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# SIMILARITY, PRECEDENT AND ARGUMENT FROM ANALOGY

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## Abstract

In this paper, it is shown (1) that there are two schemes for argument from analogy that seem to be competitors but are not, (2) how one of them is based on a distinctive type of similarity premise, (3) how to analyze the notion of similarity using story schemes illustrated by some cases, (4) how arguments from precedent are based on arguments from analogy, and in many instances arguments from classification, and (5) that when similarity is defined by means of story schemes, we can get a clearer idea of how it integrates with the use of argument from classification and argument from precedent in case-based reasoning by using a dialogue structure.

Key words: stories; case-based reasoning; argument from classification; argumentation.

This paper is about the logical structure of argument from analogy and its relationship to legal arguments from classification and precedent. Its main purpose is to provide guidance for researchers in AI and law on which argumentation scheme for argument from analogy to use, among the leading candidates that are currently available. Arguments from precedent cases to a case at issue are based on underlying arguments from analogy of a kind extremely common both in everyday conversational argumentation and in legal reasoning. There is a very large literature on argument from analogy in argumentation (Guarini et al., 2009), and the topic is fundamentally important for law because of the centrality of arguments from precedent and analogy in Anglo-American law. It is not hard to appreciate this connection, given that according to the rule of *stare decisis*, the precedent decision of a higher or equal court is binding on a similar current case (Ashley, 1988, 206).

In this paper, cases are used to argue that arguments from precedent are based on arguments from analogy in legal reasoning, and that arguments from analogy are based on a similarity between the two cases held to be analogous. As shown in the paper, this claim is controversial, because there are different views about how the argumentation scheme for argument from analogy should be formulated (Macagno and Walton, 2009). According to the version of the scheme for argument from analogy argued to be the basic one in this paper, one of the premises has a requirement holding that there is a similarity between the two cases in point. In this paper I show how to analyze this notion of similarity using the story-based approach of Bex (2009) and the formal dialogue model for investigating stories of Bex and Prakken (2010). It is shown how an abstract structure called a story scheme can be employed in a way that makes it useful to identify, analyze and evaluate arguments from analogy, and show their function in case-based reasoning where precedents are involved.

In *Popov v Hayashi* (Popov v. Hayashi 2002 WL 31833731 (Cal. Superior, Dec. 18, 2002)),

a case that has become a benchmark in AI and law (Gordon and Walton, 2006a; Wyner, Bench-Capon and Atkinson, 2007), the issue concerned which fan had ownership rights to a home run baseball hit into the stands by Barry Bonds while the precedent cases concerned the hunting and fishing of wild animals. A problem posed is that the baseball case and the animals cases don't seem all that similar to each other at first sight, even though it can be argued that they are similar (or not) in certain respects. The problem is to specify exactly how they are similar, or are supposed to be, in an argument from a precedent case to a case being decided, when the relationship between the two cases is thought to be one of similarity. Ashley (2009, 1), referring to one of the animals cases, posed the problem in the question: "How is Barry Bonds' 73<sup>rd</sup> home run like a fox in a fox hunt?" The problem is to clearly define similarity in such a way that it can be identified as being claimed to hold in a pair of cases, so that it can be used as a premise in an argument from analogy. This problem is not so easy to solve as it may initially appear to be, for as Ashley (2009, 1) observed, in legal argument from analogy it is often necessary to interpret similarity and difference at multiple levels.

### 1. The Wild Animals Cases and the Baseball Case

In the case of *Popov v Hayashi*, a valuable home run ball was hit into the stands by Barry Bonds in 2001, and a dispute arose concerning which fan had ownership rights to it. In the trial, the reasoning partly turned on some precedent cases that concerned the hunting and fishing of wild animals. Much has been written in the literature on AI and law, on its relationship to these other cases and how case-based reasoning can evaluate the argumentation in them using factors and dimensions in analogous cases (Bench-Capon, 2009, 2010).

The following account of the facts of the baseball case has been summarized from the statement of decision of the judge, Kevin M. McCarthy (McCarthy, 2002). Barry Bonds hit his record-breaking 73<sup>rd</sup> home run in 2001 at PacBell Park in San Francisco. The ball would be very valuable. Mark McGwire's 70<sup>th</sup> home run ball hit in 1998 sold for \$3 million. The ball went into the stands and landed in the upper portion of the webbing of a glove worn by a fan, Alex Popov. The glove stopped the trajectory of the ball, but the ball did not go fully into the mitt. The partial catch did not give certainty of obtaining control of the ball, since Popov had to reach for it and may have lost his balance while doing this. Just as it entered his glove, he was thrown to the ground by a mob of fans who were also trying to get the ball. Buried face down on the ground under several layers of people, he was grabbed, hit and kicked. Somebody in the crowd videotaped the incident. Another fan standing nearby, Patrick Hayashi, picked up the loose ball and put it in his pocket. When the man making the videotape pointed the camera at Hayashi, he held the ball in the air for the others to see. Hayashi was not part of the mob that had knocked Popov down, and was not at fault for the assault on Popov.

According to a tacit code of conduct concerning baseball fans' understanding of first possession of baseballs (Grey, 2002, 6), a fan who catches a ball that leaves the field of play has the right to keep the baseball. However a fan who tries to catch such a ball but does not complete the catch, has no rights to the baseball. The catch only occurs when the fan has the ball in his hands or glove and the ball remains there after its momentum has ceased, and after the fan makes contact with a railing, a wall, the ground, or other fans who are trying to catch it. If no one catches the baseball, another fan may pick it up and thereby become the owner of it.

According to these rules, it looks like Hayashi has the right to ownership of the ball, but Popov took the case to court to contest this claim.

The fundamental disagreement in the trial in the Superior Court of California City and County of San Francisco, was about the definition of possession (McCarthy, 2002, 5). In order to aid the court, Judge McCarthy asked four distinguished law professors to participate in a forum to discuss the legal definition of possession. The professors disagreed, and Judge McCarthy admitted that although the term 'possession' appears throughout the law, its definition varies, depending on the context in which it is used. The task of the court was taken to be to craft a definition of 'possession' that applies to the circumstances of the case (McCarthy, 2002, 6). Professor Brian T. Gray was one of the legal experts asked to provide advice, and Judge McCarthy adopted as his central tenet what he called Gray's Rule, the rule that to have possession of the ball, the actor must retain control of it after incidental contact with people and things (McCarthy, 2002, 8). Judge McCarthy (2002, 9) ruled that although Popov did not retain control of the ball, other factors need to be considered. One is that his efforts to retain control were interrupted by a violent mob of wrongdoers. Another is the principle that if an actor takes steps to achieve possession of a piece of abandoned property, but is interrupted by the actions of others, he has a pre-possessionary interest in the property. After examining all the arguments, Judge McCarthy decided that any award to one party would be unfair to the other, and that each had an equal and undivided interest in the ball.

During their testimony, the law professors pointed out several precedent cases where there was pursuit of an animal that the pursuer failed to catch because somebody or something intervened, and the issue was whether the pursuer could claim possession of the animal. In *Pierson v. Post* (3 Cai. R. 175; 1805 N.Y. LEXIS 311), Pierson was out with hounds chasing a fox when Post captured and killed the fox, even though he knew it was being pursued. The court decided in favor of Post on the grounds that mere pursuit did not give Pierson a right to the fox as his property. In *Young v. Hitchens* (6 Q.B.606 (1844)), Young was a commercial fisherman who spread his net, and when it was almost closed, Hitchens went through the gap and caught the fish with his own net. The court found for Hitchens. In *Keeble v. Hickeringill*, ((1707) 103 ER 1127), P owned a pond and made his living by luring wild ducks there with decoys, shooting them, and selling them for food. Out of malice, D used guns to scare the ducks away from the pond. In this case P won. In *Ghen v. Rich* (8 F.159 D. Mass, 1881), Ghen harpooned a whale from his ship and it was washed ashore. It was found by another man, who sold it to Rich. According to custom, the man who found the whale should have reported it to Ghen and collected a fee. The court found for Ghen. Gray (2002) cited a number of comparable cases from whaling where possession was defined by taking the accepted customs and practices of the whalers into account.

What makes these wild animals cases work as precedents that can be taken into account in the Popov case, and suggest a conclusion that ought to be drawn favoring one side or the other? An obvious and widely accepted answer is that the animals cases are similar to the Popov case. But what does this answer amount to? On the surface, the cases are not similar. Grey (2002, 1) made the point that catching a baseball is not similar to mortally wounding a fox or harpooning a whale: "a baseball at the end of its arc of descent is not at all like a fox racing across the commons, acting under its own volition, desperately attempting to evade death at the hands of its pursuers". At first sight, the two kinds of cases do not appear to be similar.

They are about very different activities. Evidently, the similarity is only that they are both about one party trying to catch and possess something, and about interference by another party who also seeks possession of the same thing in a way that might prevent another from obtaining possession. That's not what we normally think about when we say that two things are similar. We think of them sharing a lot of common properties of a visible kind so that they look similar. In law, however, features such as intentionality may need to be taken into account.

## 2. Arguments from Analogy and Precedent in Law

The literature on argument from analogy in fields spanning logic, argumentation studies, computer science and law, is enormous. Many proposals have been put forward to represent argument from analogy as a form of reasoning or argumentation scheme, and there is no space to try to summarize them here. We can only refer the reader to the summary of some of the leading theories in (Macagno and Walton, 1994) and the multi-disciplinary bibliography of Guarini et al. (2009). Instead, we concentrate on two particular proposals to represent the structure of this argumentation scheme that provide a useful contrast to focus the discussion.

The simplest argumentation scheme for argument from analogy can be represented by this first version from (Walton, Reed and Macagno, 2008, 315).

Similarity Premise: Generally, case *C1* is similar to case *C2*.

Base Premise: *A* is true (false) in case *C1*.

Conclusion: *A* is true (false) in case *C2*.

Let's call this scheme the basic scheme for argument from analogy. The assumption behind the basic scheme for argument from analogy is that similarity between two cases where *A* holds in the one case can shift a weight of evidence to make plausible the claim that *A* also holds in the other case. This kind of argument is defeasible, and it can in some instances even be misleading and fallacious, as the traditions of informal fallacies warn us (Hamblin, 1970). But how can similarity be defined or measured? It seems at first that it can be defined in visual terms as an overall appearance of likeness perceived between two cases. It is an important kind of argument to study, because so much of our reasoning is based on it (Schauer, 2009). This kind of similarity is so striking in some instances, at least at first impression, that it makes the person to whom the argument is directed ignore other relevant evidence.

