational fact finding can be phrased as follows.

- (1) Are the facts of the case made sufficiently explicit in a story?

A case should contain a clearly phrased, sufficiently specified and coherent story detailing "what happened". Such a story is the issue to be investigated or debated, and will—if successfully argued for—be the conclusion of the case.

In the Nadia case, a story can be reconstructed on the basis of the verdicts of the courts.

Nadia, a student living in Utrecht and her landlord, Pascal, had had a disagreement about a washing machine. On the 1st of October, Pascal lost his head and decided to kill Nadia. At 8:30 in the morning, he called his work to report in sick and grabbed a small machine gun he had in his room. Nadia was doing the laundry while calling a friend using her hands-free earpiece; the two

²⁶ In Bex and Verheij (2011b), we further explain the link between the factual and the legal aspects of a case.

other tenants had left earlier that morning. Around 8:53, Pascal confronted Nadia in the hallway. At first, Nadia greeted him but quickly she saw that he was up to no good and started screaming. At that point, Nadia's telephone conversation with her friend was interrupted. Pascal shot Nadia twice, which caused her to collapse. He then dragged her to the kitchen, where he killed her by shooting her through the head three times at close range. Pascal then dragged her body to his part of the house and closed this part off.

At approximately 9 o' clock, Pascal left the house and drove towards the nearest access to the motorway in Nadia's car. At 9:10, he suspected someone deliberately tried to cut him off on the motorway's access ramp. He steered the car off the ramp, got out and left it. Pascal was afraid the police was looking for him and he tried hiding for a helicopter in the nearby woods. Later that day (around 18:15), Nadia's body was found by the police, which had been alerted by the other tenants who had returned home. Pascal visited his parental home on the 2nd of October, where he briefly spoke to his father. Pascal then left for Poland where he stayed until the 29th of January. When he returned, he was apprehended by the police and put into custody.

This story, which was taken from the courts' verdicts with a minimal amount of interpretation on our part, provides a clear, specific and coherent account of what happened; the first critical question provides no problems.

4.2 Insufficient Support of the Facts

One's belief in the truth of a story about what happened must be supported by evidence. A key step is the identification of the evidential support that can be given for the elements of a story, that is, identifying the sources of evidence that support the story. In general, not all elements of a story can be supported by evidence. This does not need to be a problem, and is in fact unavoidable as certain story elements must by their nature be indirectly justified. When an element of a story is not supported by a piece of evidence (in a given argument), we speak of an *evidential gap* (Bex et al. 2010; Bex 2011). A typical example of an evidential gap occurs when proving criminal intent. Sometimes criminal intent can be supported directly by, for example, the confession of the suspect. But very often the criminal intent of the suspect is simply assumed; this assumption is justified because it fits a coherent story about the facts that is supported by additional evidence. For example, when the suspect is caught red-handed while leaving the house through a broken window with a backpack filled with a crowbar and the house owner's digital camera, the suspect's criminal intent can be safely assumed.

The existence of evidential gaps, here conceived of as parts of a story for which no direct evidence²⁷ is available, is one reason why a mixed-argumentative narrative perspective can be useful. The analytical argumentative perspective makes the

²⁷ There is theoretical discussion about the nature and existence of direct evidence, see for instance Anderson et al. (2005), pp. 62–63. For our purposes, it suffices to note that we consider an event to be directly supported when there is a direct, argumentative (evidential) chain of reasoning from evidence to the event.

evidential gaps visible, the narrative perspective shows why the evidential gaps can still be believed in conjunction with other facts. In general, it is a matter of good judgment which elements of a story must be directly supported by evidence and which can be assumed in conjunction with the other facts. This depends in part on the quality of the evidence (a story supported by only weak evidence can become stronger by providing evidence for more facts), but also on the nature of the crime itself. For instance, in a murder case, a case without a murder weapon is in bad shape, let alone when the body has not been found. We will call a component of a story that needs to be proven ‘essential’, but it deserves to be emphasized that which the essentiality of story components is gradual and depends on the other available evidence.

In sum, the second critical question for rational fact finding is as follows.

(2) Is the story sufficiently supported by evidence?

There might be essential elements of the story which are not supported by arguments based on evidence.

