

What Makes a Story Plausible?

The Need for Precedents

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When reasoning about the facts of a case, we typically use stories to link the known events into coherent wholes. One way to establish coherence is to appeal to past examples, real or fictitious. These examples can be chosen and critiqued using the case-based reasoning (CBR) techniques from the AI and Law literature. In this paper, we apply these techniques to factual stories, assessing a story about the facts using precedents. We thus show how factual and legal reasoning can be combined in a CBR model.

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1 Introduction [^]

[RZ 1] In a criminal case, we are often presented with a body of evidence which establishes a number of observed facts. However, this evidence is typically incomplete, and these facts will need to be linked together with some further conjectured events to make a narrative, or story, which will fill the gaps and so present a coherent whole [14]. There can be several narratives that conform to the evidence (e.g. the defence's story and the prosecution's story) and so there can be a debate as to which story we should believe. This approach, that reasoning with evidence revolves around the construction and comparison of stories, has been developed in AI and Law in a series of publications on the so-called hybrid theory of stories and arguments [4][5][6], in which hypothetical stories that explain the observed facts are supported by arguments based on evidence.

[RZ 2] The hybrid theory has been presented as a combination of a standard model of causal-abductive reasoning (e.g. [7]) and an argumentation framework in the style of [9]: observations are explained by hypothesised causal rules and facts (e.g. observing smoke we hypothesise fire and the rule fire causes

smoke) and these hypotheses can be supported or attacked using arguments (e.g. Bob said «*I saw a fire*» so fire or Wilma said «*I did not see a fire*» so fire or fireman Sam says «*Fire can cause smoke*» so fire causes smoke). This formalisation of the hybrid theory draws inspiration mainly from «rule-based» approaches in AI and Law, in particular [10]. This is not just evident in the hybrid theory's modelling of supporting and attacking arguments but also in the style in which it models stories (i.e. as networks of causal rules).

- [RZ 3] The work on the hybrid theory has so far not directly used ideas and concepts from the «case-based reasoning» (CBR) approach, as proposed by, for example, [1][2]. This is a somewhat surprising omission, as the comparison of clusters of legally relevant facts (cases) in the CBR approach seems to be a natural fit for reasoning with clusters of facts (stories) as performed in the hybrid approach. Accordingly, this paper aims to show the relation of the hybrid theory to CBR as performed in AI and Law. More precisely, we integrate legal and factual reasoning in the CATO approach of [1]. In previous work [6] we showed that for more rule-based approaches the legal reasoning in a case has many structural similarities with the evidential (factual) reasoning in a case. Here, we aim to demonstrate that the same is true if we adopt a CBR approach. Thus we continue our efforts to integrate argumentative and narrative considerations by considering how the roles of stories, cases and precedents are connected.
- [RZ 4] By looking at stories from the perspective of CBR, we can make improvements to the hybrid approach. For example, we can apply argumentation techniques used in the CBR approach (e.g. showing the similarity between cases, emphasising a distinction between cases) to the factual stories as used in the hybrid theory. This allows for a more precise and, perhaps most importantly, more realistic way of determining story coherence. In previous work, we argued that a story is coherent if it fits a story scheme, a generalised pattern of events. In actual argumentative situations, however, people will cite similar, particular, stories as precedents rather than a generalised pattern. Certainly specific stories are more vivid and more persuasive.
- [RZ 5] Integrating the hybrid theory into the CBR approach can also enhance existing work on CBR. This work has mostly concentrated on legal reasoning (that is, reasoning with legal cases and only considering facts which are directly legally relevant) and the specific facts of a case, the stories about these facts and the reasoning with these facts have not been explored in detail. Furthermore, [15] has argued that the hybrid theory's concept of *story schemes* (abstract scenarios that can serve as a scheme for particular stories) can be used to identify, analyze and evaluate arguments from analogy, and show their function in CBR where precedents are involved.