It doesn't seem to be this type of argument from analogy, however, that is being employed in the arguments from precedent from the animals cases to the baseball case. For, as mentioned above, the case of a fox hunt does not seem to be similar to the case of a baseball game in this sense. Nor does the case of harpooning a whale seem to be similar to the baseball case in this sense. Trying to catch something is a similarity, but this is only one element that ties these cases together as precedents. If you look at the overall pattern recognition type of similarity of the baseball case and the harpooning case, they are not visibly similar at all. They are only similar in some respects. This observation suggests we look at another version of the scheme for argument from analogy.

Guarini (2004) has presented a scheme for argument from analogy that he calls the core scheme (Guarini, 2004, p. 161). *a* and *b* are individual objects.

Premise 1:  $a$  has features  $f_1, f_2, \dots, f_n$ .

Premise 2:  $b$  has features  $f_1, f_2, \dots, f_n$ .

Conclusion:  $a$  and  $b$  should be treated or classified in the same way with respect to  $f_1, f_2, \dots, f_n$ .

The core scheme fits the arguments from analogy between the animals cases and the baseball case on the basis that the two premises imply that the pair of cases at issue are similar in certain significant respects. A good feature of the core scheme is that it allows the overall dissimilarities between pairs of cases to be overlooked, if the two cases are similar in one or two relevant respects, like catching something and possessing it. The assumption that the two cases are similar is only implicit, however. It is not stated as a premise in the scheme, and is not necessarily a part of it.

A more specialized scheme for argument from analogy called version 2 in (Walton, Reed and Macagno, 2008, 58) is built on the simple version, and does have an explicit statement of similarity as its first premise.

Similarity Premise: Generally, case  $C1$  is similar to case  $C2$ .

Base Premise:  $A$  is true (false) in case  $C1$ .

Relevant Similarity Premise: The similarity between  $C1$  and  $C2$  observed so far is relevant to the further similarity that is in question.

Conclusion:  $A$  is true (false) in case  $C2$ .

The problem with this version of the scheme for argument from analogy is that it does not appear to be a good fit for the arguments from analogy of the kind illustrated in the examples. It depends not only on one similarity premise, but also on another one that may not be easy to apply to cases like the baseball case and the animals cases. Two questions about the relevant similarity premise need to be answered before this version of the scheme can be applied to the similarities thought to hold between the baseball case and the animals cases. First, what does 'relevant' mean here? Guarini (2004, 162) tells us that he did not include the term 'relevance' in the core scheme because it is common practice not to include relevance claims in argument reconstruction. Second, what is the further similarity? This latter expression suggests that the existing similarity can be reused in future cases. To explore this idea, we turn to case-based reasoning, a technique that reuses a past case to draw conclusions from a current case that is similar in certain respects.

The methods for employing argument from analogy in case-based reasoning in computing use respects in which two cases are similar or different called dimensions and factors. The HYPO system (Ashley, 1990) determines how similar a current case is to past cases by having the relevant similarities each form a dimension. A dimension is a relevant aspect of the case that can take a range of values that move along the scale with values that support one party at one end and the other party at the other end of the scale. In the animals cases, possession, ownership, and motive would be examples of dimensions. These dimensions can range on a scale. For example, a dimension might range through cases where the animals are roaming free, cases where the chase had just been started, cases where pursuit was underway, cases of mortal wounding, and finally at the other end of the scale, to bodily possession. Once

determined in a given case, a dimension will favor either the plaintiff or the defendant in a legal case to some degree. For example, in the fox case the plaintiff was in hot pursuit. In the ducks case, the plaintiff was acting for economic gain, while the defendant acted from malice. In the baseball case, both parties were motivated by money, and the plaintiff would have most likely secured the ball had it not been for the assault of the crowd. Bench-Capon (2009, 46) has presented a list of four such dimensions in the wild animals cases and the case of *Popov v Hayashi*, and ranked them from most pro-plaintiff to most pro-defendant.

CATO is a simpler case-based reasoning system (Aleven, 1997) that was originally designed to aid the teaching of law students. It is based on factors, which can be seen as points on a dimension. In the wild animals cases the following would be factors: whether the party had caught the animal not, whether the party owned the land or area where the animal was, whether the party was engaged in earning his living, and whether the two parties were in competition with each other. Factors are evaluated as arguments favoring one side or the other in relation to social purposes. For example, if the party was engaged in earning his living, that would advance the social purpose of the protection of valuable activity. Or if the two parties were in competition, that would advance the social purpose of promoting free enterprise.

Guarini's version of the core scheme for argument from analogy has, instead of a general premise, a premise that states that the two cases being compared share features that should be treated or classified in the same way. These features can be identified with dimensions or factors, depending on whether you are using a HYPO-style system or a CATO-style system. If features that should be classified in the same way are equivalent to respects in which two cases are similar, a simpler version of the core scheme can be cast into the following format, which could be called the single respect scheme.

Respects Premise: Case *C1* is similar to case *C2* in a certain respect.

Base Premise: *A* is true (false) in case *C1*.

Conclusion: Support is offered to the claim that *A* is true (false) in case *C2*.

Where a number of respects are listed, this version becomes equivalent to the core scheme. The conclusion makes it clear that this is a defeasible form of argument in which further evidence can be introduced that can go against or even defeat the argument. This can happen in case-based reasoning, for example, when some factors support *A*, but then other factors are introduced that support not-*A*. Then to weigh the arguments on each side, we have to consider the cases on each side, and determine which cases more on-point, or relevant, that is, the extent to which a case's set of factors covers or overlaps the set of factors in the case at issue. These remarks suggest that to make the core scheme useful for case-based reasoning, we need to bring in a dialectical framework where there is opposition between two opposed claims, of the kind typical in a legal trial, for example.

Typically, in this kind of format, we have an argument from analogy or precedent that supports a claim *A* made by one side, and then on the other side an opposed argument from analogy or precedent that supports claim not-*A*. To comparatively weigh up the strength of the one argument as compared to the strength of the opposed argument, we have to bring in something like dimensions or factors that identify the respects in which one case is similar to

the other, and have some device for estimating how similar one is to the other by attaching weights to similarity.

In fact, case-based reasoning is built on a kind of method that is dialectical in nature. For example, HYPO is a case-based system that uses dimensions in a format called three-ply argumentation (Ashley, 1988, 206). In the first step, an argument for one side is put forward that matches the past case with the desired outcome and that also matches the case at issue. In the absence of a response, this argument implies that the side putting forward this move should win the dispute. The justification takes the form of an analogy. At the second step, the other side can reply by finding a counterexample, a case that shares the same set of dimensions with the case at issue as the cited case but has opposite outcome, or by distinguishing a case. Distinguishing a case means citing dimensions present in the case at issue that are absent in the case it is compared to and that favor the opposite conclusion, and dimensions in the compared case that favor its outcome that are not present in the case at issue. This move is a rebuttal to the argument of the first move. In the third step, the first party has an opportunity to rebut the distinction, offering a rebuttal to a rebuttal by finding other examples that suggest a different conclusion, or by citing cases that defend his position.

Wyner and Bench-Capon (2007) devised a system of case-based reasoning that includes a set of six argument structures they describe as argumentation schemes. For example (143) their main scheme (AS1), looks like this, where P is the plaintiff, D the defendant,  $P_i$  are the factors, CC is the current case and PC is the precedent case.

P Factors Premise:  $P_1$  are reasons for P.

D Factors Premise:  $P_2$  are reasons for D.

Factors Preference Premise:  $P_1$  was preferred to  $P_2$  in  $PC_i$ .

CC Weaker Exception: The priority in  $PC_i$  does not decide CC.

Conclusion: Decide CC for P.

The factors are rated on a preference scale, and these preferences are used to derive the conclusion. It may be, however, that this scheme does not represent argument from analogy. This scheme, as well as the other five schemes Wyner and Bench-Capon employ in their system, look more like factor-based species of argument from precedent. This brings us to the scheme for argument from precedent and its relation to argument from analogy.

The most common type of argument from precedent used in legal reasoning applies to a current case, and a prior case that has already been decided is taken as a precedent that can be applied to the current case (Schauer, 1987). The argumentation scheme appropriate for this type of argument is the following one.

Previous Case Premise:  $C1$  is a previously decided case.

Previous Ruling Premise: In case  $C1$ , rule  $R$  was applied and produced finding  $F$ .

New Case Premise:  $C2$  is a new case that has not yet been decided.

Similarity Premise:  $C2$  is similar to  $C1$  in relevant respects.

Conclusion: Rule  $R$  should be applied to  $C2$  and produce finding  $F$ .



In the baseball case, the rule that was applied is the one called Gray's Rule, the rule that to have possession of the ball, the actor must retain control of it after incidental contact with people and things (McCarthy, 2002, 8). In the baseball case, this rule was applied in a negative way. In the animals cases, the rule was set in place that if you don't catch something, by retaining control of it, you do not fit the requirements for possessing it (in the context comparing the animals cases and the baseball case). The same rule was then transferred to the baseball case.

Note that this scheme for argument from precedent is built on an underlying argument from analogy represented by the basic scheme (Walton, Reed and Macagno, 2008, 72). This way of configuring the two schemes makes argument from precedent a species of argument from analogy. An advantage of the basic scheme is that it has allowed us to show how some revealing relations among the schemes are involved in case-based reasoning. In the next section, we will see how argument from classification is an extension of argument from analogy typically used in many arguments from precedent.

On this basis, AS1 can be taken to be a special instance of argument from precedent of the kind specified by the scheme just above. It represents a special subtype of argument from precedent that is designed for use in systems of case-based reasoning that employ dimensions for weighing the respects in which two cases are similar. The core scheme for argument from analogy seems to better represent case-based reasoning techniques using factors or dimensions than the basic scheme, since the core scheme specifically represents respects in which two cases are similar.

### 3. Arguments from Classification and Definition

Guarini (2004, 162) argues that the core scheme does not fit all case of argument from analogy. He postulates a second scheme for argument from analogy by extending the core scheme to the next one, which we will call the derived scheme (p. 162):

Premise 1:  $a$  has features  $f_1, f_2, \dots, f_n$ .

Premise 2:  $b$  has features  $f_1, f_2, \dots, f_n$ .

Premise 3:  $a$  is  $X$  in virtue of  $f_1, f_2, \dots, f_n$ .

Premise 4:  $a$  and  $b$  should be treated or classified in the same way with respect to  $f_1, f_2, \dots, f_n$ .

Conclusion:  $b$  is  $X$ .

The derived scheme is in effect a chain argument that is constructed by incorporating the conclusion of the core scheme as an additional premise (premise 4) and adding a new premise (premise 3). The conclusion then says that individual  $b$  fits under the category (predicate) of being an  $X$ . Thus a way to reconfigure the derived scheme is as follows.