Has the story about the murder of Nadia on October 1, 2002 been sufficiently supported by evidence? In the verdicts, the following evidence information is provided, where we specify which part of the story it supports:

- The fact that Pascal has been in touch with his work is supported by telephone records (a call was made from the house to Pascal place of work) and by a testimony of Pascal’s colleague. The colleague has testified to the police and at the court hearing that there is no doubt that he has talked to Pascal over the phone and that Pascal called in sick, although he did not sound ill.
- That Nadia was making a phone call follows from the statement of the friend who has heard her scream. The earphone of the phone was lying next to Nadia’s body, the phone was on the kitchen counter.
- The exact circumstances surrounding the murder itself, that is, the shooting of an Uzi in the corridor and in the kitchen and the dragging of Nadia’s body, follow from the bloodstains, bullet parts and shells found in the house. Also an Uzi’s sawn-off barrel, cartridges and cartridge clip were found in Pascal’s room.
- That Pascal is the one who actually committed the murder, is supported by the following:
 - An intercepted telephone conversation between Pascal and his father points out that Pascal told his father that he killed Nadia after an argument about the rental agreement.
 - A statement by Pascal’s father, who claimed that in January 2003 Pascal had told him about a disagreement between Nadia and Pascal about the dryer and washing machine and that he went crazy because he had been drinking.
- The circumstances surrounding Pascal’s flight, that is, the facts that he drove Nadia’s car off the road’s bank and then fled into the forest, is supported by the following:
 - Witnesses have stated that a man fitting Pascal’s description drove the car that was steered off the ramp.

- Scent tests showed that Pascal sat on the driver's seat and had touched the gear.
- An intercepted telephone conversation between Pascal's mother and brother referred to the fact that Pascal thought someone tried to cut him off at the motorway's access ramp.
- A statement by an unnamed relative of Pascal referred to an alleged pursuit by a helicopter.

This list of evidence is taken directly from the verdicts.²⁸

The main evidential gaps in the Nadia story are Pascal's motives and the relation between these motives and his action, shooting Nadia. For example, exactly why the (seemingly trivial) disagreement caused Pascal to shoot Nadia is at first left unexplained and no evidence is mentioned for the fact that the shooting caused Nadia's death. Pascal's motives for the murder are further dealt with when looking at the plausibility of the story (critical question 4 in Sect. 4.4.). That the shooting was the cause of death can probably be supported on the basis of autopsy report on Nadia's body, but this is not mentioned in the verdicts because it was no issue in the case. In sum, critical question 2 has been satisfactorily answered.

4.3 Insufficient Support of the Relevance and Evidential Force of Pieces of Evidence

The next issue to consider is the strength of the evidence and its relevance for the facts in the story. For this, we have to look at the evidential inferences from the evidence to the facts; in Fig. 2, for example, the inference steps are based on the Witness Testimony argumentation scheme and two other generalizations. In order to determine the relevance and probative force of a piece of evidence, these generalizations and schemes warranting the inference steps should be made explicit. Because warranting generalizations might express implicit biases or prejudices (e.g. "a confession is often true", cf. Wagenaar et al. 1993), it is important to determine whether and, if so, on which grounds a scheme or generalization is considered to be valid (i.e. provide the *backing* to the *warrant*, Toulmin 1958). As was discussed in Sect. 3.1, schemes may be grounded in, for instance, logic, epistemology,²⁹ science and law.

The general validity of a warranting scheme or generalization does not imply that in the concrete situation the inference from evidence to conclusion can be made; there may be exceptional circumstances that exclude the use of the warranting scheme. For well-known argumentation schemes, the critical questions point to such typical exceptions (e.g. the witness lied or does not accurately remember, Sect. 3.1); in the case of more specific generalizations, these exceptions will have to be imagined on a more ad-hoc basis. For example, an exception to the generalization 'if person *x* was in a car at time *t* and someone looking like *x* has been seen in that

²⁸ Pennington and Hastie (1993) have shown that the chronological ordering is more convincing than an arbitrary ordering.

²⁹ Freeman (2006) has provided a classification of types of warrants based on epistemic considerations. He distinguishes a priori, empirical, institutional and evaluative warrants.

car at time t , then it is likely that the person in the car at time t was x' (Fig. 2) would be if x has an identical twin y . In that case, it would be just as likely that y was in the car at time t .

Summarizing, we find the following critical questions:

- (3) Is the support that the evidence gives to the story sufficiently relevant and strong?
 - (a) Are the reasoning steps from evidence to the facts in the story justified by explicit warranting schemes or generalizations that are valid and grounded?
 - (b) Are there exceptions to the use of the schemes and generalizations that undermine the connection between evidence and facts?

