Story Similarity in Arguments from Analogy

Douglas Walton CRRAR

In this paper a hybrid model of argument from analogy is presented that combines argumentation schemes and story schemes. One premise of the argumentation scheme for argument from analogy in the model claims that one case is similar to another. Story schemes are abstract representations of stories (narratives, explanations) based on common knowledge about how sequences of actions and events we are familiar with can normally be expected to unfold. Story schemes are used to model similarity between two cases, and as the basis of evidence to support the similarity premise of an argument from analogy. Four examples of argument from analogy are used to test the theory.

This paper extends the findings of (Walton, 2010) by testing the analysis of similarity first put forward in that paper and applied to the analysis and evaluation of legal arguments from analogy of the kind used in arguments from precedent in law. In the basic scheme for argument from analogy, one of the premises has a requirement holding that there is a similarity between the two cases in point. In (Walton, 2010) it was shown how the notion of similarity in the one premise of the basic scheme can be analyzed using the hybrid theory of legal argumentation of Bex (2009), and how legal arguments from precedent are based on arguments from analogy. It was also shown how the basic scheme is combined with another scheme for argument from analogy that does not have a similarity premise, but depends instead on specific respects in which one case is similar to or different from another.

The hybrid theory combines arguments and explanations. An explanation is built around a story of a kind often associated with a so-called script of the type studied in artificial intelligence (Schank and Abelson, 1977). A script is a sequence of actions and events that are connected together in such a way that we understand it based on our common knowledge of the way things can be generally expected to work in our familiar experience. For example, a script could be my swinging a golf club, hitting the golf ball, the golf ball flying through the air, the golf ball landing on the grass, the golf ball rolling towards the flag but stopping short of it. This sequence of events and actions can also be viewed as a story that is very much like a script, except that on the hybrid theory, parts of the story can be supported or undermined by evidence found in a specific case. Bex (2011, 59) calls such a story 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. However, I will use the notion of a story in a broader sense that comprises not only causal relations, but other kinds of relations between actions and events as well.

In this paper a distinction is drawn between stories and story schemes. Stories represent sets of particular actions or events joined together in a sequence of a kind we are familiar with from common knowledge about the way things generally work. They are specific rather than abstract. Story schemes contain variables so that different stories can be instances of the same story scheme. Story schemes are abstract.

The first part of the paper shows briefly how argument from analogy works by identifying its basic components, including the argumentation scheme for argument from analogy. The second part of the paper reviews the violinist case of Thompson (1971), as a classic case of argument from analogy used in ethical reasoning on the abortion issue. It is used as an example in part four to illustrate how the analysis of similarity will be applied. The third part introduces the reader to work on scripts and stories in artificial intelligence, concentrating on the hybrid system that will

be shown to be applicable to analyzing similarity, when suitably modified. In parts five, six and seven, three examples of argument from analogy taken from a news magazine (*Newsweek*) are reconstructed and analyzed using story schemes and stories. The application of the hybrid theory to these three examples is used to build a general method. This method can be applied to an instance of an argument from analogy in such a way that the user can systematically marshal the evidence supporting and detracting from the argument from analogy. The method works by combining story schemes with the argumentation scheme for argument from analogy.

1. Forms of Argument from Analogy

The literature on argument from analogy is abundant in many fields including argumentation, logic, ethics, law, natural science, computer science and the social sciences (Guarini et al. (2009). It is an important type of argument to study, because so much of our reasoning is based on it (Brewer, 1996, Ashley, 2006), and because it can be tricky, as the logic textbooks have emphasized by citing examples of improper uses of argument from analogy. There can be different varieties of argument from analogy (Walton, 2010), some of which do not have a premise stating that the two things that are the basis of the analogy are similar to each other (Guarini, 2004). In this paper, however, we will work with an argumentation scheme for argument from analogy, called the basic scheme for argument from analogy, which does have such a similarity premise.

In the basic scheme for argument from analogy, a similarity between two cases where a proposition *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. The following basic scheme (Walton, Reed and Macagno, 2008, 315) represents this version of the structure of argument from analogy.

Similarity Premise: Generally, case C_1 is similar to case C_2.

Base Premise: *A* is true (false) in case C_1.

Conclusion: *A* is true (false) in case C_2.

The following set of critical questions matches the basic scheme for argument from analogy.

CQ_1: Are there respects in which C_1 and C_2 are different that would tend to undermine the force of the similarity cited?

CQ_2: Is *A* the right conclusion to be drawn in C_1?

CQ_3: Is there some other case C_3 that is also similar to C_1, but in which some conclusion other than *A* should be drawn?

The first critical question relates to differences between the two cases that could detract from the strength of the argument from analogy, but respects in which two cases are similar could also be used to support the argument from analogy. The methods for evaluating arguments from analogy used in case-based reasoning apply respects in which two cases are similar or different. For example the HYPO system (Ashley,1988) evaluates argument from analogy using a range of values that move along the scale with values that support the argument at one end and detract from it at the other end of the scale. CATO (Aleven, 1997) is based on factors representing respects in which a case is similar to or different from another one. In case-based reasoning argument from analogy 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 the argument while others detract from it. To weigh the arguments on each side, we have to consider the factors on each side, and determine which factors are more “on-point”, or relevant.

The second critical question draws attention to the possible shortcoming that the conclusion suggested as the one that should be drawn in the source case is not actually justified by the details of the source case. The third critical question suggests the possibility of putting forward the kind of attack called-counter analogy, where the critic finds a third case which appears similar to the original one but has a different conclusion.

As the examples of argument from analogy to be presented in this paper will show, this type of argument works as follows. First, a source case is presented that appears plausibly to suggest a particular statement as its conclusion. Then a target case is presented, one that appears similar to the source case in some way, and the aim of the argument is to get the respondent to accept the same conclusion, or a parallel one, in the target case. How argument from analogy works by this process of transference is indicated in figure 1.

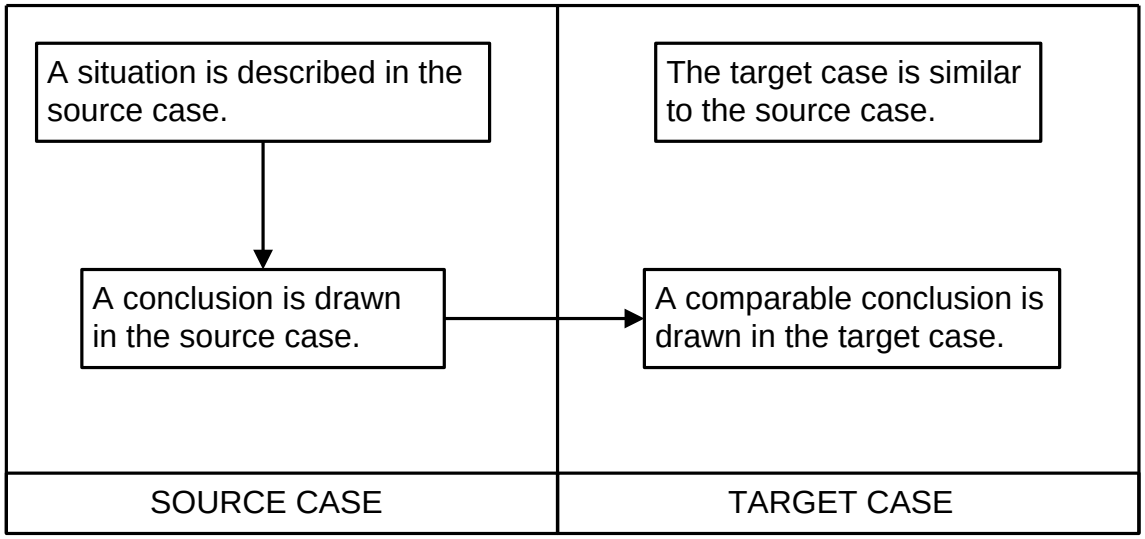

Figure 1: Transfer from a Source Case to a Target case

The reason argument from analogy works as a rational argument to persuade a respondent to accept a conclusion is that the target case is similar to the source case, and since a particular kind of conclusion was drawn in the source case, then a comparable conclusion should be drawn in the target case.