Premise 1:  $a$  has features  $f_1, f_2, \dots, f_n$ .

Premise 2:  $b$  has features  $f_1, f_2, \dots, f_n$ .

Conclusion 1:  $a$  and  $b$  should be treated or classified in the same way with respect to  $f_1, f_2, \dots, f_n$ .

Premise 3:  $a$  is  $X$  in virtue of  $f_1, f_2, \dots, f_n$ .

Conclusion 2: *b* is *X*.

The first three steps represent the core scheme for argument from analogy, and all five steps, taken together as a chain of reasoning, represent the derived version. This way of proceeding enables us to represent the classification of some individual entity under a general category, which is a feature of some arguments from analogy. Classification is very important as part of the argument, but it needs further amplification to show how classification is tied to argument from analogy in the baseball case.

Recalling the details of Judge McCarthy's analysis of the reasoning in the baseball case, he said that the task of the court was taken to be to craft a definition of 'possession' that applies to the circumstances of the case (McCarthy, 2002, 6). This remark sets in place the first criterion for similarity between the baseball case and the precedent animals cases. All are about the fundamental issue of possession. The problem was that the distinguished law professors disagreed on how possession should be defined. Judge McCarthy then pointed out that although the term 'possession' appears throughout the law, its definition varies depending on the context in which it is used. This situation is not unique to the baseball and animals cases. It is typical of legal reasoning of the kind used in trials, as suggested by Hart's famous example of deciding whether a skateboard is a vehicle that ought to be banned from the park (Hart, 1949; 1961; Loui, 1995). To someone not familiar with disputed cases in legal reasoning, the problem looks easy to solve. It looks like all we have to do is to define the concept of vehicle. But in hard cases, it is not possible to give a legal definition that provides sufficient support by itself to arrive at a decision that resolves the dispute. The underlying reason is that legal concepts like 'vehicle' are open-textured, to employ Hart's term, or defeasible, to employ the term currently in use in logic and computing.

As Judge McCarthy put it, the task of the court was taken to craft a definition of 'possession' that applies to the circumstances of the case. But how can this be done given the conflicting opinions on how 'possession' should be defined in law? Law articulates rules or principles that are sometimes established by the courts based on (1) previous cases, and (2) in other instances may even be based on commonly accepted practices that have found their way into law in supporting the formulation of such rules. A set of such rules can provide necessary or sufficient conditions that function as partial definitions. These rules help the argumentation to move forward even in the absence of a fixed definition that is complete and that can be mechanically applied to hard cases. The reader will recall from the description of Judge McCarthy's reasoning above that he used Gray's Rule, the rule that to have possession of the ball, the actor must retain control of it after incidental contact with people and things. Gray's rule was in turn based on a set of rules for the first possession of baseballs, accepted as customs and accepted practices in baseball. As applied to the baseball case, this rule led to the conclusion that Popov did not have possession of the ball. However, in the end, even that finding did not resolve the issue of which party had rights to ownership of the ball.

To analyze how the arguments from precedents from the animals cases to the baseball case are based on a notion of similarity that fits the similarity premise of the scheme for argument from precedent, we need to examine some other argumentation schemes that are also involved in the baseball case. The first is the scheme for argument from verbal classification (Walton, Reed and Macagno, 2008, 319).

Individual Premise: *a* has property *F*.

Classification Premise: For all *x*, if *x* has property *F*, then *x* can be classified as having property *G*.

Conclusion: *a* has property *G*.

The case of the drug-sniffing dog (Brewer, 1996) shows how an argument that has been classified in the law literature as argument from analogy is really an instance of arguing from analogy to a verbal classification. Suppose that a trained dog sniffs luggage left in a public place and signals to the police that it contains drugs. Should this event be classified as a search according to the Fourth Amendment? If it can be classified as a search, information obtained as a result of the dog sniffing the luggage is not admissible as evidence. If it is not classified as a search, the information is admissible (Weinreb, 2008).

Ashley's method of distinguishing between deep and shallow analogies between pairs of cases uses an ontology (Ashley, 2009, 8) to represent classifications of concepts to support legal reasoning about claims and issues. This ontological framework specifies and organizes classes of concepts that can be used to represent the important features of cases. It includes representation of actual concepts like 'animal', as well as legal concepts like 'possession'. I take this as evidence to support the view that arguments from analogy, as used in law, are based on argument from classification, even though the use of argument from classification in the sequence of reasoning may not be all that obvious in many instances.

On Brewer's analysis, this first classificatory stage of reasoning by analogy leads to a later evaluation stage in which the given event is compared to other cases that have already been classified legally as being searches or as not being searches. Ideally, we could define the term 'search' by using a set of necessary and sufficient conditions for what constitutes a search in any given case, and then apply the definition to the case at issue. Then we could use the argumentation scheme for argument from definition to verbal classification (Walton, Reed and Macagno, 2008, 319).

Definition Premise: *a* fits definition *D*.

Classification Premise: For all *x*, if *a* fits definition *D*, then *x* can be classified as having property *G*.

Conclusion: *a* has property *G*.

However, although this scheme may work in easy cases, where the definition clearly fits the case, it falls down when the term at issue is defeasible. Then what we need is a defeasible definition, but since the definition is defeasible, it may still be open to contention what conclusion it directs us to draw in the case at issue. As the baseball case shows very well, argument from definition to verbal classification does not work, and we have to fall back on Gray's rule. Since defeasible definitions are ubiquitous in legal argumentation, as Hart showed, and as the cases treated here illustrate, these considerations bring out the importance of modeling them in some way that is both precise and useful.

The theory of defeasible definitions provided by McCarty and Sridharan (1982) uses what are called prototypes and deformations. On this approach, there is an invariant component to provide necessary, but not sufficient, conditions for the existence of the concept, a set of

exemplars, each of which matches some but not all of the instances of the concept, and a set of transformations in the definitional expansion which expresses relationships between the exemplars. McCarty and Sridharan state that one exemplar can be mapped into another exemplar in a certain way. This method of working with defeasible definitions in argumentation in AI and law has been applied to the case of *Eisner v. Macomber* (252 U.S. 189 (1920)).

#### 4. Similarity

The basis for deciding whether one case is a precedent for another in law has been the subject of debate for generations, and a common view is that a precedent case holds for cases that are similar but not identical to it (Schauer, 2009, 46). How this works is easy to see if two cases are very similar in obvious respects, but how is a case where a man sued a company because there was a decomposed snail in his beer bottle similar to case where a man tried to sue because of a defective Buick automobile? The answer is that even though the two cases are dissimilar in many respects, they are similar in that they were both consumer transactions that caused illness, and the defect was not immediately apparent (Schauer, 2009, 46). But surely just these common respects are not enough in themselves to make the one case similar enough to the other so that one could be taken as a precedent for the other. There is something about the common sequence of events that makes the one case similar to the other. First the plaintiff bought some product that he assumed was the normal product he expected, and he thought therefore that the product was reasonably safe to use. Then something in the product turned out to be defective, and when he used the product this defect caused some harm that impacted badly on his health. There is a thread, or sequence of events that is of the same kind in both cases. It started in the same way, went through the same kind of chain of events, and ended in the same way. Another thing both cases have in common is that both were about recompense that the plaintiff claimed was due to him because of this harm he supposedly suffered. They are both about the same basic issue that defines the claim to be proved in the lawsuit.

What is the similarity between the wild animals cases and the baseball case that enables an argument from precedent to be drawn from the one to the other? The situation of a baseball hit into the stands where fans jostle to try to retrieve it is not similar to a situation of fishing for a whale or hunting a fox. Gray (2002, 1), as quoted above, made the point that catching a baseball is not similar to mortally wounding a fox: "a baseball at the end of its arc of descent is not at all like a fox racing across the commons, acting under its own volition, desperately attempting to evade death at the hands of its pursuers". Even though the animals are different, and the details of how they are caught or pursued are different, the wild animals cases are similar among themselves. They are all about pursuing, catching, wounding and holding wild animals, and about which party has the right to possession of the animal at the end of the process. In most of these respects, the whales cases, the fox case, and the ducks case are similar. They are all about this same process of pursuing and possessing wild animals. The baseball case is noticeably different. It is not about pursuing, catching or possessing a wild animal.

So what similarity is there that supports the transfer via the arguments from precedent from the earlier ones to the later one? It is not just the element of possession, for there are many cases of disputes about possession of something that are not similar enough to these cases to

provide precedents for them. The similarity involves both possession and this pursuing and catching process. All the cases are about catching something, or attempting to catch it, and about which party may rightly be said to possess it at the end of this attempting to catch process. They are also about someone else interfering with this process, and preventing the other party from catching and possessing the animal.

When you abstract away from the details of the animals cases and the baseball case that are not relevant in the argument from analogy that connects them, what is left is a template linking a series of events and questions into an ordered sequence. If we distinguish following Ashley (2009) between deep and shallow analogies, a template that matches up the same sequence fitting two cases can reveal a deep similarity that is more significant, as opposed to a shallow similarity in which the two cases do not appear to be similar. The sequence template for the deep similarity that runs through the animals cases and the baseball case is visually represented in figure 1. In the next section, it will be shown how such sequence templates can be represented as abstract structures that can be applied to real cases of arguments from analogy.

If this analysis of this special type of similarity between these pairs of cases is correct, the consequences for studying how argument from precedent is based on argument from analogy are highly significant. When we say that two disputed cases are similar, and therefore that the one case can work as a precedent for the other, it doesn't mean that the two cases appear to be similar in many respects, so that there has to be a visual match of some sort between them. This pattern recognition kind of similarity represents only a superficial type of similarity. Superficially, the cases initially look very different. It looks like there is no basis for a compelling argument from analogy between them. It's only when you probe into them further, and detect a sequence in how the concepts in each case are tied together in a template within the argumentation about the dispute at issue, and see how this template affects the reasoning on each side, that the similarity important for precedent emerges. McLaren (2003; 2006) has developed a two-stage case retrieval system in SIROCCO that assessed similarity of cases in terms of sequence of events and demonstrated empirically the utility of the approach in improving retrieval of relevant engineering ethics cases involving engineering ethics code provisions. The template is just one small part in the larger structure of the dialogue in a case (Ashley, 2004; 2009, 9) that goes through several stages.

These observations suggest that there are three stages to using argument from analogy. At the first stage, two cases may look similar, and this apparent match may suggest a rough analogy that could be used to support an argument from analogy. At the second stage, a closer look at the similarity premise can be given, to see whether the similarity is merely visually apparent, as an instance of pattern recognition, or whether there is a logical similarity of the kind that can be supported by applying a template like that pictured in figure 1. The third stage is the evaluation of the argument from analogy, by citing and comparing the respects in which the one case is similar to (or dissimilar from) the other. Although the basic scheme for argument from analogy is initially the more useful for identifying this type of argument at an early stage, when you get to the later stages of analyzing and evaluating arguments from analogy, the core scheme becomes more useful.