Often, common argumentation schemes (such as the scheme for Witness Testimony or Expert Opinion) need not be explicitly stated. But the possibility of exceptions can never be neglected. In our case study, most reasoning steps are based on plausible schemes or generalizations. Perhaps the use of the scent test (Fig. 2) as a basis for drawing conclusions is the most controversial.³⁰ If we consider the criticisms concerning these scent tests well-founded, then we must conclude that the scent tests cannot be used to support the conclusion that Pascal was in Nadia's car (critical question 3a).

With respect to most of the listed pieces of evidence, we need not assume that there are exceptions to the underlying rules (critical question 3b) and we can infer the events of the story supported by the evidence. One exception here is Pascal's father's testimony: it might very well be possible that the father is biased when testifying about his own son (critical question 3 for the Witness Testimony Scheme). However, in this case there was other corroborating evidence (the intercepted telephone conversations) so it seems that Pascal's father told the truth in this case.

4.4 Insufficiently Critical Assessment of the Story

Now that we have considered questions 1, 2 and 3, we are in the following position: there is a sufficiently clearly delineated account of the facts (the story), of which as many as possible have evidence supporting them, of which the relevance and strength has been established. The argument about the case as-a-whole can be further improved by critically analysing the story and showing that there are no viable alternatives.

One way of analysing a story is to look at its coherence. In Sect. 3.2, we saw that story schemes play an important role in determining this coherence: they allow us to determine whether a story is *complete* (i.e. have all the essential parts of the corresponding story scheme) and they have associated critical questions which point to typical sources of doubt. Note that a story should fit a valid story scheme just as an inference should be based on a valid argumentation scheme. For example, a story

³⁰ The tests raised controversy in another well-publicised Dutch case, namely the Deventer Moordzaak.

that follows a pattern where a conspiracy by the state against the accused is suggested, for example, is less coherent because such a pattern of actions is unusual.

Just as arguments are not always based on well-known argumentation schemes, stories are not always be based on (valid) story schemes: in Sect. 3.2, we discussed three ways of performing abductive reasoning, two of which (reasoning with similar cases and constructing completely new explanations) do not provide us with a story based on a general scheme. In order to test a story's coherence, we can therefore, not always rely on critical questions associated with a scheme but we need also look at the consistency of the story as well as the plausibility of the individual causal relations and events in a story. For example, a story which reports that aliens landed on earth or a story which says that the victim's death was caused by her being shot with a ballpoint pen using a makeshift crossbow is less plausible and thus lacks coherence.³¹

An assessment of the coherence of a story is to a large extent independent from the evidence available and can be based on our general expectations about the world (i.e. people do not usually shoot someone over a simple disagreement, shooting someone from close range might kill them). However, there always is the danger of preferring a "good" story (i.e. a coherent one) to a "true" story (i.e. supported by strong evidence) (Bennett and Feldman 1981). It is therefore, important to emphasize that the belief in a story must first and foremost depend on the extent to which the evidence supports the story. The coherence of a story plays an important role when there are evidential gaps: an unsupported fact that is part of a coherent story is more believable than one which is part of an incoherent story. Furthermore, in a case where the coherence of a story is lacking, this should be countered by particularly solid evidence. Thus, a critical examination of the coherence of a story might push the search for further evidence, as will be shown in the example below.

In addition to analysing the coherence of the story, we should also determine whether there is evidence that refutes the story, that is, whether there are arguments based on evidence that attack the story. There can be evidence against the facts in the story itself, or evidence against facts that follow from the story (*story consequences*). These story consequences are not part of the story itself, but causally follow from it. For instance, when according to the story the suspect fled from the scene of the crime while bleeding heavily, one story consequence is that there are probably traces of blood at the crime scene. If no evidence for this is found, the believability of the story is reduced. Now, the fourth critical question can be phrased as follows:

- (4) Has the story itself been sufficiently critically assessed?
 - (a) Is the story sufficiently coherent? Are there elements missing? Are there implausible events or causal relations? Is the story inconsistent?
 - (b) Is there evidence that refute elements of the story?
 - (c) Have story consequences been used to test the story?

³¹ This second example is based on an actual Dutch case, aptly named the "Ballpoint-case" (Feteris 1999).