One problem with applying this scheme to the analysis and evaluation of arguments from analogy is to determine how similarity should be defined or measured. It might seem at first that it can be defined in visual terms as an overall appearance of likeness perceived between two cases. However, the examples used in this paper suggest that we have to look for some better or more precise way of defining similarity that might be more useful to handle these cases.

2. The Violinist Example

The violinist example is a famous cases of argument from analogy in public affairs (quoted below), used by Thomson (1971, 48-49) to argue for the claim that abortion is permissible.

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.”

When this hypothetical case is presented to a respondent, he or she is likely to draw by argument the conclusion that the person attached to the violinist has the right to unplug himself. The premise of the argument is the assumption that the violinist has no right to the use of that other person’s body, and the conclusion drawn is that the person does not violate that person’s right to life when he unplugs him. By a process of transference, an argument from the reasoning used in this case can be applied to the similar case of an abortion using argument from analogy. By this reasoning it is argued that a pregnant woman has the right to terminate her pregnancy, even though the fetus will die as a result. The reason is based on the assumption that the source case of the person who has the decision of whether to unplug the violinist is similar to the target case of the woman who decides whether or not to have an abortion. The intended conclusion of the argument from analogy is that the abortion will not violate the right to life of the fetus, but only deprive the fetus of the use of the pregnant woman’s body. Just as in the violinist case, the violinist had no right to the use of the other person’s body, so in the abortion case it is concluded, the fetus has no right to the use of the woman’s body.

The violinist case has been much discussed in bioethics. Arguments pro and con cite particular respects in which the two cases are held to be similar or different. For example, one con argument is that in the violinist case, the person kidnapped did nothing himself to cause the violinist to be attached to him, and so the analogy to the abortion case is only applicable in those cases where the woman had no choice about becoming pregnant, as in a case of rape. The aim here is not to list or evaluate these pro and con arguments, but to identify the similarity that links the two cases together enabling the source case to be used as a plausible argument from analogy to support the conclusion of the target case. This aim is achieved by showing how the source case and the target case share a certain kind of structure called a story.

3. Scripts and Stories

Early work in artificial intelligence (Schank and Abelson, 1977) postulated what were called scripts representing sequences of actions and events of kinds we are all familiar with in everyday life. The following temporally ordered sequence of nine events is a variant of the restaurant script, often used as an example. 1. John went into a restaurant. 2. John sat at a table. 3. A waiter gave John a menu. 4. John ordered a steak and salad dish. 5. The waiter served the steak and salad dish to John. 6. John ate the steak and salad. 7. The waiter gave the bill to John. 8. John paid the bill. 9. John left the restaurant. Scripts are based on common knowledge about the way things are normally done or the way things normally happen in situations that we can be expected to be familiar with. Later work in artificial intelligence introduced a variant on scripts called MOPs, or memory organization packages that 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 a story, a larger connected sequence of events or actions that hangs together and can be used to explain an event or action.

Pennington and Hastie (1992) provided experimental evidence to show that jurors in trials use narrative story structures to organize and interpret evidence. During the course of the trial, the jurors construct stories that they use to make sense of trial information by organizing it into a coherent mental representation. Stories are organized into units called episodes that represent our knowledge as human agents about action sequences in the world.

The process of story construction is a way of understanding human action and is important for analyzing the concept of explanation on a dialectical model in which explanation is viewed as a transfer of understanding from one agent to another, whether that agent is a human being or an automated agent of the kind studied in multi-agent systems. Pennington and Hastie (1992, 190-191) found that there several factors that determine the acceptability of the story. The greater the story's coverage of the evidence presented at trial, the more acceptable the story is as an explanation of the evidence. Coherence of the story includes consistency and plausibility. Plausibility is enhanced by the consistency of the story with knowledge of events taken to be real. Uniqueness, another factor, means that if there is one coherent story that story will be accepted, whereas if there is more than one story, competing stories need to be compared to judge which is the best or better explanation of the facts.

Stories are different from argumentation schemes, but there is one instance of a common type of story that bears a close relationship to a particular argumentation scheme. The argumentation scheme for practical reasoning is basically reasoning from two premises, one of which states an agent's goal while the other states some means to carry out that goal, and the conclusion is that the agent should take the action represented by the means. The simplest form of practical reasoning that is readily familiar to all of us can be represented by the following argumentation scheme, where first-person pronoun 'I' represents a human or artificial agent. An agent is an entity that has goals, some limited knowledge of its circumstances, and the capability of acting to alter those circumstances. The conclusion means that the agent should carry out the designated action assuming that it is acting in a rational manner.

Major Premise: I have a goal, *G*.

Minor Premise: Carrying out this action *A* is a means to realize *G*.

Conclusion: I should (practically speaking) out this action *A*.

In more complex models of practical reasoning, the agent may have multiple goals, and may take into account counterbalancing negative consequences of the action being contemplated that would provide reasons against carrying out the action.

There is a very common type of story used over and over again in legal reasoning about evidence in trials that appears similar to the scheme for practical reasoning. We can give an example of it by adapting the one used by Pennington and Hastie (1992, 192). First there a series of initiating events: two men, Arthur and Bob, are in a bar; Arthur threatened Bob; Bob has no weapon; Bob leaves. After this point there is a sequence of actions: Bob goes home; Bob gets a knife; Bob goes back to the bar; Arthur hits Bob; Bob stabs Arthur. Also involved in the sequence is a set of goals: Bob intends to find Arthur; Bob intends to kill Arthur. Following the sequences of actions there is a set of consequences: Arthur is wounded; Arthur dies. Once we are informed about all these main elements, based on our common knowledge of how situations like this can go, we can grasp the whole sequence of events as an intelligible story.

The relationship between the argumentation scheme for practical reasoning and the story about the two men in the bar is complex (Walton, 2011), but can be briefly explained as follows. Once the circumstances, actions and consequences in the example have been set out, abductive reasoning from the conclusion represented by the description of the stabbing enable us to use

common knowledge to reason backward to the assumption that Arthur intended to kill Bob. The argumentation scheme for practical reasoning can be used to reason forward from a set of premises about goals and circumstances to a conclusion about an action. But it can also be used abductively to reason backward to an agent's goals or motives from a description of his or her actions and circumstances of a case (Bex, Bench-Capon and Atkinson, 2009).

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 a story, which is like a script or MOP except that it can be abstract or specific. For example, the sentence 'John entered the restaurant' might be an item in a specific story, whereas 'He entered the restaurant' might be an item in an abstract story scheme. The plausibility of the story, Pennington and Hastie showed, can be evaluated not only by the factors listed above, but also by how well it is based on the evidence in a case. By this means, they argued, stories can be used to help evaluate evidential reasoning in a legal case. The method is to compare competing stories to find the best story, the one that is most plausible based on the evidence.

It is a problem in some cases that a more plausible story may not be well supported by the evidence whereas a less plausible story may be better supported by the evidence. To solve this problem (Wagenaar, van Koppen and Crombag, 1993) devised a type of story called an anchored narrative, where some parts of the story are supported by items of evidence in a case while other parts of the story are not. (Bex, 2009) built a formal system for reasoning with arguments, stories and criminal evidence, called a hybrid system because it combines story-based explanations with arguments that can support part of an explanation or be used to refute part of it. Bex's theory is based on generalizations as well as stories. A generalization has the form p_1 & p_2 & . . . & $p_n \Rightarrow q$, using a conditional operator $\Rightarrow$ that represents defeasible generalizations (Bex and Prakken, 2010). 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 particular events or actions described in a story to their representation in a more abstract level in a story scheme is explained by Bex (2009, 127).

We will use Bex's theory to model the notion of similarity used in the basic argument from analogy, but we will modify his theory in certain respects. On Bex's theory, generalizations and story schemes can be abstract or specific. An abstract scheme contains statement functions with variables whereas a specific scheme contains only statements. For example '*x* robs *y*' is a statement function containing two variables, whereas 'Alice robs supermarket' and 'Bob robs bank' are statements (Bex, 2009, 126). I will retain this feature. Indeed, it will be fundamental to my analysis of the notion of similarity used in argument from analogy. However, I will depart from Bex's theory in the terminology I use when I apply the distinction to argument from analogy. Here a distinction will be drawn between sequences of statements that make up what is called a story, and sequences of statement functions that make up what is called a story scheme. As the examples treated below will show, it is this distinction that is the key to the method applied to modeling similarity when reconstructing, analyzing and evaluating instances of the basic argument from analogy found in a text of discourse.