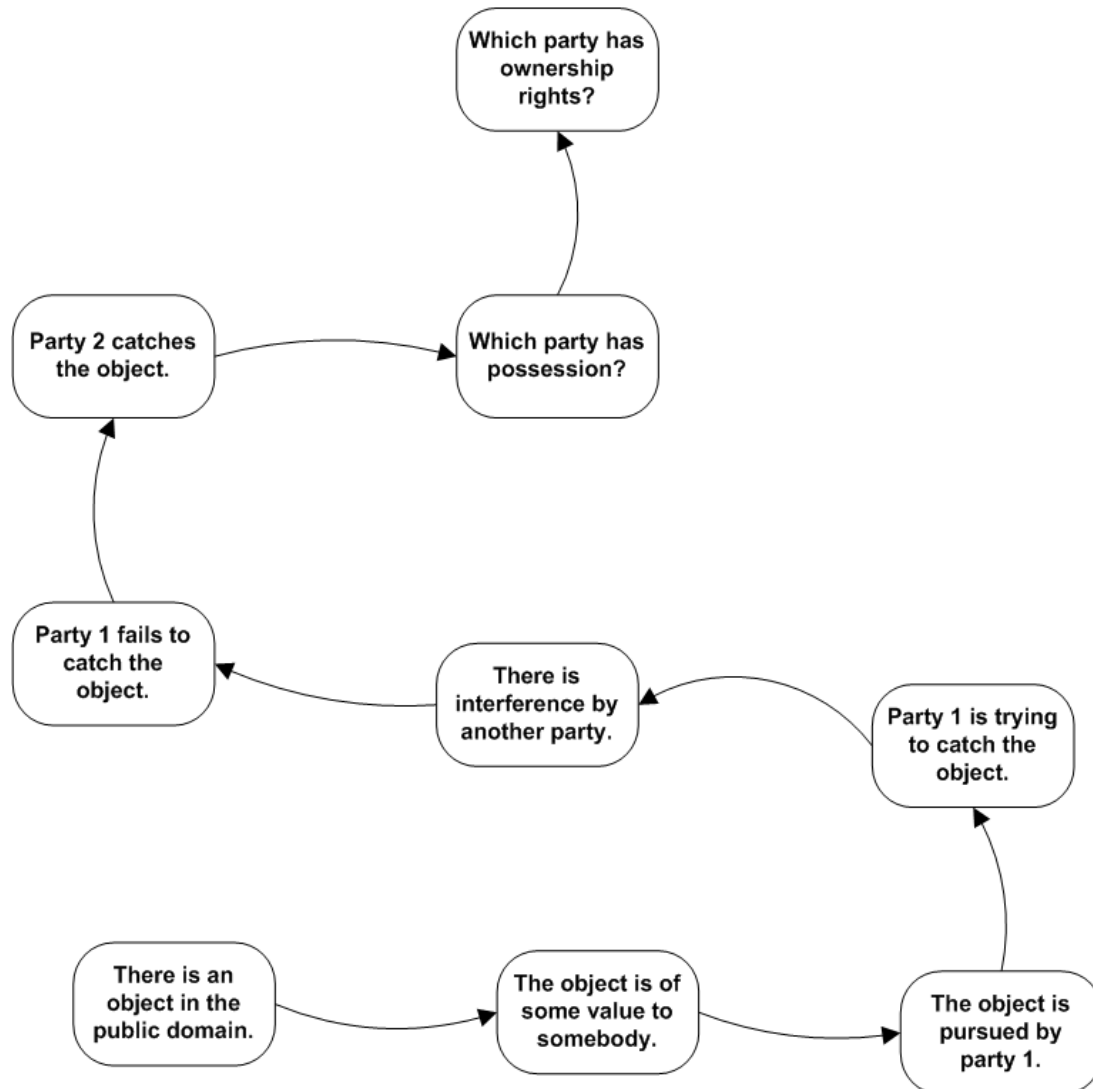


Figure 1: Sequence Template for Similarity of the Animals and Baseball Cases

In these cases, you have to recognize that the dispute is about possession of the contested entity, and the reasoning relates to details of this attempting to catch process, how it went along the way as the two parties took part in it, and how it ended up. The similarity between these cases that supports argument from analogy and argument from precedent needs to be represented by a typical sequence of actions, events and questions of the kind shown in figure 1. Seven steps in the sequence are episodes, and the last two are questions. In this example, the first seven steps represent a sequence of intentional actions of an agent, and something that interferes with the agent's achieving his goal.

## 5. Scripts and Stories

Commonly known ways of carrying out everyday activities were codified in early work in AI (Schank and Abelson, 1977) in sequences called scripts. The standard example is the restaurant

script, an ordered set of seven statements. 1. John went to a restaurant. 2. The hostess seated John. 3. The waitress gave John a menu. 4. John ordered a lobster. 5. He was served. 6. He left a tip. 7. He left the restaurant. Gaps in the sequence can be made explicit by defeasible inferences based on common knowledge about the way things are normally done in the script. For example, we can infer defeasibly that lobster was on the menu. It would be an exception if lobster was a special item not listed on the menu, and the waitress told John about it. However, the gap-filling inference can be drawn if there is no information to the contrary, because normally restaurant customers get their information about what to order from the menu.

Modules called MOPs, or memory organization packages (Schank, 1986), that also represent stereotyped sequences of events, are used in case-based reasoning (Leake, 1992). They are smaller than scripts and can be combined in a way that is appropriate for the situation when they are needed. For example, the space launch MOP includes a launch, a space walk and a re-entry (Leake, 1992, 73). Scripts and MOPs can be used to build or amplify what is often called a story, a connected sequence of events or actions that hangs together, is ordered as a sequence, and that contains gaps that can be filled in.

Pennington and Hastie (1993), among other authors, have argued that understanding actions carried out in criminal cases is done by constructing competing stories about what supposedly happened using the evidence in the case. The method is to find the best story, the best script connecting the known facts, or at any rate the one that seems most plausible based on the evidence. Such a plausible story describes a general pattern of states of kinds that we are all normally familiar with. The problem is that a plausible story may not be very well supported by the evidence whereas a less plausible story may be supported by more evidence. To deal with this problem (Wagenaar, van Koppen and Crombag, 1993) devised a special type of story used to represent legal reasoning called an anchored narrative. (Bex, 2009) has proposed a hybrid framework for reasoning with arguments, stories and criminal evidence, a formal framework that shows how the plausibility of the story can be evaluated by giving arguments that ground the story on evidence that supports or attacks it.

Pennington and Hastie (1993) also had the idea that the plausibility of a story can be tested by its evidential support. They devised the notion of an episode scheme, which is like a script or MOP except that it can be more abstract or more specific. An example would be a scheme for intentional action that describes the general pattern of events in the restaurant script, by citing the events of ordering, eating paying (Bex, 2009a, 94). Bex (2009) combined the episode schemes of Pennington and Hastie with the scripts of Schank and his colleagues to form what are called story schemes. These are modeled as an ordered list of events or types of events that can be more abstract or more specific. Bex (2009, 59) offers the following example. John Haaknat is a drug addict who needs money and decides to rob a supermarket. He gets the money and jumps into his car and takes off, but seeing the police he parks his car at a nearby park and then jumps into a moat to hide. Later the police search the park and find him soaking wet from the water in the moat. Bex (2009, 59) constructs a graph that exhibits the causal relations between the various events in the story, as shown in figure 2.

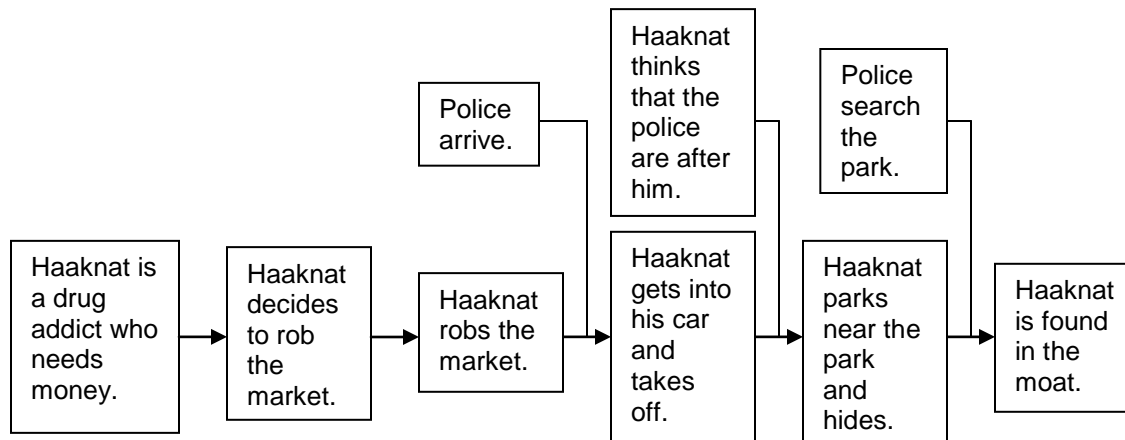


Figure 2: Causal Structure of the Haaknat Story

Bex (2009, 59) calls it a causal structure, because it contains implicit causal relations assumed by the reader of the story that enable the reader to connect the sequence as a series of events and actions that make sense. We can recognize it as a story, even though not all the events and causal relations have been rendered explicitly.

## 6. Modeling the Sequence Template as a Story Scheme

Evidential reasoning in law is typically based on general knowledge accepted in a certain community, codified in the form of generalizations (Bex et al., 2003). Examples of such generalizations are ‘the forceful impact of a hammer can cause a person’s skull to break’, and ‘witnesses under oath usually speak the truth’ (Bex, 2009, 18). Generalizations can default when applied to specific instances. For example, it may not be true that the forceful impact of a plastic hammer can cause a person’s skull to break. A story scheme is a collection of literal schemes and (causal) generalizations schemes that fits the following definition (Bex, 2009, 126).

**Definition:** a *story scheme*  $G_S \in \text{Schemes}$  is a set comprised of literal schemes and causal generalizations such that the set of components  $(G_S) = G_S \cup \{\varphi \in G_S \text{ or } \varphi \text{ is the antecedent or the consequent of some } g_i \in G_S\}$ .