2 Case Based Reasoning in AI and Law [^]

- [RZ 6] The leading CBR systems in AI and Law are HYPO [2] and CATO [1]. We will base our approach to CBR on CATO (cf. also [3][8][11]).
- [RZ 7] The key idea of CATO is that cases can be described as collections of *factors*¹. A factor is a stereotypical fact situation that has legal relevance, such as *bribed-employee*, *information-disclosed-in-negotiations*, *information-reversed-engineered*, *plaintiff-tooksecurity-measures* and the like. The facts of the case determine whether particular factors are present or absent from a case. If present, the factors provide a reason to decide for either the plaintiff or the defendant. Thus *bribed-employee* and *plaintifftook-security-measures* are reasons to find for the plaintiff, and *information-disclosed-in-negotiations* and *information-reversed-engineered* are reasons to find for the defendant in a trade secrets case. Typically a case will contain a number of factors, some favouring the defendant and some favouring the plaintiff, and the court will need to decide which set of reasons prevail.
- [RZ 8] Guidance on the relative strengths of sets of factors can be obtained from the precedent cases. If the combination presented in a case under consideration (the current case) has been found before, then it would be expected that the decision in the past case would be the decision in the current case. Equally if the current case contained a superset of the factors, with the additional factors favouring the side that won before one would expect that side to win a fortiori. Normally, however, there will be no exact match

and missing and additional factors will serve to distinguish the current case from the precedent. Equally some precedents may point one way and other the other, so providing counter examples.

[RZ 9] As HYPO, CATO supports a three ply form of argument:

1. One side cites a precedent case (a case with factors in common with the current case) decided for their side;
2. Other side presents counter examples (cases with factors in common decided for the other side) and distinguishes the cited cases;
3. Original side may distinguish the counter example, and cite any additional reasons to support their side.

[RZ 10] Whereas the dimensions of HYPO are independent, CATO arranges the factors in a hierarchy where the base level factors are reasons to decide that a more abstract factor is present or absent. Thus if *information-improperly-obtained* is an abstract factor (favouring the plaintiff), *bribed-employee* is a reason to think it present while *information-disclosed-in-negotiations* and *information-reversed-engineered* are reasons to think it absent. Factors belonging to the same abstract factor may be substituted for one another (if their polarity is the same) or cancel one another (if the polarity is different). This enables distinctions to be downplayed by cancelling a factor, or by substituting a factor in the precedent but not the current case by one in the current case but not the precedent.

[RZ 11] CATO recognises the following argument moves: Citing a case to a past case with a favourable outcome (Ply 1); Distinguishing a case with an unfavourable outcome (Ply 2); Emphasising the significance of a distinction (Ply 2); Downplaying the significance of a distinction (Ply 3); Citing a favourable case to emphasise strengths (Ply 3); Citing a favourable case to argue that weaknesses are not fatal (Ply 3); Citing a counterexample (Ply 2). In section 4 we further discuss these moves when we relate them to stories about the facts.

3 The hybrid theory for Inference to the Best Explanation [^]

[RZ 12] The hybrid approach combines stories and arguments in a framework for abductive Inference to the Best Explanation (IBE) [4][5][6]. In IBE, we have a set of observed facts which have to be explained by a hypothesis. In other words, given a set *O* of observations and the knowledge that hypothesis *H* explains *O*, we infer that *H* is probably the case. A hypothesis can take the form of a story, a chronological sequence of states and events that forms a coherent whole. Arguments are used in the hybrid theory as the basis for the observations: every element of *O* is the conclusion of an argument (usually based on evidence) that is part of the hybrid framework.

[RZ 13] In IBE it is imperative that we also consider alternative hypothetical stories that explain the observations, and these stories will then have to be compared. In this comparison, it is not only important that a story conforms to the evidence but also that a story is *coherent*.² Generally, we say that a story is coherent if it conforms to the way we expect things to happen in the world. This means not only that a story should be consistent, but also that it should be anchored in plausible common-sense knowledge of the world [14]. For example, a story where a man enters a restaurant, orders a hamburger, receives his hamburger from the waiter, removes his pants and offers the waiter his pants in exchange for the hamburger can be considered incoherent and hence implausible³: people do not normally remove their pants in restaurants, nor do they offer their pants as barter for food.