Let us elaborate these questions for our example case about Nadia. We start with component 4a: the coherence of the story. Something that at first sight is implausible is the assumption in the story that the disagreement over the washing machine led Pascal to murder Nadia. No reasonable person would assume that a disagreement over washers and driers would lead a person to murder someone, so the causal relation between the motive (disagreement) and the action (murder) is implausible. In the previous section we argued that less plausible stories can be held true, as long as they are supported by strong and relevant evidence. In the case, the causal relation is supported in part by the tapped phone conversation that suggests that Pascal went berserk under the influence of alcohol. This makes the story more credible, as it is well known that people who have been drinking can get overly aggressive. Still, given the seriousness of what has happened, more is needed.

In its decision, the court of appeal inadvertently elaborates on Pascal's tendency to react rather violently in response to what most consider to be futile causes. In the decision, a report of a psychiatric observation clinic is discussed; it is used to provide support for the decision to keep Pascal under psychiatric surveillance. The report of the PBC explains that Pascal has a disorder by which ordinary events make him feel seriously threatened and react with disproportionate violence. From a rational perspective, the report can be viewed as support for the fact that Pascal has a tendency to react violently. Assuming that Pascal has this tendency, the events surrounding the death of Nadia and its cause are suddenly a lot less incredible, especially if we also take into account that Pascal had been drinking.

Another part of the story that on closer inspection might be regarded as incredible, is that Pascal has killed Nadia with an Uzi. Even if he had an Uzi available, shooting one requires training, in particular in the purposive way as mentioned in the story. On the other hand, one could say that someone who owns an Uzi will probably know how to use it. The court of first instance mentions in connection with another murder of which Pascal was a suspect that Pascal learnt how to use an Uzi when he was in military service. This fact can be used to take away doubts about whether Pascal could shoot to kill, as in the case of the murder of Nadia.

Critical question 4b concerns counterevidence against the story. We already saw in the example in Fig. 3 that Pascal denied he killed Nadia. More specifically, he claimed he was in Poland at the time of the killing. Now, in this case Pascal's claim can be seen as a simple refutation of the main story: Pascal being in Poland and killing Nadia at the same time cannot be part of the same consistent story. However, as was discussed in Sect. 2.2., this refuting claim can also be regarded as a (arguably very simple) alternative story because arguments and stories are communicating vessels. In Sect. 4.5., we will therefore, further analyse Pascal's statements as an alternative story.

Finally, the story consequences should be tested. The perpetrator, whoever it may be, shot Nadia at close range and has subsequently dragged her body to another place. So it is highly likely that the perpetrator would have blood on his hands, clothes and shoes. It is hence quite possible that the offender's shoeprints can be found in the house. If the offender then stepped into her car, there can also be traces of Nadia's blood in or on the car. The ruling of the court stated that indeed

shoeprints were found in the house and that there was blood on the door lock and the floor mat on the driver's side of the car. The questions to be asked are then whether the shoeprints are Pascal's, and whether the blood on the car is Nadia. The evidence shows that both can be answered positively. The shoeprints were probably made by Reebok shoes and Pascal has stated that he indeed owned shoes of this brand, and that he was wearing them when he left the country briefly after October 1. A comparative DNA analysis showed that the profiles of the blood found in and on the car matched Nadia's profile.

4.5 Insufficient Attention for Alternative Accounts of the Facts (Tunnel Vision)

In the hybrid theory (or any theory of Inference to the Best Explanation for that matter), sufficient attention should be paid to possible alternative scenarios of what has happened. So-called "tunnel vision" (i.e. focusing too much on one interpretation of the facts) can and has lead to miscarriages of justice in the past. A serious search for alternative scenarios is needed. These alternatives may be provided by the opposing party at trial, but it is also important that the investigators or decision makers themselves actively consider different accounts of what may have happened. Story schemes might be of help in this respect, as they provide guidelines or templates for possible stories. However, care should be taken that the "stock" of story schemes is big enough: considering alternatives based on only a small set of story schemes is also a form of tunnel vision, and as was argued in Sect. 3.2, one might have to imagine totally new hypotheses when no relevant schemes are available. Note that alternatives should not only be actively sought, they should also be adequately supported by evidence and analysed. Essentially, for any alternative story we should ask critical questions 1 through 4. In the case of a verdict in a case, it should then be shown that the alternative stories are of a lesser quality than the main story that fits the verdict. There are no hard-and-fast rules that determine when one story is better than another. That is, we cannot safely say that, for example, a story that is supported by two pieces of evidence is better than a story supported by one piece of evidence. If, for instance, the first story is a highly incoherent account supported by statements of two witnesses who are suspects themselves and the second story is highly coherent and supported by hard evidence such as CCTV images, we would argue the second story is the better one.