Both generalizations and story schemes can be abstract as well as specific. The underlying logic of this framework is based on a set of inference rules for classical logic combined with a defeasible modus ponens rule for the conditional operator  $\Rightarrow$  that represents defeasible generalizations (Bex and Prakken, 2010). A generalization has the form  $p_1 \& p_2 \& \dots \& p_n \Rightarrow q$ . A generalization with free variables is a scheme for all its ground instances, and a literal scheme is a scheme for all its ground instances. For example (Bex, 2009, 126), ‘x robs y’ is a scheme for ‘Haaknat robs supermarket’ and also a scheme for ‘John robs bank’. A story scheme can also contain causal links, as in the following example: {motive  $\Rightarrow_c$  goal, goal  $\Rightarrow_c$  action, action  $\Rightarrow_c$  consequence}.

A set of events or actions in a story corresponds to a component of the story scheme if the scheme is derivable from the events through a process of applying abstractions. This process of linking to particular events or actions described in the story to their representation in a more



abstract level by a story scheme is explained by Bex (2009, 127) with two examples. In the first example, the event ‘Haaknat robs supermarket’ is a particular instance of the abstract scheme ‘x robs y’ straightforwardly, and a more complex inferential process that Bex calls an explicit abstraction generalization is not needed. In the second example, however, a more complex process is required. In this example, ‘Haaknat robs supermarket’ is said to correspond to the action component of the intentional action scheme through the abstraction generalization  $\text{Haaknat robs supermarket} \Rightarrow_A \text{action}$  because  $\{\text{Haaknat robs supermarket}\} \cup \{\text{Haaknat robs supermarket} \Rightarrow_A \text{action}\} \vdash_A \text{action}$ .

The sequence template shown in figure 1, classified as an episode scheme in the sense of Pennington and Hastie (1993), can also be seen at a higher level abstraction as a story scheme in the sense of Bex (2009, 2009a), as we now show.

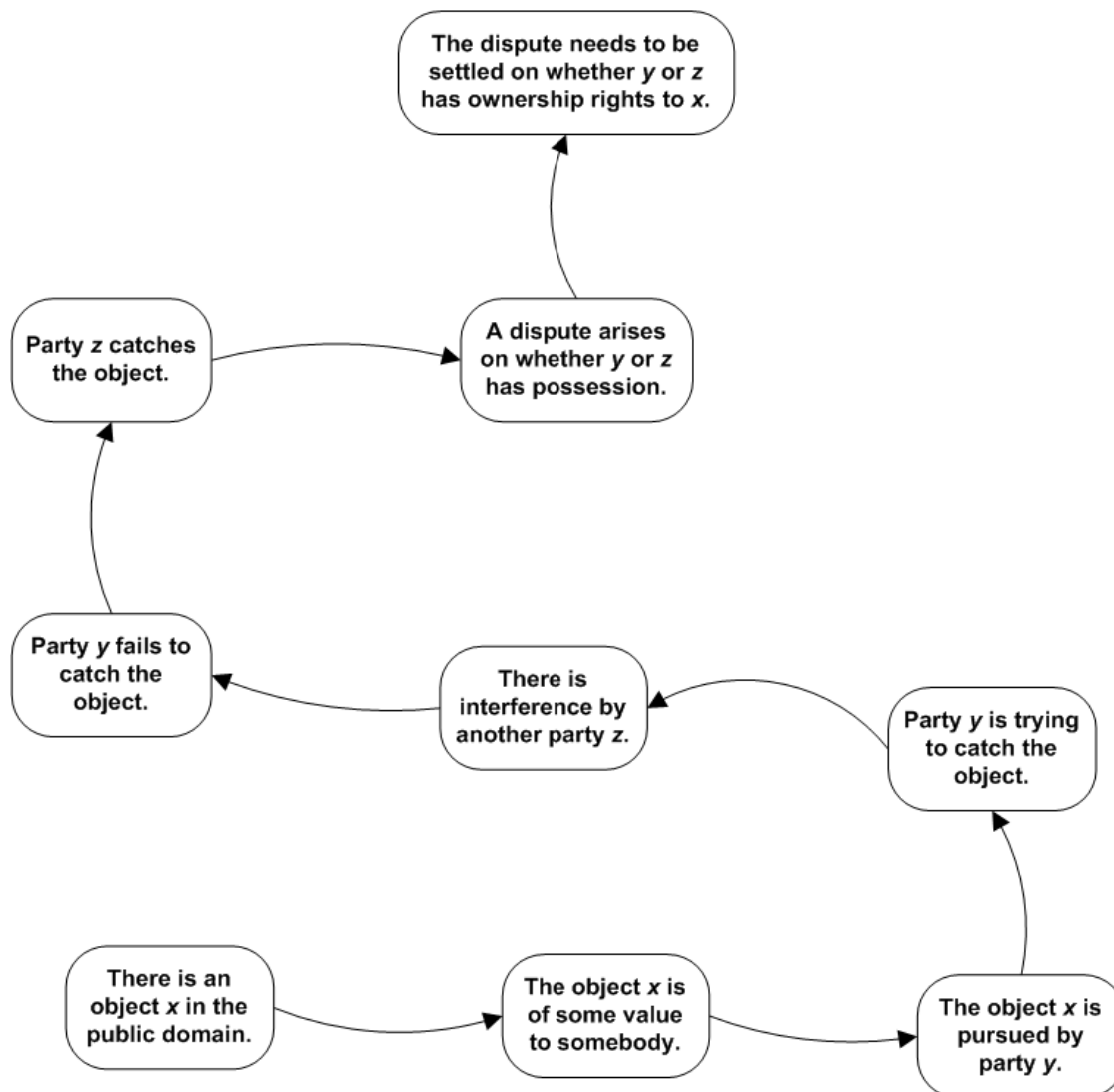


Figure 3: Story Scheme that the Baseball Case Shares with Animals cases

The story scheme shown in figure 3 is an abstraction, a template that offers a way of representing the sequence of actions in the template at a higher level of abstraction representing a story as a connected causal sequence.

In the cases discussed in this paper, the story scheme in figure 3 links the fox case, the fish case, and the whale case all together as similar in relevant respects, and links each of them to the baseball case. This does not mean that each case is similar to each other one in every respect, or even in every relevant respect. It only means that they are similar in that they all share a certain abstract pattern as a story scheme that fits the general causal sequence represented in figure 3.

At this point we have represented the notion of similarity that argument from analogy is based on, by adapting the story scheme structure of Bex (2009) that evolved from the story-based approach to reasoning about factual issues in criminal cases. This analysis offers a better way of showing how to marshal evidence in support of the similarity premise in an argument from analogy. It also offers support for the view that version 2 of the argumentation scheme for argument from analogy applies better to cases like those exploiting the analogy between the animals cases and the baseball case than version 1. However, we still have not posed the question of how to evaluate arguments from analogy that fit version 2 of the argumentation scheme. Some clues as to how to go about this are suggested by the dialogue structures used by Bex (2009, 139- 156) and by the formal dialogue game designed for use in investigating stories by Bex and Prakken (2010). Arguments from analogy are defeasible, because even though an analogy can be strong in certain respects, it can always be attacked by showing that it fails to hold, or is weak, in other respects. It is suggested in the next section that some directions on how to approach the problem of evaluation of arguments from analogy are offered by finding some resources from case-based reasoning and from these dialogue models.

## 7. Dialectical Aspects of Argument from Analogy

Using the Haaknat example again, Bex and Prakken (2010, 5) show how two competing explanations that are offered as evidence in a criminal case can be evaluated to see which is the better explanation. One criterion they use is evidential coverage, meaning how many arguments can be used to support claims that are parts of the explanation. Haaknat was found hiding in a moat in the park after the robbery, and the prosecution explanation was that he had fled there after the robbery to avoid arrest. Haaknat offered a different explanation. He argued that he was hiding in the moat because he had an argument with a man over some money, and this man had drawn a knife. Haaknat's explanation was that he had fled to escape this man. There are various criteria that can be used to evaluate which is the more plausible explanation, internal consistency of each story being one of them. Bex and Prakken provide a formal dialogue model that represents a process of evaluation in which each side presents arguments to support its own story, and asks critical questions to test and throw doubt on the plausibility of the other party's story. The same kind of dialogue model can also be used to provide a method for evaluating the strength of an argument from analogy, the case in point being the analogy between the baseball case and the previous animal cases.

Judge McCarthy (2002, 9) ruled that although Popov did not retain control of the ball, other factors need to be considered. One factor is that his efforts to retain control were interrupted

by a violent mob of wrongdoers. Another is the principle that if an agent takes steps to achieve possession of a piece of abandoned property, but is interrupted by the actions of others, he has a pre-possessory interest in the property. After examining all the arguments, Judge McCarthy decided that any award to one party would be unfair to the other, and that each had an equal and undivided interest in the ball. In the end, the precedents from the animals cases did not decide the outcome of the case. But still, they did help to support Gray's rule, and Gray's rule acted as a partial definition of possession that influenced the line of reasoning that led to the decision. So argument from precedent and argument from analogy, as well as argument from classification and definition, were important in understanding how the sequence of argumentation in the case went.

The baseball case suggests that argument from analogy cannot be analyzed and evaluated in specific cases without placing its use within a broader context where there is a disputed issue. This context includes a sequence of argumentation relevant to that issue that it intended to resolve it by weighing the arguments on both sides. How does the process of applying these schemes to evaluating the arguments by fitting them to cases in this context work?

- The process uses general rules derived from legally authoritative sources by statutory interpretation.
- It uses arguments from analogy to previous decided cases.
- Argument from precedent is based on argument from analogy.
- It uses argument from established rules from these sources.
- In some instances, it uses argument from generally accepted practices in specific kinds of practical activity domains.
- It uses and arrives at classifications based on these rules.
- Instead of fixed definitions, it uses defeasible partial definitions in the form of necessary and sufficient condition rules.
- It applies these rules to the problematic case that needs to be decided by examining and weighing the arguments pro and contra based on the evidence from these and other sources.

The argumentation in a trial can be viewed in this context as a pro-contra dialogue process in which one side puts forward arguments, the other side puts forward opposed arguments, and then each side gets a chance to critically examine the claims and arguments of the other side. Critical questioning, therefore, as well as argumentation schemes representing the different types of arguments, are both important. The task of weighing the arguments requires looking at how each argument can be questioned and attacked (Atkinson et al., 2007). Matching each scheme there is a set of typical critical questions that can be used to reply to an argument of that type by probing into its weak points.