[RZ 14] Bex and colleagues distinguish two perspectives on story coherence. The first perspective is on an atomistic, more local level, as it concerns the individual causal links and events that are assumed and does not consider the story «as a whole». If, in the hybrid theory, valid arguments against the plausibility of such assumptions in the story are given, the story coherence decreases. For example, in the story of the man in the restaurant, the causal link between receiving a hamburger and removing one's pants is either non-existent or at best tenuous in the extreme. In contrast, a holistic and global perspective on story coherence is provided by *story schemes*, abstract scenarios that can serve as a

scheme for particular stories [4][6]. The knowledge used in determining story coherence often does not take the form of individual (causal) generalizations but is more naturally thought of as a cluster of generalized events and other background information forming an abstract rendition of how things generally happen in the world [13]. One example of such a story scheme is the restaurant script, which lists the roles (customer, waiter) and sequence of events (ordering, eating, paying) for a restaurant visit. The coherence of a story can be assessed by seeing if it fits a plausible story scheme. A story which is not backed by such a scheme is less coherent, unless the deviation can be motivated by specific evidence. For example, to be at all plausible the story about the restaurant would need some additional events supported by evidence, such as the waiter spilling hot liquid on the man.

3.1 Precedents in factual reasoning ^

[RZ 15] The question now is how to find valid, plausible story schemes. Story schemes ideally model the way things tend to happen in the world. This means that the plausibility of story schemes depends on *precedent stories*: the restaurant scheme we use is based on our experiences of restaurants, and none of the authors ever had a strange experience like the one described above. Here, a precedent is an instance of a story scheme, and so can help to establish the validity of the story scheme as a determinant of global coherence. Furthermore, in realistic contexts people will usually find it more effective to cite a precedent story rather than an abstract story scheme.

[RZ 16] As an example, suppose two people meet on a train: on one story it is a chance encounter, in another it is an arranged meeting. If both people regularly use the train at similar times a chance meeting is entirely plausible. If they rarely use the train, or live elsewhere, it is less so. But citing a particular story can help, particularly a personal one: *you remember when you met Bill on the Rialto bridge? Neither of you knew the other was in Venice, but these coincidences do happen*. The object here is to establish from personal experience that the improbable actually does occur from time to time, so the coincidence is at least possible. An appeal to personal experience or an appeal to a well-known story is much more powerful than citing a story scheme for chance encounters: *A is at location L for reason RA – B is at location L for reason RB – RA and RB are unrelated – A and B meet*. The real story provides a unity to elements which would remain entirely disconnected in the abstract scheme.

[RZ 17] Citing a similar story thus helps establishing coherence. Here, it is important that the current story and the supporting example be relevantly similar: that is, it can explain similar observations (relevance) and resist attempts to distinguish it (similarity). As [15] argues, we would want the story and the precedent to be an instance of the same story scheme: the chance meeting on the train and the meeting with Bill are both instances of the scheme for chance encounters. If we cannot find a precedent story which matches on enough facts, we can attempt to find a more general precedent (e.g. citing a story which contains a coincidence but says nothing about chance meetings). However, in such a case it is easier to reduce the force of the example by pointing to relevant differences. These distinctions can then be emphasised and downplayed, and so we suggest that precedent stories can be selected, attacked and justified using techniques from CBR, which is itself centrally concerned with identifying relevant similarities and differences.

4 Incorporating Factual Reasoning into CBR ^

[RZ 18] In this section we aim to give a basic overview of how factual stories and story precedents can be modelled and analysed in a way similar to CATO's modelling of legal cases and precedents. Section 3.1 introduces stories and story schemes (loosely following their formalisation in [4],[6]) and briefly relates these factual stories and schemes to the (legal) constructs present in CATO. In section 3.3 we show how the argument moves of CATO, designed to establish whether a precedent is relevantly similar, can be applied to stories.

4.1 Stories, story schemes and cases ^

[RZ 19] Stories are finite sequences of facts, events or states of affairs that are assumed, at least for the

moment, to have happened or existed. Stories are specific rather than general. Consider a simple example story about Tony (T), who killed Gordon (G) in a knife fight: [*T stabs G, stabbing injured G, G died*]. Story schemes are abstract scenarios, the structure of which is close to that of stories. Basically, a story scheme is a sequence containing narrative units [12], which represent (sets of) generalized facts or types of facts: [*X has motive to stab Y, X stabs Y, stabbing causes injury, Y dies*]. The narrative units thus represent what we call *story roles*, general roles that facts in a story can take. Note that story schemes are hierarchical, in that narrative units can be specifications of other, more abstract narrative units. For example, the narrative units *X and Y are in an argument, Y draws a knife* can be a specification of *X has motive to stab Y*.