Evidential gaps often also lead to situations where the choice between alternatives is complicated. For example, when the prosecution claims criminal intent but the defence argues this is not the case, the judge or jury is faced with two "alternative" stories which are essentially the same save for the single element of *mens rea*. Without any additional evidence pointing to the suspect's intent, the choice between these alternatives is hard to make. In the Netherlands, the situation where there are two alternatives which are both compatible with the same evidence is called a "Meer-en-Vaart" situation (after the Meer-en-Vaart case, Dutch Supreme Court February 1, 1972, NJ 1974, 450). The Dutch Supreme Court has decided that in such Meer-en-Vaart situations the question why the one story should be chosen over the other has to be explicitly addressed.

To summarize, quantifying the quality of stories is a hard, if not impossible, task and the comparison of stories is a complicated pursuit. Because of this, it is important that all stories and their supporting arguments are dialectically analysed using critical questions. Furthermore, any reasons for choosing one story over the other should be made explicit. Thus, we have the following critical question:

- (5) Have alternative stories been sufficiently taken into account?
- (a) Has a sufficient search for alternative explanations been performed, not only in the investigative phase, but also in court?
 - (b) Have the alternatives been sufficiently analysed? Are there explicit reasons to choose one story over the alternatives?

In the Nadia case, Pascal told the alternative story that he was suffering from amnesia and could not remember what happened on October 1. He claimed to have been kidnapped and taken to Poland, although by unknown persons and for unknown reasons. First, this can hardly be considered a story (cf. our critical question 1 that requires a sufficiently specific account of the facts); in the previous section, we therefore, already presented part of this story (that Pascal was in Poland) as a simple refuting argument. However, let us for the moment assume Pascal's "account" is an alternative story. It is immediately apparent that Pascal's story is not nearly as coherent and well-supported as that of the prosecution. As for the story's coherence (critical question 4a), several crucial elements are missing, such as the identity and motive of the kidnappers. Furthermore, the story is incoherent: Pascal claims to have blanket amnesia but he *does* remember he did not kill Nadia and was in Poland. As for evidential support (critical question 3), only Pascal's statement supports his story and there was no corroborating evidence for, for example, the kidnapping having taken place. Also, the court explicitly refutes the amnesia defence (critical question 4b): it states it does not believe Pascal, because Pascal has never sought medical help for his alleged amnesia. Thus, the court explicitly refutes Pascal's alternative.

4.6 Missing Weighing of Reasons

Finally, a general caveat is in place: any conflicting reasons must be weighed. There may, for example, be conflicting arguments based on evidence (e.g. two witnesses who make opposite statements about the suspect's whereabouts). Conflicting reasons do not only exist at the level of arguments for or against individual events, but also at the level of stories. For example, there might be reasons for and against a story as a whole or reasons for choosing one story over another. When there are explicit grounds that can decide the weighing of such opposing reasons, they should be given. The stronger and more relevant the reasons are, the more important it is to decide explicitly how they are weighed against each other.³² The final critical question can now be phrased as follows:

³² The exact role and nature of the weighing of reasons goes beyond the goals of this paper. In our perspective on the weighing of reasons, the issue whether certain given pros outweigh given cons is itself open for argumentation. For instance, in the law, precedents can sometimes be used to argue how certain

(6) Have all opposing reasons been weighed?

Have all considerations that are used to weigh opposing reasons been made explicit? Has this been done both at the level of individual facts and events and at the level of stories as-a-whole?

In the Nadia case, there was no difficulty in the balancing of reasons at the level of stories. Pascal's "story" was so implausible and badly supported that it could be considered as refuted by itself (because of its incoherence), even without considering the plausible and well-supported story of the prosecution. As an example of a weighing of individual events, we mention the smell test that played a role in determining the circumstances of Pascal's flight. By itself, such a smell test may not be considered sufficiently satisfactory, but in conjunction with other evidence (testimony, intercepted telephone conversation, traces of blood) it nevertheless helped to support this part of the story of the prosecution.

5 Conclusion

In this paper, we have proposed a series of critical questions for the hybrid argumentative—narrative theory of reasoning about the facts and the evidence in legal cases. Some of these critical questions point to the argumentative part of a hybrid case (in particular critical question 2 about the sufficient support of the events, and question 3 concerning the relevance and strength of the support). In this more argumentative part of an analysis, our critical questions for the case-as-a-whole are supplemented by the critical questions associated with argumentation schemes as studied in argumentation theory. There are also general critical questions that are strongly connected to a narrative style of analysis (in particular question 4 about the coherence of the supported story, and question 5 about the consideration of alternative stories). Analogous to the argumentative side of the theory, these critical questions are supplemented by critical questions for individual story schemes. Thus, we expand on the analytical tools for analysing legal argumentation that are currently available, such as Walton's argumentation schemes (Walton 2002), Wigmore's charts (Wigmore 1931; Anderson et al. 2005) and the Amsterdam school's pragma-dialectical analysis (e.g. Feteris 1999).