The rest of the paper will apply stories and story schemes to model the structure of argument from analogy in four examples. In this paper a story is defined as a connected sequence of events or actions understandable by common knowledge that is specific rather than abstract in the senses that (1) it contains no variables and (2) it represents an account of some particular events or actions in some given case. In contrast, a story scheme is defined as a connected sequence of events or actions understandable by common knowledge, but one that contains variables, in such

a way that many different stories can be instances of it. As will now be shown, these notions of story and story scheme can be used as part of a method to analyze an argument from analogy in any given case. The method begins by identifying the story in the source case.

4. Analysis of the Violinist Case

The following story can be identified in the violinist case. This story is identified below as an ordered sequence of statements presenting a story.

1. Person finds himself attached to famous violinist.
2. Person had no choice about this arrangement.
3. Having violinist attached is an encumbrance to person.
4. Having violinist attached will hinder person's daily activities.
5. Violinist will die if removed from person.
6. Violinist can only survive if attached to person for nine months.
7. Person can make a choice about removing violinist.

No conclusions are drawn yet. The above sequence of seven statements represents only a connected set of events that enables one to recognize the story in the case.

The next step in the method is to identify the comparable story in the target case.

1. Woman who has been raped finds herself pregnant.
2. Woman had no choice about becoming pregnant.
3. Being pregnant is an encumbrance to woman.
4. Being pregnant will hinder woman's daily activities.
5. Fetus will die if removed from woman.
6. Fetus can only survive if carried to term of approximately nine months.
7. Woman can make a choice about removing fetus.

Once the story has been identified in the source case and also in the target case, the basis for the similarity premise of the argument from analogy linking the two cases can be analyzed. There are three factors. In this particular case, it is shown how the first factor of the similarity resides in the one-to-one correspondence between the seven statements in the source story and the seven matching statements in the target story. The second factor is the ordering of the statements, which is identical. The third factor is that both stories make sense to us based on common knowledge about how things generally go in situations that are familiar to us in outline even though they may be hypothetical. For example, the sequence of actions and events in the violinist case probably appears unfamiliar, and even strange to us as a kind of case we have never encountered, and probably never will. But still, it makes sense to us as something that could conceivably happen, and the steps from one stage to the next in the sequence exhibit no unbelievable leaps. Even though we may not personally be familiar with making a decision on whether to have an abortion, the sequence of actions and events in the target case is also plausible, in the sense that each step is connected to the next, and the sequence of actions and events make sense of something that is known to happen.

The next step in the method of analyzing an argument from analogy is to proceed to a higher level of abstraction where the story scheme that is common to both stories is articulated. This story scheme can be identified as the following sequence: {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 nine months; *x* can make a choice about

whether to have *y* removed or not}. The story scheme for this particular argument from analogy can also be represented by the linear structure in figure 2, where the open sentences in the text boxes contain variables. The statement functions in the rounded boxes are abstractions of the statements in the corresponding story. The arrow is that joined the rounded boxes represent different kinds of relations between the pairs of statements in the corresponding story. Sometimes they represent causal relations, but not always. Often they represent descriptions of something that happened before an event or something that happened after it has a place in the sequence of the story.

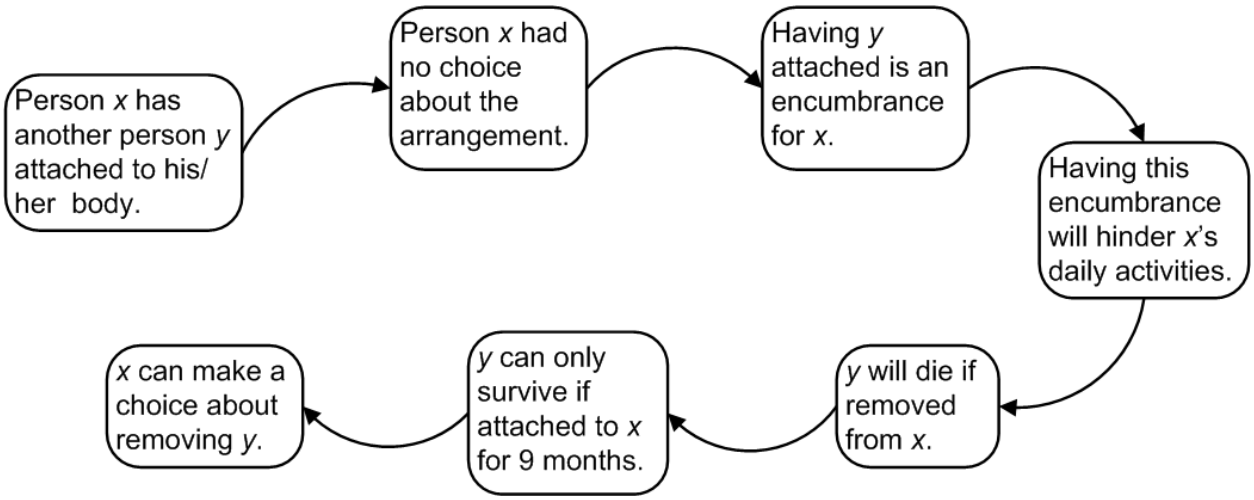

Figure 2: Linear Tree Structure of the Story Scheme in the Violinist Case

This story scheme presents an abstract structure that applies both to the source case and to the target case. The conclusion drawn from the story in the source case 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 choose whether to have an abortion.

Once we have identified the story scheme that is common to the two cases and that is the basis of the similarity between the two cases that makes the argument from analogy from the source case to the target case plausible, we have grasped the basis of the similarity that supports the similarity premise of the argumentation scheme for argument from analogy. The argument from analogy is strong, for three reasons. First, it fits the scheme for argument from analogy. Second, the story scheme ties together a set of common elements in an orderly sequence both stories fit. Third, the fitting of the pair of stories into the story scheme support the first premise of the argumentation scheme for the argument from analogy. For these three reasons the violinist case presents us with a strong argument from analogy that is in favor of the conclusion it was put forward to support. Once the original argument from analogy has been identified, and its parts have been fitted together, the basis for studying further argumentation either pro or con this argument is there. We can see, for example, that there are different ways of supporting or attacking the argument, by citing further similarities and differences, by presenting a counter-analogy, and so forth. We can now construct an argument graph showing the argument and how it relates to other arguments that might be used to support it, to critically question it, or to attack it by counter-arguments. How to construct such an argument graph is shown in the last example.

In the abortion example, the story scheme brings out the basis of comparison between the violinist scenario and the abortion scenario. Then additional differences and similarities can be brought in relating to the story scheme, and both scenarios. The essential work of the story scheme is that it offers an analysis of the structure of the similarity premise of the argumentation scheme for argument from analogy. The analysis of the example does this essential work as follows. Being attached to a violinist is obviously not the same as being pregnant. However, they are both instances of *X is attached to Y*. The analysis of this example above shows how the procedure works. Normally, you wouldn't be able to directly match 'pregnant' with 'violinist'. As shown by the analysis of the violinist example, you first have to show similarity between the two stories and then the next step is to proceed to a higher level of abstraction. On this method what you have to do next is to go through the following three-step procedure: *first* go up to a more abstract level, *second*, thereby show the match, and then *third* you are finally able to draw the justified conclusion that the two cases are similar.

Before going on to analyze some other examples, here a qualification needs to be made, in answer to the following objection. From the reconstruction of the violinist example, it looks like if we just constructed a long principle, conjoining the propositional functions expressed in the boxes in figure 2, we would have captured what we needed to capture to fully represent the similarity between the two cases that is the basis of the analogy. But it can be shown that this will not work in all cases. Take for example the following story/episode scheme:

Woman is pregnant, woman did not have a choice, woman is encumbered, …etc

Now, say that we have the following story scheme

X did not have choice → X has Y attached → X is encumbered, … etc

Now, these two cannot be matched, as the sequence is different. But obviously this is not what we want: it is perfectly acceptable to match this story to this story scheme. In some cases, sequence is important (when representing causal or temporal issues), but in other cases, the sequence is not that important (as long as the story mentions that X did not have a choice, it does not matter where in the sequence this is mentioned). The objection is that by using the arrows, the analyst is enforcing a sequence, which is not what one would want. To overcome this objection we need to use Schank and Ableson's (1977) more rich representation of a story scheme, which can be illustrated by the story scheme for 'murder' in Bex and Verheij, 2012).