The dialogue game of Bex and Prakken (2010) is designed to regulate the discussion in a criminal case where both players want to find a plausible explanation for the facts of the case, and where the goal is to find the best explanation. Each competing explanation is modeled as a story that can be supported or attacked by the factual evidence in the case, and also evaluated by other criteria like internal consistency. Even though in this paper the central concern is not explanation but argument from analogy, this dialogue game is useful because it contains

arguments, and easily accommodates the use of defeasible argumentation schemes (Prakken, 2005). In such a dialogue, or another comparable type of dialogue of the kinds used in artificial intelligence and law, when an argument is put forward it can be attacked in several ways. When an argument from analogy is initially put forward, it is possible that there is a strong or even striking similarity between the case at issue and the analogous case. As the dialogue proceeds, however, questions may arise on whether the two cases are similar in certain specific respects or dissimilar in other respects. It is a sequence of argument moves during a particular stage of a dialogue that determines how strong the argument from analogy should be taken to be, from a logical point of view. It is this dialogue sequence that should provide the basis for evaluating the strength of the argument from analogy.

As noted above, HYPO processes cases based on arguments from analogy and precedent using the process called three-ply argumentation (Ashley, 1988, 206). First, an argument for one side is constructed by finding a past case in which the outcome closely matches that of the desired outcome of the case under consideration, based on the dimensions. Second, the other side can reply in one of several ways. The other side can reply by finding a counterexample, a past case that matches the current case but which has the opposite outcome. Another reply is to distinguish the case by pointing to dimensions present in the current case that are absent in the precedent. Third, the original party can offer a rebuttal of the previous move by making several kinds of moves. These include distinguishing counterexamples, pointing out additional dimensions, or citing cases which show that weakness identified does not rebut his position. The three-ply argumentation could be used to effectively set up the pre and post conditions for a dialogue model of HYPO, for example by specifying sets of critical questions for argument from precedent.

The three-ply HYPO sequence can be compared to the set of critical questions matching version 1 of the argument from analogy (Walton, Reed and Macagno, 2008, 315).

CQ<sub>1</sub>: Are there differences between *C1* and *C2* that would tend to undermine the force of the similarity cited?

CQ<sub>2</sub>: Is *A* true (false) in *C1*?

CQ<sub>3</sub>: Is there some other case *C3* that is also similar to *C1*, but in which *A* is false (true)?

CQ<sub>1</sub> corresponds to the reply in HYPO of distinguishing the case by pointing to dimensions present in the current case that are absent in the precedent and that favor the opposite conclusion, and dimensions in the precedent that favor its outcome that are not present in the current case. CQ<sub>3</sub> corresponds to the reply in HYPO of finding a counterexample. The reply of offering a rebuttal in HYPO fits under CQ<sub>2</sub>. The reply of citing cases which show that weakness identified does not rebut his position is not illustrated in the baseball case, but it could suggest a continuation of the argument by further pro and contra argumentation.

## 8. Two Other Test Cases and their Implications

There are many different types of arguments from analogy, and the tools for analysis applied to the Popov case in this paper fit some better than others. However, in this section it is most useful to deal briefly with two cases. The first one is interesting because its basic structure

appears to be fairly simple in the way it fits the story scheme. The second one brings up some important points concerning the relationship between the two schemes for argument from analogy set out in section 1.

One of the most famous cases of argument from analogy in public affairs is the hypothetical violinist case (quoted below), used to argue that abortion is permissible in (Thomson, 1971, 48-49).

You wake up in the morning and find yourself back to back in bed with an unconscious violinist. A famous unconscious violinist. He has been found to have a fatal kidney ailment, and the Society of Music Lovers has canvassed all the available medical records and found that you alone have the right blood type to help. They have therefore kidnapped you, and last night the violinist's circulatory system was plugged into yours, so that your kidneys can be used to extract poisons from his blood as well as your own. The director of the hospital now tells you, "Look, we're sorry the Society of Music Lovers did this to you - we would never have permitted it if we had known. But still, they did it, and the violinist now is plugged into you. To unplug you would be to kill him. But never mind, it's only for nine months. By then he will have recovered from his ailment, and can safely be unplugged from you."

This hypothetical case has been taken to be highly persuasive as an ethical argument on the abortion issue, even though there is a large amount of literature containing arguments supporting and attacking it. When this case is presented to a respondent, he or she is likely to agree that the person attached to the violinist has the right to unplug himself. According to the argument from analogy, this statement fits together with the similarity premise to enable the conclusion to be drawn that a pregnant woman has the right to terminate her pregnancy, even though the fetus will die as a result. Thomson's argument is that the person in the source case who unplugs the violinist does not violate his right to life, because the violinist has no right to the use of that other person's body. By argument from analogy, we are then led to the conclusion that abortion does not violate the fetus's right to life but merely deprives the fetus of the use of the pregnant woman's body, something which the fetus has no right to.

This case can be analyzed using the following episode scheme: {person x has had another person y attached to his body without x having any choice; having y attached is an encumbrance that will hinder x's daily activities; x and y are attached in such a way that y will die if removed from x; y can only survive when removed from x after a period of 9 months; x can make a choice about whether to have y removed or not}. This story scheme presents an abstract structure that applies both to the violinist case and to a case at issue about a woman who has become pregnant. The conclusion drawn from the description of the person attached to the violinist is designed to elicit the idea that the person to whom the violinist was attached should have the right to choose to have him detached. By argument from analogy, the conclusion drawn is that a woman who has become pregnant due to rape should have the right to have an abortion.

The violinist case has been much discussed in the ethical literature, and many arguments pro and contra have been put forward by citing the respects in which the two cases are similar or different. Objections to the argument have tended to proceed by arguing that there are important differences between the violinist case and cases of a mother aborting a fetus. One

such objection is that the argument extends only to cases of abortion where the pregnancy was caused by rape. In the violinist case, the person kidnapped did nothing himself to cause the violinist to be attached to him, whereas in typical abortion cases, the pregnant woman chose to have intercourse. Another difference is that the fetus is the woman's child while the violinist is a stranger.

The argument from analogy initially appears plausible, for two reasons. One is that there appears to be a striking similarity between the two cases because the story scheme ties together a set of common elements in a sequence that both cases exhibit. The other reason is that in the violinist case it seems reasonable to conclude that the person attached to the violinist should have the right to remove him, assuming that he is not obliged in any way to support the violinist by undergoing the arduous procedure that is necessary. When you combine these two reasons, the violinist case appears to present a strong argument from analogy that is in favor of the conclusion it was put forward to support. But as differences are explored as well as similarities, the argument begins to seem less compelling.

The basic problem we started out with in this paper is that there seemed to be two different argumentation schemes for argument from analogy, and it seems difficult to choose which one is the better, or which one should generally be used. One scheme is very simple. It simply states that when two cases are similar, and where some conclusion can be drawn in the one case, a comparable conclusion should also be drawn in the other case. The other scheme is more complex. It says that two cases are similar in certain respects, allowing for the possibility they may also be different in other respects, and then it claims that the respects in which they are similar are decisive, or outweigh the respects in which they are different. On this basis, it claims that because some conclusion can be drawn in one case, a comparable conclusion should also be drawn in the other. The more complex scheme easily fits the case-based models of argument from analogy that use factors or dimensions.

What is the relationship between these two forms of argument? Here the following hypothesis is put forward, based on the approach that when an argument from analogy is first used at some stage of a dialogue to persuade the other party to accept a claim, it needs to be tested and evaluated by means of a sequence of argumentation that follows from this initial move. When the argument is first put forward it is in the structure of the simple version of the scheme, but later during the sequence, as critical questions are posed and counter-arguments are put forward, the more complex version of the scheme is the structure that the argumentation best fits.

A test case that is interesting to briefly consider is from copyright law. Striking similarity has sometimes been used as an argument that relies on similarities or claimed identities between two works to prove that there was a violation of copyright law in which one party copied some intellectual property belonging to the other. In law, in order to prove such a copyright violation there are two component claims that have to be proved, copying and improper appropriation of copyrightable expression. In the absence of direct evidence of copying, one may meet the burden of proving copying indirectly by showing that the alleged copier had access to the work and that the two works are substantially similar. The doctrine of striking similarity arises because two works, for example two songs, can be so strikingly alike in their sounds, their notes, and the sequences of tones and cadences in the melodies, that it might seem to someone suspecting his or her work has been stolen that there could be absolutely no doubt

that the one has been copied from the other. However, such an appearance of similarity or even identity can be misleading when drawing an inference about copying. There could be other explanations. It could be merely coincidence, or both parties may have copied from a common source in the public domain. Hence striking similarity should not, by itself, be regarded as sufficient evidence to fulfill the burden of proof for establishing violation of copyright. Arguments from analogy based on such a striking similarity, nevertheless are highly persuasive, because of the powerful psychological effect of the perceived similarity. The nature of the problem is indicated in Judge Frank's often-cited opinion in *Arnstein v. Porter* (154 F.2d 464 (2<sup>nd</sup> Cir. 1946) to the effect that even where access is absent, the similarity can be so striking that it precludes the possibility that the plaintiff and defendant independently arrived at the same result. This ruling could be "disastrous" (Patry, 2005/06) if it were used as a sufficient basis for justifying an inference of copying in all circumstances. The problem is to judge why this kind of direct inference from striking similarity to a conclusion of copyright violation represents a kind of inference that jumps to a conclusion quickly while overlooking other evidence that needs to be taken into account.

Arguments from striking similarity are based on the simple version of the argumentation scheme for argument from analogy. If the analogy between two cases is striking, meaning that it is much stronger and more convincing than the usual kind of comparison between cases, the argument initially appears to be so strong that it is frozen at the initial stage. Instead of moving on to the sequence of argumentation including critical questioning and counter arguments, the sequence stops there. What this shows is that if we go exclusively by the simple version of argument from analogy, the argument may appear so powerfully persuasive that it jumps to a simplistic conclusion without taking into account other relevant evidence that needs to be considered. The hypothesis that both schemes need to be used can help to explain what has gone wrong when an argument from analogy based on striking similarity jumps to a premature conclusion. It initially provides some legitimate evidence to support an ultimate claim based on a highly persuasive analogy, but its evaluation has not proceeded far enough into the subsequent sequence of argumentation in the dialogue to properly take into account all the relevant evidence that needs to be considered. It is precisely for these reasons that jumping to a conclusion is a form of argumentation often associated with logical errors and informal fallacies (Walton and Gordon, 2009).