Our hybrid theory and the associated critical questions show that the dialectical argumentation that is involved in reasoning on the basis of evidence is an intricate process that cannot be modelled appropriately using just syllogistic arguments of the form *A therefore B*. We have shown how two kinds of general knowledge about the world play a role: (1) defeasible argumentation schemes that specify which kinds of reasons support which kinds of conclusions (such as the witness testimony scheme), and (2) story schemes that specify which clusters of facts and events are plausible

Footnote 32 continued

reasons must be weighed. See also Wellman (1971), Naess (1978), Govier (1999), Feteris (2008), Hage (1996, 1997), Verheij (1996). The debate on the weighing of reasons has recently been revived by the Symposium on Conductive Arguments, organized at University of Windsor in 2010 (about which a special issue of the journal *Informal Logic* is in preparation).

and coherent combinations that can be expected to happen (such as the restaurant script or the murder story scheme). Here our approach echoes Twining when he said that the knowledge humans use when arguing cannot just be captured as conditionals; rather it is a ‘a complex soup of more or less well grounded information, sophisticated models, anecdotal memories, impressions, stories, myths, proverbs, wishes, stereotypes, speculations and prejudices’ (Twining 1999, p. 91).

One of the lessons learned from the work on the hybrid theory is that stories and arguments are to some extent “communicating vessels”: when dealing with the complex reasoning involved in large criminal cases, a narrative approach works best for some points of a case, while in other instances an argumentative approach is most natural. However, for a deeper understanding of the connection between argumentation and narrative, it seems to be required to develop a further integration of both, in order to make their differences and similarities more clear-cut. Meanwhile, our hybrid approach allows for the flexibility of the separate argumentative and narrative approaches whilst at the same it uses arguments and stories as complementary tools for complex reasoning. The case studies in this text and by Bex (2011) accentuate the value of a hybrid, argumentative-narrative analysis of reasoning about the facts in criminal cases.

We believe that stories and story schemes will play an important role, not just for reasoning with evidence but in the field of argumentation in general. In particular, we consider the following issues to be urgent topics of research:

1. *Elaboration of the notion of a story scheme.* What are the properties of story schemes that make them useful in argumentation? What is the role of abstraction of stories and story hierarchies? When can a story be generalized to a story scheme? When is a story an instance of a story scheme?
2. *Integration of argumentation and stories.* Can argumentation and stories be connected in a more fundamental way than in the hybrid theory? Can the idea of ‘communicating vessels’ be fleshed out in a genuine integrated approach? What are the limitations of integrating arguments and stories given their distinct roles? Are there criteria to determine which elements of a story must be directly supported by evidence, and which can be assumed in conjunction with the other facts?
3. *Embedding in software support systems.* Can sets of argumentation and story schemes form the backbone of useful software support systems?
4. *Repositories of argumentation and story schemes.* Which (types of) argumentation and story schemes are relevant for argumentation? How do we extract such schemes from actual arguments and stories?
5. *Case studies.* Are real cases usefully analyzable using the hybrid theory? Are they an appropriate source of argumentation and story schemes?

Some ideas about these questions have already been proposed by the current authors and their collaborators. Questions 1 and 2 have been explored by Bex (2009, 2011), Bex and Verheij (2010) and Verheij and Bex (2009). Van den Braak (2010) has already shown that a tool which allows for “story-mapping” (cf. argument-mapping with schemes, Reed et al. 2007) can be of use in police investigations and police training (Question 3). Bex et al. (2003) and Walton (2002) mention a number of argumentation schemes which can be used specifically in reasoning with

evidence (Question 4). Bex et al. (2003) analyse a part of the famous Sacco and Vanzetti case using argumentation schemes and Bex (2011) devotes a large part of his book to analysing a Dutch murder case using the hybrid theory (Question 5).

As can be seen, the focus in recent research has mainly been on arguments and argumentation schemes. We think these first ideas are a fertile ground on which new research can be built, further exploring the use of stories in philosophical and computational theories of complex reasoning.

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