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

Some information (under 3) is important to the story scheme (and any episode scheme that matches it), but does not have to be put into sequence. What this qualification means, when it comes to analyzing the other examples we will now study, is that the sequences shown in the diagrams of stories and story schemes have been shown in a simplified way. Some events have to be drawn in a strict sequence while others are "loose", meaning that they could be dawn in a

different order, i.e. the order of them is not strict. These questions about story schemes methodology will be further discussed in section 8.

5. The More Power Example

In the perspectives column of *Newsweek* (June 29, 2009, 21), the following argument from analogy was put forward as a response to a proposal to give the Federal Reserve more power to regulate the financial system: "it's like a parent giving his son a bigger, faster car right after he crashed the family station wagon". The argument from analogy in this case is based on the transference from the source case to the target case. The source case very graphically suggests a particular conclusion and then that conclusion is transferred by analogy to the situation presented in the target case. In the source case we can all easily appreciate the situation because of our common knowledge about this particular situation. We know that young people tend to lack mature judgment skills, and also tend to be excited by driving a large powerful vehicle. So when we are presented with a situation where the son has crashed the family station wagon, we immediately suspect the possibility that the son may have been driving carelessly or too fast, and precautions may need to be taken about his driving in the future. Hence we recognize immediately that giving the son a bigger, faster car right after this crash might be very dangerous.

The argumentation scheme for argument from analogy can be applied to this example as follows. Once we recognize that giving the son a bigger, faster car might be very dangerous, we draw the conclusion that it would be imprudent to do so. The argumentation leading to this decision is based on practical reasoning. The reason why giving the son a bigger, faster car is not a good idea is that there could be negative consequences of doing so. In other words, the base premise of the argumentation scheme for argument from analogy is supported very well by the information given in the source case and by the common knowledge we have about such a case. Next, we turn to the similarity premise.

How is this common knowledge about the source case transferred to the target case? To build a basis for answering this question we begin by constructing a story representing the situation depicted in the source case. This story has six steps.

1. Parent allows son to drive family station wagon [implicit].
2. Son crashes the family station wagon.
3. Son crashing the family station wagon is a very bad outcome [implicit].
4. Parent gives son a bigger, faster car.
5. The bigger, faster car has a greater capability for a more serious crash [implicit].
6. Giving son a bigger faster car could lead to an even worse outcome [implicit].

Now we have the problem of evaluating the similarity premise. How similar are the source case and the target case in such a way that the source case provides a good basis for a strong argument from analogy to the target case?

To build a basis for answering this question, we abstract from this story to get the story scheme contained in the source case. Initially, the source case and the target case do not seem to be all that similar. One is about a son driving the family station wagon, and the other is about regulating the financial system by giving power to the Federal Reserve. However, both cases are about one agent giving power to another agent or agency to carry out some actions, and about what might happen if more power is given to the second agent by the first. This commonality of

the two cases can be expressed as a story scheme. An abstract representation of this story scheme is presented in figure 3.

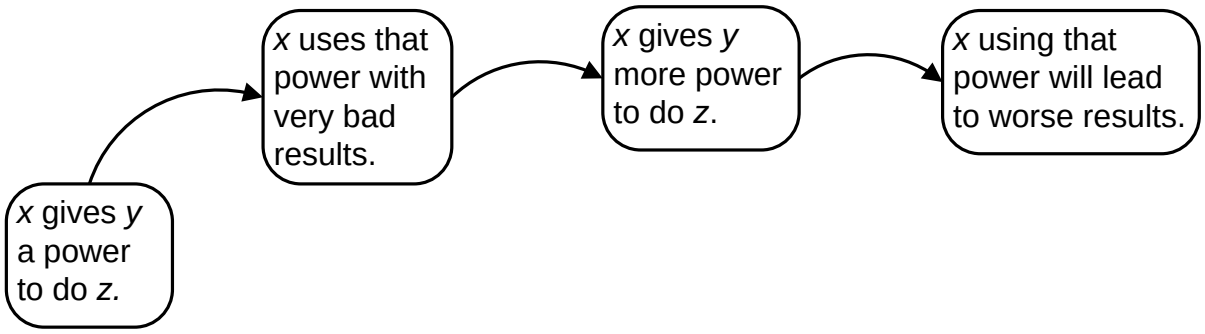

Figure 3: Story Scheme for the More Power Example

Next, we can apply this story scheme to the target case, generating the story for the target case.

1. Government gave the Federal Reserve power to regulate the financial system [implicit].
2. There was a major economic downturn [implicit].
3. Having a major economic downturn is a very bad outcome [implicit].
4. The proposal is to give the Federal Reserve more power to regulate the financial system.
5. The Federal Reserve having more power to regulate the financial system gives it greater capability that could lead to an even worse economic downturn [implicit].
6. Giving the Federal Reserve more power to regulate the financial system could lead to an even worse economic downturn [implicit].

The implicit conclusion drawn in the source case was that giving the son a bigger, faster car is a bad idea. Once the similarity is established between the source case and the target case, given that the stories in both cases fit the story scheme, by parity of reasoning as shown in figure 4, a comparable conclusion is suggested for the target case.

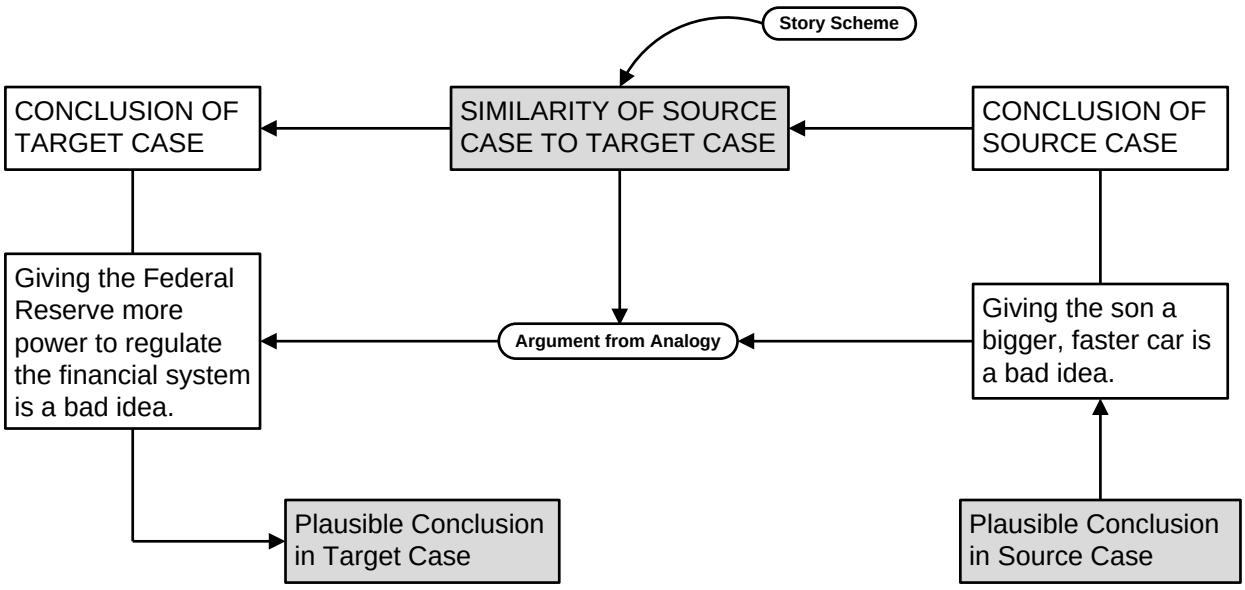

Figure 4: Parity of Reasoning from Source to Target Case

As shown in figure 4, the ultimate conclusion shown at the left is the statement that giving the Federal Reserve more power to regulate the financial system is a bad idea. To see the sequence of argumentation in which the story scheme is embedded, you have to begin by looking at the line of argument along the top of figure 4. There is a transfer effect because the conclusion of the source case supports the conclusion of the target case in virtue of the similarity between the two cases. The similarity is modeled by the story scheme that can be seen to be common to the two cases. Thus because the conclusion of the source case, the statement that giving the son a bigger faster car is a bad idea, is supported by the plausible argument presented in the source case, the argument from analogy carries this plausibility over to the target case. By the parity of reasoning underlying the argument from analogy, the conclusion that giving the Federal Reserve more power to regulate the financial system is a bad idea is made to seem plausible. The fitting of the story scheme to both the story of the source case and the story of the target case offers an analysis of the structure of the analogy between the two cases, showing how the similarity premise is well supported by the evidence of the case. As shown by the sequence of argumentation in figure 4, we start out with a plausible conclusion in the source case, and then by virtue of the similarity between the source case and the target case supporting the argument from analogy, we get to a plausible conclusion in the target case.