Finally, we need to note in this section that on one model of legal argumentation, the sharpness of the dispute over which scheme of the two is the best one to represent the logical structure of argument from analogy can be softened. Carneades (Gordon and Walton, 2006) is a mathematical and computational model of legal argumentation that builds on ontologies from the semantic web. Carneades has been implemented using a functional programming language, and has a graphical user interface in which a given argument is visualized as a directed graph (Gordon and Walton, 2009). Carneades is a system for reasoning with argumentation schemes, and has the distinctive feature that it manages the critical questions matching a scheme into three categories, thereby enabling them to be treated as premises of the scheme, in some instances additional implicit premises (Walton and Gordon, 2005). It would be easy to manage critical questions by modeling them as additional premises in a scheme, except that there are two different variations on what happens when a respondent asks a critical question. In some instances, when a critical question is asked, a burden of proof

shifts to the proponent's side to answer it, and if this burden is not fulfilled the argument is defeated. In other instances, merely asking the question does not defeat the proponent's argument until the respondent offers some evidence to back it up. To cope with variation, Carneades distinguishes three types of premises, called ordinary premises, assumptions and exceptions. An assumption is not explicitly stated in the premises of a scheme, but behaves like an ordinary premise, one that was explicitly stated. An assumption is taken to hold, so that if a critical question is directed to it, and some evidence is not given to support it in line with the questioning, it now fails to hold. An exception is not taken to hold unless evidence can be given to show that it does hold. By treating the argumentation schemes and their matching critical questions this way, the Carneades system makes it less crucial whether some factor that is important for evaluating an argument that fits a scheme is treated as a premise of the scheme or as a critical question matching the scheme.

We can classify the critical questions matching version 1 of the scheme for argument analogy, as shown in section 7, as follows. The second critical question merely asks whether one of the premises is true, so it can be treated as a normal premise. The first and third questions cite specific differences or another case that is needed to furnish evidence required to call the argument from analogy into question. So they are best treated as exceptions.

What these observations reveal is that if we use Carneades to model argumentation from analogy, the critical question that asks whether there are differences between the two cases can be represented as an additional premise of the simple scheme. This appears to show that there is a transition from the simple scheme to the more complex scheme. This transition appears to represent a typical sequence of dialogue in which the argument from analogy is analyzed in greater depth. In the simple scheme, the factors or dimensions appear only in the critical questions, but in the more complex version of the scheme, more of them appear in the scheme itself. From the point of view of the Carneades model, since critical questions can be represented by fitting them into the scheme and treating them as premises, and since counter-arguments can be represented in a dialogue format, the structure allows for an orderly transition from the application of the one scheme to the other. But before this transition can be properly understood, both schemes need to be revised.

## 9. Reconfiguring the Schemes

What is the best argumentation scheme and the best set of critical questions for argument from analogy, from among those surveyed in section 2? The best one to work with initially is the following modified version of the simplest scheme from (Walton, Reed and Macagno, 2008, 315).

Similarity Premise: Generally, case *C1* is similar to case *C2*, based on their shared scheme story.

Base Premise: *A* is the conclusion to be drawn in case *C1*.

Conclusion: The conclusion *B*, comparable to *A* in case *C1*, based on their shared scheme story, is to be drawn in case *C2*.

The violinist case can be used to illustrate how this argumentation scheme applies to an argument from analogy. The similarity premise is the statement that the case of the person



with the violinist attached to his body is similar to the case of a woman with a pregnancy due to rape. The base premise is the statement that the conclusion to be drawn in the violinist case is that the person attached to the violinist should have the right to detach him. The comparable conclusion to be drawn in the pregnant woman case is that she should have the right to an abortion.

In light of the examples studied in the paper, and especially in light of the use of models in artificial intelligence based on factors and dimensions, the following set of critical questions matching the scheme is now proposed.

CQ<sub>1</sub>: Are there respects in which *C1* and *C2* are different that would tend to undermine the force of the similarity cited?

CQ<sub>2</sub>: Is *A* the right conclusion to be drawn in *C1*?

CQ<sub>3</sub>: Is there some other case *C3* that is also similar to *C1*, but in which some conclusion other than *A* should be drawn?

It should be noted here that the first critical question relates to a factors or dimensions that represent similarities or differences between the two cases that tend either to support or detract from the argument from analogy. Another way to look at this critical question, therefore, is as an initial point in a sequence of dialogue that goes into pro and contra arguments with respect to the claim made in the argument from analogy. The third critical question also represents a kind of counter argument that is often called a counter analogy in logic textbooks, a second argument from analogy directed against the first one that goes to the opposite conclusion of the first one. The critical questions can be viewed as representing species of counter-arguments, and as well, on the Carneades model, they can be viewed as species of premises of the scheme. On this model, their function is to shift the burden of proof from the one side to the other in dialogue. Thus we can see that there are different ways of evaluating arguments from analogy, but the main functions of the simplest version of the argumentation scheme and its matching set of critical questions are to enable us to identify arguments from analogy, and to provide at least some entry point for instructing a beginner about questioning them.

Once we have identified and analyzed the argumentation in a given instance as an argument from analogy using the story scheme model of the similarity premise along with the other premise, we typically want to go on to the next tasks of analyzing and evaluating the argument. This takes us to the following sequence of the argumentation following the initial use of the argument from analogy in the dialogue. The best device that is useful at this stage is case-based reasoning with its use of dimensions and factors. The simple scheme above is the best representation of the form of argument from analogy to be used, however, because it distinguishes the respects in which one case is similar to another, based on the story scheme common to the two cases. These respects can then be added to or challenged by bringing out new ones, or new differences between the two cases, i.e. factors or dimensions.

During the process of argument evaluation, there is a two-part dialogue sequence representing how an argument from analogy is typically put forward initially and then later critically questioned and examined in more detail for its strengths and weaknesses. In the first part, the argument from analogy appears plausible if there is a story scheme into which the

sequence template for the two cases fits. Such a fit makes the argument from analogy appear strong by supporting the similarity premise of the basic scheme. The basic scheme does not distinguish between other additional respects that may be brought out in which the one case is arguably similar to the other or dissimilar. However, during the next part of the sequence, issues concerning specific respects in which the one case is similar to the other or not may arise.

Guarini's version of the scheme for argument from analogy (section 2), has a premise that states that the two cases being compared share a set of common features. By treating features as equivalent to respects in which two cases are similar, a simpler version of the core scheme was recast into what we called the single respect scheme. To fit with the new version of the simplest scheme above, we now offer this reformulated version of the single respect scheme.

Respects Premise: Case *C1* is similar to case *C2* in a certain respect.

Base Premise: *A* is the conclusion to be drawn in case *C1*.

Conclusion: the conclusion comparable to *A* in *C1* is to be drawn in case *C2*.

Where a number of respects are brought together by using the single respect scheme, repeatedly to cite several common features in which the two cases are held to be similar, the single respect scheme becomes equivalent to Guarini's core scheme. Respects, or features if you will, can be identified with dimensions or factors, depending on whether you are using a HYPO-style system or a CATO-style system.

When the simple scheme is applied to a case, there are already some points of similarity, as well as a general pattern of similarity, postulated by the story scheme. The single respects scheme is supposed to go beyond this level by citing specific features the two cases share. To make this scheme useful in relation to the simple scheme, we have to define 'respect' as referring to a specific feature in which two cases are held to be similar. In this way, the single respect scheme is an extension of the simple scheme.

Next, the problem is to fit the simplest scheme and its matching set of critical questions alongside the single respect scheme into a dialogue framework in which they can be employed alongside each other. How this will work is that the new version of the simple scheme is applied at the first point in the dialogue where the argument from analogy is put forward. Next, the critical questions are asked, and the first critical question concerns respects in which *C1* and *C2* may be different. Put in a stronger form, this critical question could be a counterargument that draws a conclusion that is the negation of the original argument from analogy, based on the premise that there are one or more respects in which the two cases are different. This is a contra argument, but there is also a matching pro argument of the type represented by the single respect scheme. So the single respect scheme represents a form of argument that is opposed to the counterargument based on different respects. Such a pattern of argumentation is common in case-based reasoning where some factors support the conclusion *A*, but then other factors are cited that support the conclusion not-*A*. As noted, case-based reasoning weighs the arguments on both sides by considering the cases on each side and determining which cases are more on-point, or relevant in terms of the overlap of each case's factors with those of the current case. Fitting together these arguments and critical questions needs to be done in a dialectical framework where an argument from analogy is initially put forward and

then challenged, initially by asking critical questions, but then at a later stage by probing into specific respects in which two cases are similar or different. What we see is that there is a surface level that represents the initial impact of putting forward an argument from analogy, and a deeper level of analysis and criticism in which specific respects of similarity or difference are specified in weight against each other.

Our new version of the simplest scheme for argument from analogy has three components, the similarity premises, the base premise and the conclusion. The single respect scheme, and the multiple variants of it corresponding to Guarini's scheme are addressed to the similarity premise. Depending on whether the respect cited is a pro or contra factor, the respect scheme will be an argument for or against the similarity premise. Notice that when an argument fitting such a respect scheme is brought forward, we are now at the evaluation stage. When the argument from analogy is originally brought forward in the form of an argument fitting the simple scheme, we are just at the presentation stage where the argument, if the similarity fits a plausible story scheme, will be a provisionally acceptable argument. But when the dialogue starts to go into a discussion of specific similarities and differences between the two cases, we have now entered the evaluation stage. In other words, during this stage the question being discussed is how plausible the argument is. The important thing to note is that when the specific respects in which the one case is similar to or different from the other are being put forward, the arguments are either supporting the similarity premise or attacking it. The first critical question of the simple scheme represents this kind of attack on the similarity premise, whereas the third critical question represents a different kind of argument. In this different kind of argument, the counter-argument purports to prove the negation of the conclusion of the simplest scheme.

## 10. Conclusions

Judge McCarthy's remark cited at the beginning of section 7 shows that the fundamental task of the trial in the baseball case was to craft a definition of possession that would be applicable to the case. The court partly carried out this task by using defeasible rules for partly defining possession of baseballs. But these rules failed to resolve the issue of which party should legally have ownership of the contested baseball. What the trial showed is that although the baseball case is about argument from classification and definitions, as well as about argument from analogy, the argument from definition cannot solve the problem by itself. It cannot be solved by itself because the concept of possession that needs to be defined is open-textured, and how it should be applied varies with the context of each individual case. Another more general lesson learned is that the philosophical notions of definition and analogy that we started out with did not work very well as applied to the task of seeing how arguments from precedent are based on arguments from analogy. In particular, we see that the schemes for argument from analogy have to be reconfigured, and fitted in to the schemes for argument from classification and argument from precedent to provide a basis for revealing how legal arguments from precedent work.