[RZ 20] A story can be matched to a story scheme by assigning the facts to their respective story roles, that is, matching the facts in the story to the relevant narrative units in the scheme. This matching is done through a combination of variable instantiation (e.g. *T stabs G is an instance of X stabs Y*) and so-called abstraction rules, rules that generalise facts to their more abstract versions (e.g. **if** *T and G are in an argument and G draws a knife then T has motive to stab G*). Coherence of the story is determined by checking whether the story has no «loose ends» (there are facts in the story that do not match a narrative unit in the scheme) and whether the story «has all its parts» (all the narrative units in the relevant scheme are matched by a fact in the story) [4]. For example, our example story does not complete the example scheme, as there is no fact that matches the narrative unit *X has motive to stab Y*.

[RZ 21] CATO's cases are very similar to story schemes. Story schemes are clusters of abstract facts, narrative units, and cases are clusters of legally qualified abstract facts, factors. In other words, the factors represent what we call the legal roles that facts in a story can play. Here, we distinguish between a specific case and a general case with factors. An example of a general case is [*Defendant killed Victim, Defendant intended to kill Victim, Defendant killing Victim was premeditated*]; a specific case is not a scheme but rather an instantiated «legal story», e.g. [*T killed G, T intended to kill G, T killing G was premeditated*]. Facts in a story can be matched to the factors in a case in the same way as they are matched to the narrative units in a story scheme, namely through a combination of variable instantiation and rules. For example, an abstraction rule **if** *T stabs G and stabbing injured G and G died then T killed G* can be used to match the story to the *Defendant killed Victim* factor in the case.

4.2 Argument Moves and Precedents [^]

[RZ 22] In the current paper, the notion of coherence is based on precedent. That is not to say that story schemes play no role in determining coherence; the story and the precedent should be an instance of the same (plausible) story scheme (cf. [15]). Rather, this paper presents new ways to determine the coherence: instead of citing a story scheme, we cite a precedent story as the basis for the construction of a story scheme. After a precedent has been cited, variants of CATO's argument moves can be used to argue about the differences and similarities between the precedent and the current story. Effectively, these argument moves are about whether the current story relevantly matches the story scheme based on the precedent.

[RZ 23] *Citing a precedent story*: This move establishes a story scheme based on the precedent story, and then (implicitly) argues that the current story matches that scheme.

[RZ 24] *Distinguishing a precedent story*: The precedent story and the current story will each contain elements beyond those required for matching a common story scheme. For example, the current story and the precedent may have the central action in common (stabbing), but may well differ as to the type of people involved. Such differences can be offered as reasons to argue that the current story does *not* match the scheme established by the precedent.

[RZ 25] We can identify different kinds of distinction between stories (cf. [16]), depending on whether the current story is missing a fact required to make the story coherent, or has an additional fact (that the precedent lacks) which jeopardises the coherence of the story. In the first case, there is an *assumption* satisfied in the precedent which is not satisfied in the current case: this means that the current story is not complete, it does not «have all its parts». In the second case, there is a fact in the current story

which supplies an *exception* to the story scheme.

- [RZ 26] *Emphasising the significance of a distinction*: this move accompanies a distinction and attempts to pre-empt any attempt to downplay; it seems as much rhetorical as logical.
- [RZ 27] *Downplaying the significance of a distinction*: Downplaying a distinction has variants according to the nature of the distinction. If the distinction is an unsatisfied assumption, it is necessary to point to some fact in the current story which can play a similar role, thus having the current story complete the story scheme after all. If the current story has what appears to be an exception, downplaying involves finding a fact in the current story that provides an exception to that exception.
- [RZ 28] *Citing a case to emphasise strengths* and *citing a case to argue that weaknesses are not fatal*: These two moves respond to a distinction and involve citing other stories which can serve as precedent stories. When it is argued that the current story misses an assumption, new precedent stories can help to show that this assumption is not vital to the coherence of the story. Against the second type of distinction one can cite further precedent stories matching the current story and containing the alleged exceptions, showing that it is possible to have this additional fact in a coherent story. These moves are essentially attempts to shift the story scheme relied on slightly. The difference between *emphasise strengths* and *weakness not fatal* seems to be largely rhetorical, focusing on the strengths or alleged weaknesses of the current story, respectively.
- [RZ 29] *Citing a counterexample*: This move involves citing a new precedent story that argues for a different story scheme. Counterexamples are used to demonstrate that there are alternatives, and so avoid tunnel vision.