One can see that the kind of reasoning involved in both the source case and the target case is practical reasoning used in deliberation on what to do. The question is whether giving the Federal Reserve more power to regulate the financial system is a good idea or not. As noted above, the story of the source case presents negative consequences of giving the son a bigger, faster car. These negative consequences are transferred by analogy to the target case, suggesting that giving the Federal Reserve more power to regulate the financial system could lead to an even worse economic downturn.

6. The Fire Example

The next example (from *Newsweek* October 5, 2009, 33) is a response from General Stanley A. McChrystal to a proposal "reportedly emanating from the office of VP Joe Biden, to give up on nation building in Afghanistan and just go after the terrorists in their lairs". The response from McChrystal is quoted as follows: "You can't hope to contain the fire by letting just half the building burn". An officer on McChrystal's staff backed up this argument with additional support by saying, "Civil war would immediately break out. You'd have a failed state, like Somalia, only much harder to get to". Applying the first step of the method to this case, we construct an episode sequence for the source case as follows.

1. Only one half of a building is burning.
2. The two halves of the building are closely interconnected [implicit].
3. Fire Department tries to contain the fire by letting the burning half burn.
4. Fire Department doesn't (or can't) do anything effective about preventing the fire from spreading from the one half to the other [implicit].
5. The whole building will burn down [implicit].

The story scheme reconstructed from this target case is shown in figure 5.

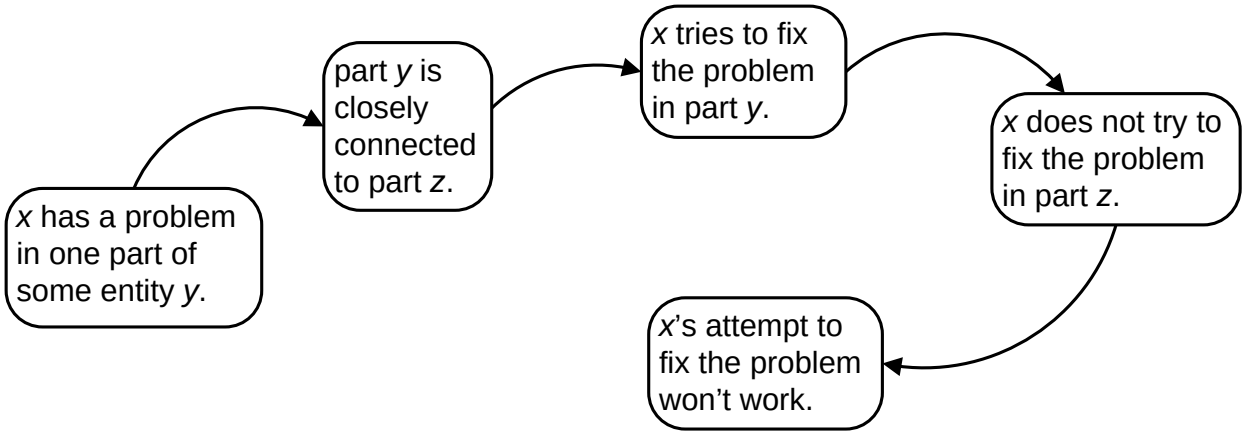

Figure 5: Story Scheme for the Fire Example

How can this story scheme be applied to the target case? In this instance, the match is not so exact and we have to extract more implicit elements. In this deliberation the participants are deciding between two proposals for action. The current plan being implemented is described as one of nation building in Afghanistan. This plan applies to the whole country. The proposal being put forward is to "just go after the terrorists in their lairs". The way that the proposal is phrased indicates that it applies to only part of the country, namely the places where the terrorists are hiding. Bringing up these implicit elements, we can see that the proposal being put forward applies to fixing the problem in a part of the country. This fits the third element in the sequence displayed in figure 5 representing the story scheme. It is also implied that the proposal to go after the terrorists in their lairs makes no attempt to fix the problem in other parts of Afghanistan. What is being implied by the analogy between the two cases is that these two parts are closely connected. This fits the second element in the sequence of the story scheme, the propositional function that part *y* is closely connected to part *z*. Using these implicit elements we can reconstruct the story for the target case as follows.

1. There is a problem with terrorists in Afghanistan located in specific places (their lairs).
2. The terrorists have close connections with other people who do not live in these places.
3. The proposal is to fix the problem in the specific places where the terrorists are located.
4. The proposal takes no measure to fix the problem in these other places.
5. The proposal won't work to fix the problem.

This case is one of a deliberation where a decision needs to be made between two competing proposals, and the argument from analogy is being used as a counterargument against the proposal being put forward for implementation.

An interesting aspect of this case is that the argument from analogy used in it is backed up by another argument from analogy used to support it. The officer on the staff compares the situation in Afghanistan to a past situation in Somalia, where a civil war broke out, presumably after a military intervention by foreign powers. Here we have an interesting case of one argument from analogy being used to support another one by citing an additional case held to be comparable to the one being attacked by the original argument from analogy. This argument too can be shown to be based on a story scheme where there was a military intervention that resulted in a civil war, which in turn resulted in a failed state. Presumably this case was similar in that it was an attempt to solve the problem in one part of the country without addressing the problem in another closely connected part of the country.

7. The Course Requirement Example

The examples studied so far fit a typical pattern for the employment of argument from analogy, where the argument proceeds straightforwardly from a conclusion derived in the source case to a comparable conclusion derived in the target case. There are more complex cases, however, in which the argumentation in the source case is related to the argumentation in the target case in a different and more complex manner.

The following example can be used to illustrate a case of this sort. It is also from the text of part of an article in *Newsweek* (Lisa Miller, Harvard's Crisis of Faith, *Newsweek*, February 22, 2010, 44). During a faculty luncheon at a bistro in Cambridge Massachusetts, in a meeting on curriculum reform, Steven Pinker, discussing the topic of religion, was quoted as putting forward the following argument: "requiring students to take a course in a Reason and Faith category would be like requiring them to take a course in astronomy and astrology". Pinker was further quoted as saying: "Faith is believing in something without good reasons to do so. It has no place in anything but a religious institution, and our society has no shortage of these." Analyzing this argument is more complex because there are three arguments combined together to attack the proposal to require students to take the course in the Reason and Faith category.

There can be more than one way to analyze the argumentation in this case, but to bring out how the argument from analogy works in it, the best way as to begin is by identifying these three arguments. In the three lists of statements below, some of the premises are explicitly stated propositions while others are implicit premises that have been added to bring out some necessary assumptions that are helpful for grasping the structure of the argumentation. Premises are marked as P_i and conclusions as C_i. The statements making up the premises and conclusion of this first argument, including some implicit premises and conclusions, can be set up as a key list.

Key List for Main Argument

P1: Requiring students to take a course in two disconnected subjects makes no sense.
P2: Two subjects are disconnected if the method of proving something in one is completely different from the method of proving something in the other [implicit].
P3: Faith is believing in something without good reasons to do so.
P4: Reason is believing in something only with good reasons to do so [implicit].
C1: The method of proving something with reason is completely different from the method of proving something with faith [from premises 3 and 4].
C2: Reason and faith are disconnected subjects [from premise 2 and conclusion 1].
C3: Requiring students to take a course in a combined subject where one subject is based on reason and the other is based on faith makes no sense [from premise 1 and conclusion 2].
P5: In a course in a Reason and Faith category, one subject is based on reason and the other on faith [implicit].
C4: Requiring students to take a course in a Reason and Faith category makes no sense.