The most important conclusion of the paper is that when similarity is defined in the way indicated using story schemes, we can reconfigure the argumentation schemes for argument from analogy in the way shown in section 9, and thereby solve the problem of how they should

fit together. The new version of the simple scheme functions as a device for identifying any given instance of an argument from analogy in a text of discourse while the more complex type of scheme advocated by Guarini functions as a device for evaluating an argument from analogy as strong or weak. The idea is that the two schemes need to be employed in tandem, with the simple scheme being used first and the more complex scheme being used to follow it up. This approach has better enabled us to bring out the significant relationships of argument from analogy with other closely related schemes like argument from classification and argument from precedent. We are now in a position to see how the basic scheme ties in with the core scheme, and how the core scheme fits with tools like use of factors and dimensions in case-based reasoning.

By carefully distinguishing these schemes from each other, and by contrasting them with related schemes, we were able to get a much more precise and useful theory that shows how argumentation from analogy works in case-based reasoning. In particular, we have seen how the notion of analogy needed to be reconfigured to provide a better basis for revealing how arguments from precedent work, based on a premise of similarity between two cases. In typical cases where an argument from precedent is used, as illustrated by the examples treated, it was seen to be based on an underlying argument from analogy. In dealing with arguments found in cases, there are two general sorts of tasks to be undertaken by argumentation methods. The first task is that we have to recognize arguments from analogy, and to do this we need to distinguish between it and other closely related arguments like argument from classification and argument from precedent. As the case of the drug-sniffing dog showed in section 3, the first classification stage of reasoning by analogy leads to a later evaluation stage. The best device to be used for carrying out the first task is the argumentation scheme for argument from analogy, along with the matching critical questions and the other schemes studied in this paper.

It was noted in section 7 that the three-ply argumentation procedure can be used to set up pre and post conditions for a dialogue model of use of argument from analogy, and the other related types of arguments we considered, using case-based reasoning. It was shown how Carneades can manage schemes and critical questions, and how the formal dialogue system of Bex and Prakken (2010) for investigating stories provides a framework for elucidating how the story-based model and the argument-based model of evidence can be combined in a unified formal framework. A future project is to show in more detail how the argumentation scheme for argument from analogy should be evaluated in these systems. Another project is to apply the argumentation schemes and the story scheme to further cases of argument from analogy. Such cases could be drawn both from law and from argumentation in everyday conversational discourse.

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### References

- Aleven, V. (1997). *Teaching Case Based Argumentation through an Example and Models*. PhD Thesis, University of Pittsburgh, Pittsburgh, Pennsylvania.
- Ashley, K. (1988). Arguing by Analogy in Law: a Case-Based Model. *Analogical Reasoning*, ed. D. H. Helman. Dordrecht: Kluwer, 205-224.
- Ashley, K. (2004). Capturing the Dialectic between Principles and Cases. *Jurimetrics*. 44, 229-279.
- Ashley, K. (2006). Case-Based Reasoning. *Information Technology and Lawyers*, ed. A. R. Lodder and A. Oskamp. Berlin: Springer, 2006, 23-60.
- Ashley K. (2009). Ontological Requirements for Analogical, Teleological and Hypothetical Reasoning. *Proceeding of ICAIL 2009: 12<sup>th</sup> International Conference on Artificial Intelligence and Law*. New York: Association for Computing Machinery, 1-10.
- Atkinson, K., Bench-Capon, T.J.M. and McBurney, P. (2005). Arguing About Cases as Practical Reasoning. *Proceedings of the 10th International Conference on Artificial Intelligence and Law*, ed. G. Sartor. New York: ACM Press, 35-44.
- Bench-Capon, T.J.M. (2009). Dimension Based Representation of Popov v Hayashi. *Modelling Legal Cases*, ed. K. Atkinson. Barcelona: Huygens Editorial, 41-52.
- Bench-Capon, T.J.M. (2010). Representing Popov V. Hayashi with Dimensions and Factors. *Artificial Intelligence and Law*, to appear, 2010.
- Bex, F. (2009). *Evidence for a Good Story: A Hybrid Theory of Arguments, Stories and Criminal Evidence*. PhD Thesis: University of Groningen.
- Bex, F. (2009a). Analysing Stories Using Schemes. *Legal Evidence and Proof: Statistics, Stories, Logic*, ed. H. Kaptein, H. Prakken and B. Verheij. Farnham: Ashgate, 93 -116.
- Bex, F. and Prakken, H. (2010). Investigating Stories in a Formal Dialogue Game. In P. Besnard, S. Doutre & A. Hunter (eds.), *Computational Models of Argument: Proceedings of COMMA 2008*. Amsterdam etc, IOS Press, 73-84.
- Bex, F., Prakken, H., Reed, C. and Walton, D. (2003). Towards a Formal Account of Reasoning about Evidence: Argumentation Schemes and Generalizations. *Artificial Intelligence and Law* 11, 125-165.
- Brewer, S. (1996). Exemplary Reasoning: Semantics, Pragmatics and the Rational Force of Legal Argument by Analogy, *Harvard Law Review*, 923-1038.
- Gordon T. F. and Walton, D. (2006). The Carneades Argumentation Framework, *Computational Models of Argument: Proceedings of COMMA 2006*, ed. P. E. Dunne and T. J. M. Bench-Capon. Amsterdam: IOS Press, 195-207.
- Gordon, T.F. and Walton, D. (2006a). Pierson v. Post Revisited', *Computational Models of Argument: Proceedings of COMMA 2006*, ed. P. E. Dunne and T. J. M. Bench-Capon. Amsterdam: IOS Press, 208-219.
- Gordon, T. F. and Walton, D. (2009). Proof Burdens and Standards, *Argumentation and Artificial Intelligence*, ed. I. Rahwan and G. Simari. Berlin: Springer, 239-260.
- Gordon, T. F., Prakken, H. and Walton, D. (2007). The Carneades Model of Argument and Burden of Proof. *Artificial Intelligence*, 171, 875-896.
- Gray, B. E. (2002). Reported and Recommendations on the Law of Capture and First Possession: Popov v. Hayashi. *Superior of the State of California for the City and County of San Francisco*, Case no. 400545, November 6, 2002. Available May 24, 2009 at: [http://web.mac.com/graybe/Site/Writings\\_files/Hayashi%20Brief.pdf](http://web.mac.com/graybe/Site/Writings_files/Hayashi%20Brief.pdf)

- Guarini, Marcello (2004). A Defense of Non-deductive Reconstructions of Analogical Arguments. *Informal Logic* 24: 153-168.
- Guarini, M., Butchart, A., Simard Smith, P., and Moldovan, A. (2009). Resources for Research on Analogy: A Multi-disciplinary Guide. *Informal Logic* 29(2), 84-197.
- Hamblin, C. L. (1970). *Fallacies*. London: Methuen.
- Hart, H. L. A. (1949). The Ascription of Responsibility and Rights. *Proceedings of the Aristotelian Society*, 49, 171-194. Reprinted in *Logic and Language*, ed. A. Flew, Oxford, Blackwell, 1951, 145-166.
- H. L. A. Hart, *The Concept of Law*, Oxford, Oxford University Press, 1961.
- Leake, D. B. (1992). *Evaluating Explanations: A Content Theory*. Hillsdale, New Jersey: Erlbaum.
- Loui, R. P. (1995). Hart's Critics on Defeasible Concepts and Ascriptivism. *Proceedings of the Fifth International Conference on Artificial Intelligence and Law*, New York, ACM Press, 21-30. Available at: <http://portal.acm.org/citation.cfm?id=222099>
- Macagno, F. and Walton, D. (2009). Argument from Analogy in Law, the Classical Tradition, and Recent Theories, *Philosophy and Rhetoric*, 42, 154-182.
- McCarty, L. T. and Sridharan, N. S. (1982). A Computational Theory of Legal Argument. LRP-TR-13. Laboratory for Computer Science Research, Rutgers University: New Brunswick, NJ, 1-36.
- McCarthy, K. M. (2002). Statement of Decision. Superior Court of California, December 12, 2002, Case of Popov v. Hayashi #4005545: [www.findlaw.com](http://www.findlaw.com).
- McLaren, B.M. (2003). Extensionally defining principles and cases in ethics: An AI model. *Artificial Intelligence Journal*, 150, 145-181.
- McLaren, B.M. (2006). Computational models of ethical reasoning: Challenges, initial steps, and future directions. *IEEE Intelligent Systems*. Published by the IEEE Computer Society, July/August, 29-37.
- Patry, W. (2005/06). The Patry Copyright Blog. Accessed July 22, 2010 at this site: <http://williampatry.blogspot.com/2005/06/striking-similarity-and-evidentiary.html>
- Pennington, N. and Hastie, R. (1993). The Story Model for Juror Decision Making. *Inside the Juror: The Psychology of Juror Decision Making*, ed. R. Hastie. Cambridge: Cambridge University Press, 192-221.
- Prakken, H. (2005). Coherence and Flexibility in Dialogue Games for Argumentation. *Journal of Logic and Computation*, 15, 1009-1040.
- Schank, R. C. (1986). *Explanation Patterns: Understanding Mechanically and Creatively*. Hillsdale, New Jersey: Erlbaum.
- Schank, R. C. and Abelson, R. P. (1977). *Scripts, Plans, Goals and Understanding*. Hillsdale, New Jersey: Erlbaum.
- Schauer, F. (1987). Precedent. *Stanford Law Review*, 39(3), 571-605.
- Schauer, F. (2009). *Thinking Like a Lawyer*. Cambridge, Mass.: Harvard University Press.
- Thomson, J. (1971). A Defense of Abortion. *Philosophy and Public Affairs*, 1(1), 47-66.
- Wagenaar, W. A., van Koppen, P. J. and Crombag, H. F. M. (1993). *Anchored Narratives: The Psychology of Criminal Evidence*. Hertfordshire: Harvester Wheatsheaf.
- Walton, D. and Gordon, T. F. (2005). Critical Questions in Computational Models of Legal Argument. *IAAIL Workshop Series, International Workshop on Argumentation in Artificial Intelligence and Law*, ed. P. E. Dunne and T. J. M. Bench-Capon. Nijmegen: Wolf Legal Publishers, 103-111.

Walton, D. and Gordon, T. F. (2009). Jumping to a Conclusion: Fallacies and Standards of Proof, *Informal Logic*, 29, 215-243.

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

Weinreb, L. L. (2005). *Legal Reason: The Use of Analogy in Legal Argument*, Cambridge: Cambridge University Press.

Wyner, A., Bench-Capon, T. J. M. and Atkinson, K. (2007). Arguments, Values and Baseballs: Representation of Popov v. Hayashi. *Legal Knowledge and Information Systems (JURIX 2007)*. Amsterdam: IOS Press, 151-160.

Wyner A. and Bench-Capon, T. J. M. (2007). Argument Schemes for Legal Case-Based Reasoning. *Legal Knowledge and Information Systems (JURIX 2007)*, A. Lodder and L. Mommers, eds. Amsterdam: IOS Press, 139-149.