4.3 An example of CBR with stories and precedents ^

- [RZ 30] Having looked at the individual moves, let us consider an example to show them in action. In our example, the observation to explain is that Tony killed Gordon in a knife fight. That Tony killed Gordon is not at issue: there were plenty of witnesses as it took place quite openly in a Glasgow street. But it is important to get a story establishing Tony's motive, as this will affect the sentence. Wilma and Bert are discussing the matter.

Image

Image

Image

- [RZ 31] Note that the debate is not just there to satisfy curiosity. It matters legally which story is accepted. A fight mutually entered into (*West Side Story* and *Romeo and Juliet*) would be manslaughter, but a gangland killing would get a heavier sentence than a family feud in the current climate. Finally if we follow *Cavalleria Rustica* and the Laertes role of *Hamlet*, we can explain Tony's role as self defence and he might even be acquitted. These different legal options can be expressed by matching the different stories to different legal factors that give rise to different legal consequences. In [6], the authors explain this interplay between factual stories and legal cases in more detail.

5 Conclusions and future work ^

- [RZ 32] In this paper, we have shown how reasoning with factual stories and story schemes can be modelled in the style of Case Based Reasoning models from AI and Law [1],[2], demonstrating the connection between CBR and the hybrid theory of [4][5]. It turns out that the precedent cases of CBR have a natural counterpart in factual reasoning: story schemes. The facts of the story can then be mapped to the elements of these story schemes (narrative units) as well as to the elements of cases (factors), thus enabling us to give factual as well as legal interpretations of a story in a similar way. This further allows for the argumentative moves of CATO to be applied to factual stories, enabling moves like citation and distinction in discussions about the facts of a case.
- [RZ 33] The link between CBR and factual stories allows for a more realistic way of discussing story coherence

in the hybrid theory: precedent stories can be cited, obviating the need to explicitly model abstract story schemes. The argument moves then enable a natural dialogue concerning the facts of the story. Furthermore, we have specified the relation between the facts of a case and the factor-based cases, something which is often left implicit in the literature on CBR. Finally, the current model specifies [15]'s Scheme for Argument from Analogy, which uses story schemes to determine the similarity between precedents cases/stories and the current case/story.

[RZ 34] Our emphasis here on the coherence of stories does not mean that the evidence plays a secondary role; cf. the slogan that a «good» (i.e. coherent) story does not win over a «bad» (i.e. incoherent) story. We would certainly not want to sentence someone just on the basis of West Side Story and Romeo and Juliet! Instead, when a story is coherent (as established here by CBR styled techniques), we have found a good hypothesis of what may have happened. It is then the evidence that is provided for such a hypothetical story that determines whether it can be believed or not (cf. [4][5][6]).

[RZ 35] In future research, it might be interesting to explore how techniques from CBR can be used to discuss the evidence in the case. For example, one party might try to discredit a witness by citing a precedent: «Do you remember the other case where the victim's wife testified? It turned out she was lying all along». The other party can then distinguish the current case: «Yes, but in the other case the wife gained financially in the event of an acquittal, which is not so in this case.»

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¹ HYPO used dimensions rather than factors, where a dimension has an associated continuous or discrete magnitude.

Factors can usefully be seen as points on particular dimensions.

- ² This coherence is independent from the evidence, as it is general whereas the evidence is specific; only in the absence of specific evidence we use generalised patterns to fill the gaps. Furthermore, less common events must be better justified by evidence in order to be considered in a story.
- ³ We use the terms coherence and plausibility interchangeably: a story is coherent if it adheres to (i.e. is anchored in) plausible common-sense knowledge and being more coherent makes a story more plausible.