The structure of the main argument is shown in the argument diagram in figure 6. The argument diagram shown in figure 6 is visualized in the Carneades system (Gordon, 2010) where each argument is a node. Four arguments are shown, a1,…, a4. In the linked arguments (one in which the premises go together to support the conclusion) each premise is shown connected to the

argument node by a line and the node is shown connected to the conclusion by an arrow. An example is a3 with its pair of premises P2 and C1 supporting conclusion C2. In this type of diagram we also have chained arguments. For example, C1, the conclusion of a4, reappears as a premise in a3. A convergent argument (where each premise independently supports the conclusion) is represented as two arguments.

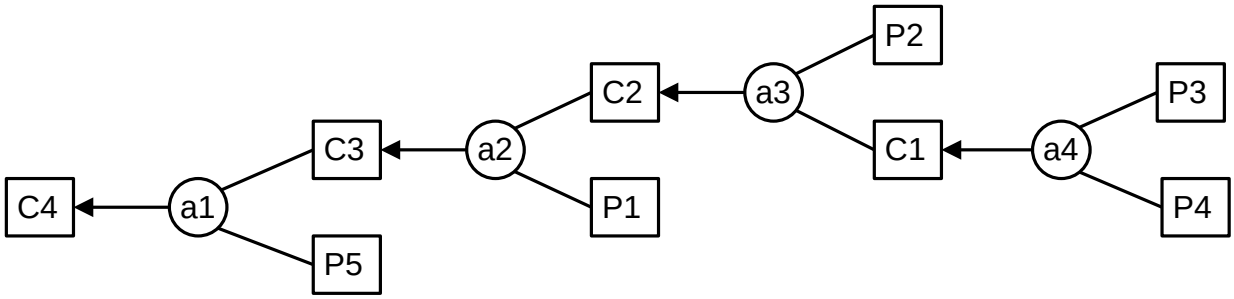

Figure 6: Structure of the Main Argument in the Pinker Example

So we can see that this argument is fairly complex. It is composed of several subarguments and implicit premises that function together to lead to the ultimate conclusion C4, shown at the left of the diagram in figure 6.

The second argument is independent of the first one. It is a linked argument in which the two premises go together to support the conclusion.

P6. Teaching about faith has no place in anything but a religious institution.

P7. A university is not a religious institution [implicit].

C5. Teaching about faith has no place in a university.

The structure of the second argument is shown in figure 7.

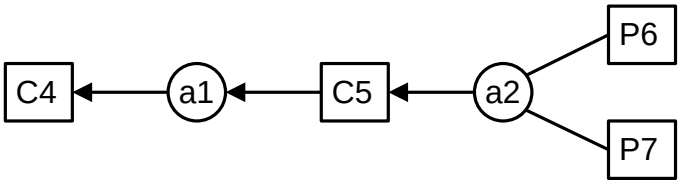

Figure 7: Structure of the First Supporting Argument in the Pinker Example

The second argument is an additional argument that also supports the conclusion of the main argument, and so it could be added in to the argument shown in figure 6, making a larger argument diagram. The two arguments fitting into the larger argument diagram have a convergent structure.

The third argument to be considered in the example is the argument from analogy, made of the following two premises supporting the conclusion C4, also the conclusion of the first argument.

P8: Requiring students to take a course in astronomy and astrology makes no sense.

P9: Requiring students to take a course in astronomy and astrology is similar to requiring students to take a course in Reason and Faith.

C4: Requiring students to take a course in a Reason and Faith category makes no sense.

So here we have an additional argument for C4. This argument from analogy is highly plausible, we can reasonably presume, given the type of audience it was addressed to. It would be persuasive to a group of university professors at a faculty meeting who can draw on their experience of both teaching courses and attempting to devise new courses that would be innovative and appealing for students. A proposal to require students to take a course in astronomy and astrology would be puzzling, and perhaps even objectionable to them.

We can show how an argumentation scheme is displayed on an argument diagram by representing the structure of this argument in figure 8.

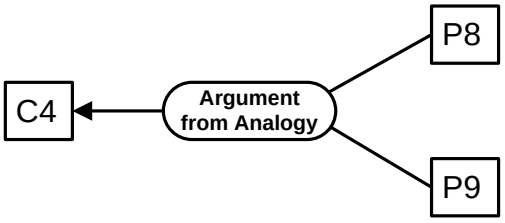

Figure 8: Structure of the Third Argument in the Pinker Example

This argument goes along with the argument shown in figure 7 as an additional argument supporting C4. The story scheme for this argument is shown in figure 9.

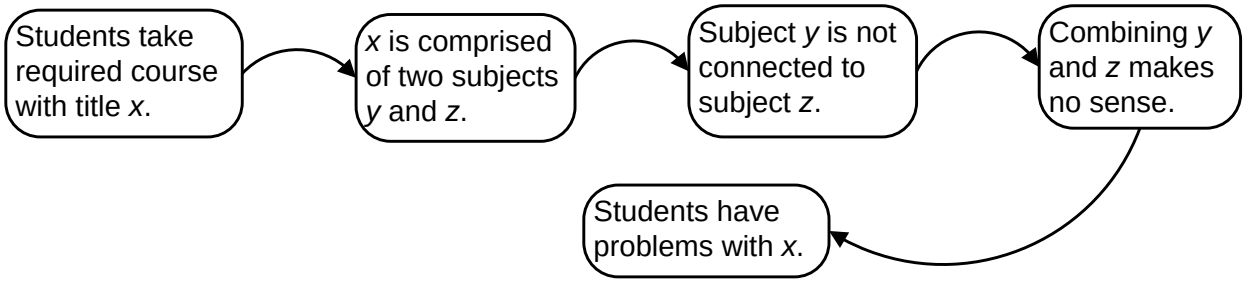

Figure 9: Story Scheme for the Argument from Analogy in the Pinker Example

The source case is the story about taking a course in astronomy and astrology. The target case is the story about taking a course in Faith and Reason.

There is another aspect of the argumentation in this case that can be brought out by considering another plausible candidate for an implicit premise that could be added in.

P10: The reasons why requiring students to take a course in astronomy and astrology makes no sense are essentially the same as the reasons given in the argument above about faith and reason, namely that the two subjects are disconnected.

P10 provides an easily available reason to support P8. By supporting premise P8 of the argument from analogy, the addition of P10 as an implicit premise strengthens the support for the ultimate conclusion C4. The reason why this is so draws from the main argument where it was stated that faith is believing in something without good reasons to do so, whereas university courses, most emphatically those in science, are based on evidence of a kind that presents good reasons for believing in something. At this point in the discussion, a proposal to require students to take a

course in astronomy and astrology would seem dubious and open to critical questioning from the viewpoint of these faculty members.

The issue of whether adding in P10 is a legitimate interpretation of the argument is an open question. If it is added in, the argument is stronger, but also more complex. The argument from analogy now plays an abductive role in relation to the first argument. The proposal to require students to take a course in astronomy and astrology seems to make no sense, but what is the best explanation of why it makes no sense to the audience of faculty members present? The best explanation is the one already presented in the main argument where the view was expressed that requiring students to take a course in two disconnected subjects makes no sense, and that two subjects are disconnected if the method of proving something in one is completely different from the method of proving something in the other. These two statements offer a plausible explanation of why the proposal to require students to take a course in astronomy and astrology seems to make no sense. The professors at the faculty meeting understand why such a course would be difficult to teach in a manner that would offer a coherent course that would be useful to students who might take it.

Even though the argumentation in this example is more complex than in the previous two examples, it is possible to see that the argument from analogy in it can be analyzed using the same method. The line of argument is comparable to the argument from analogy used in the fire example, except that in the fire example, the problem was that the two things were closely connected. In this example, the problem is that the two things are disconnected. In this example it is alleged that requiring students to take a course in astronomy and astrology makes no sense because the two subjects are disconnected. Here the story for the source case is built around the idea that the two subjects are disconnected, and the story scheme is built around the notion of two things *x* and *y* being disconnected. The novel way the argument from analogy is used in this example is that the source case is applied to a complex main argument built on requirements that are stated for defining the notions of faith and reason.

This example shows how arguments from analogy can in some instances be woven into complex networks of argumentation where they are used to support or attack other arguments, or conversely where other arguments are used to support or attack the argument from analogy. Actually, both kinds of cases are possible in the same example where there is a complex network of pro and con argumentation in which an argument from analogy is nested in with other arguments surrounding it. It has been shown that these kinds of cases can be handled using existing argumentation methods of argument diagrams and argumentation schemes.

8. Questions about the Story Schemes Theory

An objection might be made that while the arrows in the story diagrams often represent causal relations, in some instances they do not. The question then might be asked: what does the arrow stand for? It is a misconception to think that the arrow stands for some kind of single logical relationship like logical implication. It is just a relation that enables the analyst to construct a tree structure representing connections between actions and events. The sequence in the story is based on the common knowledge we all have about how certain kinds of familiar types of situations can be expected to go, based on some kind of pattern of events that we know how to use and to apply in everyday argumentation and explanations. The empirical work of Pennington and Hastie (1992; 1993) showed how juries use these patterns when arriving at a decision in a trial. Very often these sequences are of a causal nature, but not always. The arrow represents a

relation that can be used to put a story into an order that represents a comprehensible sequence of events or actions. In recent work, Bex, Bench-Capon and Verheij (2011, footnote 4) develop the notion of an explanatory link. A link $A \rightarrow B$ denotes that *A* explains *B*. The explanation may be causal, motivational, teleological, or represent other kinds of explanations.

There are two approaches to story coherence. One is an atomistic approach that concentrates on the links and events making up the story rather than considering the story as a whole (Bex, Bench-Capon and Verheij, 2011, 26). To give an example of how the holistic approach works they consider the story of the man who enters a restaurant, orders a hamburger, gets his hamburger from the waiter and proceeds to eat it. When it comes time to pay, he removes his pants and offers the waiter his pants. This is an incoherent story, because being asked to pay does not explain removing pants, because it is not a proper cause/motivation. In another approach, called the holistic or global approach, story coherence is achieved by relating the particulars of this story to a cluster of generalized events that form an abstract sequence representing how things generally or normally happen in a way that is familiar to us. On this holistic model the coherence of a story is evaluated by seeing whether it fits a plausible story scheme. If the story fits such a scheme it is more coherent. However the story can also be shown to be plausible once additional evidence is provided. For example suppose additional evidence is added to the story in the form of the event that the waiter spilled hot soup on the man's legs. Then the story would be coherent.

Such sequences are reminiscent of the four kinds of action relations identified in the literature on action theory. For example, (Goldman, 1970) identified four kinds of action relations. These can be briefly explained by examples. Causal generation is the relation between my flipping a switch and my turning a light on. In conventional generation my action of extending my arm out of a car window can conventionally generate my action of signaling a turn. In simple generation my dangling a line in the water generates my fishing. Augmentation generation is the relation between my saying hello and my saying hello loudly. These relations, which may be of varying kinds, allow analysts to put a sequence of action descriptions into an ordering that has explanatory power. Consider this example of an action sequence: he tensed his forefinger, he pulled the trigger, he fired the gun, he fired a bullet, he shot a bullet at a man, he shot a man, he killed a man, he committed murder. Each step in this sequence of action descriptions describes something that may be said to be the same action, representing the same action in different ways.

For example it might be objected that the last arrow in figure 3 has to capture a relation indicating something more than mere temporal sequence for this scheme to capture the force of the alleged analogy. The fourth event merely happening after the first three does not capture the analogy since the fear appears to be that in the two cases in question, the fourth event is rendered highly likely by the preceding events, and that is crucial to capturing the purported analogy. This observation shows us that an event can be placed in an episode sequence because it is a consequence, or likely outcome, of the previous events in the sequence. The stories can describe not only actions, but also the consequences of actions, motives for actions, and other connections that are not always strictly speaking causal. This variability in the kinds of relations that make up these sequences in stories is not a problem, however. How we build up stories, and find story schemes in them, is by using our knowledge of how the whole sequence fits together as a common scheme that we are familiar with because it relates to our common experiences of doing things, reasoning about how to do things, and drawing conclusions about motives, consequences for actions, and so forth. Once we do this, we find structures underlying diverse examples of stories that fit these stories. Once we begin to realize by confronting similar arguments in cases

over and over again, as one might do as a criminal lawyer who continually has to deal with the same kinds of arguments, one might ascend to a higher level of abstraction as an analyst and begin to identify common patterns in them. Just as we have now begun to identify argumentation schemes that represent common types of arguments repeated over and over again, like practical reasoning and argument from analogy, we can also begin to identify story schemes. What the arrow represents is what happens next in sequence of actions or events of kinds we become familiar with. The arrow represents a relation that enables analysts to build a tree made of nodes and arrows in order to represent a pattern or structure that reveals how one scenario used in analogy is similar to another.

(Bex, Bench-Capon and Verheij, 2011, 27-30) have shown how story schemes relate to argument from analogy, and also argument from precedent, an argumentation scheme that is based on the scheme for argument from analogy, by linking story schemes to the case-based reasoning system called CATO (Ashley, 1988). This system uses precedents to support an argument and distinguishes between precedents to attack an argument from precedent. They use the example of a legal case where Tony killed Gordon in a knife fight openly in a Glasgow street (Bex, Bench-Capon and Verheij, 2011, 27). Legally, it is important to get a story establishing Tony's motive, and one way to do this is to compare this story to another comparable story that might be familiar. The example is expressed in the form of a dialogue between Wilma and Bert. Wilma compares the story of Tony and Gordon to the story of Bernardo of the Sharks gang who stabs and kills Riff of the Jets gang in West Side Story. There is a match between elements of the schemes of the two stories because just as Bernardo and Riff are from the same area, Tony and Gordon were from the same area. The matching of the elements of the two stories can be used as an argument from analogy to support the conclusion that the motive was a gang feud. As a counterargument, Bert argues that Tony and Gordon are both middle-class youths, whereas the Jets and the Sharks are lower class immigrant gangs. This is the kind of move made in CATO called a distinguishing move that attacks the prior argument from analogy by claiming a difference between two cases (Aleven, 1997). If the second story is a distinguishing move it attacks the argument of the first story by making it less coherent. In the story scheme theory, there is a failure to match between one element of the two stories (class background). These pro and contra moves in this sequence of precedent and distinguishing moves of argumentation are developed into a lengthy dialogue by (Bex, Bench-Capon and Verheij, 2011, 29-31). This sequence shows the similarities when a match between two stories strengthens the argument from precedent, whereas failures to match represent differences distinguish between the two story schemes.

What has to be emphasized here is that story schemes are based on an understanding function that enables one party to explain something to another party on the basis of common knowledge they share. Explanations are different from arguments, even though, as case-based reasoning technologies like CATO show, they are commonly intertwined with them. The notion of the story scheme is fundamental to a theory of explanation built on the notion of understanding. It is the story scheme that holds an explanation together as underlying structure that enables it to transfer understanding from the explainer to the questioner.

9. Conclusions

What this paper has shown is that the three examples of argument from analogy in everyday conversational argumentation cited in the paper can be analyzed using the basic scheme for

argument from analogy along with the story-based theory of similarity that was applied to legal arguments from analogy in (Walton, 2010). Also, it has extended the findings of (Walton, 2010) by building a more systematic method for reconstructing, analyzing and evaluating instances of the basic scheme for argument from analogy by applying stories and story schemes. This finding is significant for argumentation theory generally, and for building practical methods useful for informal logic that can be applied to arguments from analogy in everyday conversational texts of discourse, for example in political argumentation and media reporting of political and other kinds of argumentation.

Perhaps the most important and most generally useful finding of the paper is that, as illustrated by the examples of argument from analogy analyzed above, there is a model of the notion of similarity that can be applied to the reconstruction, analysis and evaluation of such examples. This finding shows how the basic scheme can be useful, and how the similarity premise can be supported or refuted by a kind of evidence that has an identifiable structure, and that can be collected and assessed so that it can be used in conjunction with other argumentation tools.

Story schemes allow us to answer the critical questions for the analogy scheme in more detail than any other evaluation has so far done. What would the author of a logic textbook, or any argument critic say for that matter if asked why any two cases in question are similar, and asked to give a reason for this similarity? Let's take the violinist examples as a case in point. Presumably such a critic would say that both stories are both about people who have unwanted bodies attached to them. The analysis in this paper has shown how to go beyond that point by giving evidence on which this claim can be based. In this instance the similarity is evidenced by the story scheme that matches both stories. Would other theorists have a satisfactory answer, one that goes into this much analytical detail?

The examples analyzed in this paper are useful to show how argumentation structures can be combined with story scheme structures. They show how arguments from analogy can be supported by story scheme structures. The theory presented in the paper can easily represent more complex cases in which a story scheme structure can be supported by pro arguments or undercut by con arguments. For example, a con argument could be put forward alleging that the target case is dissimilar to the source case in some respect. Or to cite another kind of con argument, an argument from counter-analogy could be put forward to attack the original argument from analogy. Such cases can be analyzed by already existing story schemes along with existing methods of argumentation, including argumentation schemes and argument diagramming.

How the full argumentation methodology works in the fire example is shown in the argument diagram in figure 10. In this figure, the pro argument is shown by the plus sign in the node containing the argumentation scheme, and each of the two con arguments has a minus sign in its node. Argumentation is essentially a method of analyzing and evaluating the arguments both for and against a claim to see which side has the stronger argument to support or attack the ultimate conclusion at issue. This is illustrated in the argumentation represented in figure 10, where we have argumentation pro and con. To evaluate this example in the Carneades system (Gordon, 2010), the pro argumentation would be weighed against the con argumentation. Arguments from analogy can be evaluated in different ways. Carneades offers one way, but the problem of how to evaluate arguments from analogy using argumentation technology has to be beyond the scope of this paper. It is another project to be carried out once the hybrid method of combining

argumentation with story schemes has been refined and tested by using it to analyze more examples of argument from analogy.

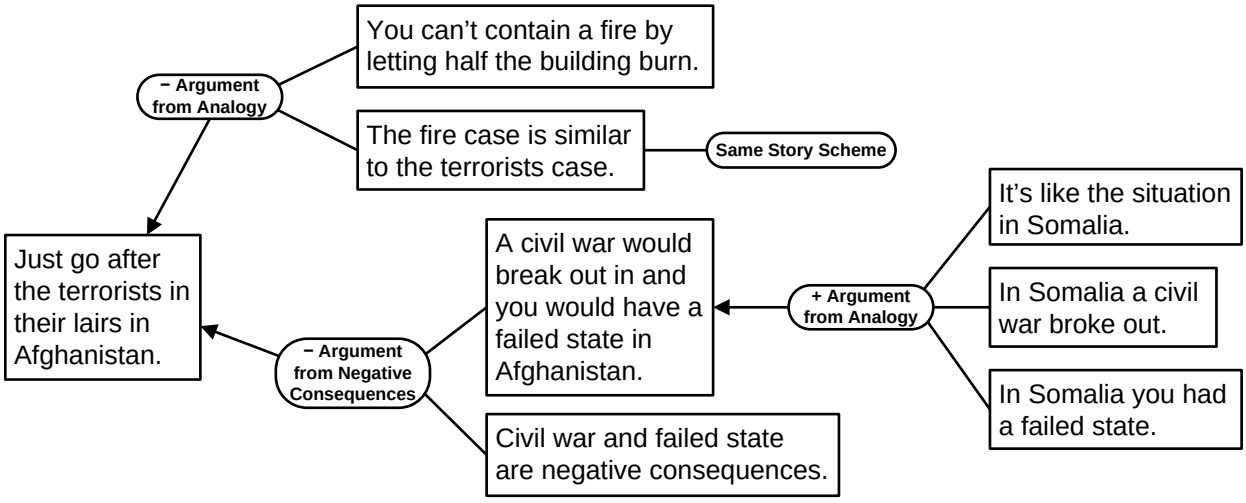

Figure 10: Combined Arguments in the Fire Example

As figure 10 shows by example, the hybrid theory is integrated into a method in which story schemes, arguments of various kinds, including arguments from analogy, argumentation schemes and argument diagramming structures, all fit together into a unified theory.

All of the examples in this paper are instances of using argument from analogy to respond to a proposal made in deliberation, where the argument is used to attack the proposal. This observation is interesting and may suggest that the use of argument from analogy to respond to a proposal made in deliberation is a special category. However, at present, there is no reason to think that the method built in this paper is not applicable to many or all arguments from analogy, including ones used to support or attack a claim in a persuasion dialogue. Argument from analogy can be used in more complex ways when embedded within a larger argumentation structure in which it is contained. The analysis of the Pinker example began to show some of this kind of complexity. More work needs to be done to show whether more complex forms of argument from analogy, like relational use of argument from analogy, can be modeled using the story schemes approach. Relational uses of argument from analogy have a similarity premise of the form '*x* is more similar to *y* than to *z*'. For example, in classifying species in biology, if one kind of bird *x* is more similar to another kind of bird *y* than to a third kind bird *z*, this closer similarity can be evidence for classifying *x* and *y* together in the same species as opposed to classifying *x* and *z* together in the same species. Since this is a kind of pro-contra argumentation used to support classifications, it look like it can be analyzed using the argumentation scheme for argument for verbal classification (Walton, Reed and Macagno, 2008, 319). Carneades has this argumentation scheme, as well as the schemes for argument from analogy and argument from negative consequences, and could apply them to this example.

So far the method based on the hybrid approach to similarity has only been applied to the four examples studied in this paper, and some more complex examples of legal argumentation studied in (Walton, 2010). So it is still a matter of conjecture whether it applies to all instances of argument from analogy, or only to some of them. Future research is needed to explore this conjecture by trying to apply it to more examples of argument from analogy, both in everyday

conversational argumentation and in special contexts like legal argumentation and scientific argumentation.

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. (2006). Case-Based Reasoning. *Information Technology and Lawyers*, ed. A. R. Lodder and A. Oskamp. Berlin: Springer, 2006, 23-60.
Bex, F. (2009). 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. (2011) *Arguments, Stories and Criminal Evidence: A Formal Hybrid Theory*. Dordrecht: Springer.
Bex, F., Bench-Capon, T. and Atkinson, K.(2009). Did He Jump or Was He Pushed? Abductive Practical Reasoning, *Artificial Intelligence and Law*, 17, 79-99.
Bex, F. and Prakken, H. (2010). Investigating Stories in a Formal Dialogue Game. In P. Besnard, S. Doutre and A. Hunter (eds.), *Computational Models of Argument: Proceedings of COMMA 2008*. Amsterdam etc, IOS Press, 73-84.
Bex, F.J., Bench-Capon, T.J.M., & Verheij, B. (2011). What Makes a Story Plausible? The Need for Precedents. *Legal Knowledge and Information Systems. JURIX 2011: The Twenty-Fourth Annual Conference* (ed. K.M. Atkinson), 23-32. Amsterdam: IOS Press.
Bex, F. and Verheij, B. (2012), Solving a Murder Case by Asking Critical Questions: An Approach to Fact-Finding in Terms of Argumentation and Story Schemes, *Argumentation*, to appear (doi: 10.1007/s10503-011-9257-0).
Brewer, S. (1996). Exemplary Reasoning: Semantics, Pragmatics and the Rational Force of Legal Argument by Analogy, *Harvard Law Review*, 923-1038.
Goldman, A. (1970). *A Theory of Human Action*. Princeton: Princeton University Press.
Gordon, T. F. (2010). The Carneades Argumentation Support System, *Dialectics, Dialogue and Argumentation*, ed. C. Reed and C. W. Tindale, London: College Publications.
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.
Leake, D. B. (1992). *Evaluating Explanations: A Content Theory*. Hillsdale, New Jersey: Erlbaum.
Pennington, N. and Hastie, R. (1992). Explaining the Evidence: Tests of the Story Model for Juror Decision-making. *Journal of Personality and Social Psychology*, 62(2), 189-206.
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.
Schank, R. C. and Abelson, R. P. (1977). *Scripts, Plans, Goals and Understanding*. Hillsdale, New Jersey: Erlbaum.
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. (2010). Similarity, Precedent and Argument from Analogy, *Artificial Intelligence and Law*, 18 (3), 217-246.
Walton, D. (2011). Telological Argumentation to and from Motives, *Law, Probability and Risk*, 10, 203-223.
Walton, D., Reed, C. and Macagno, F. (2008). *Argumentation Schemes*. Cambridge: Cambridge University Press.

Acknowledgements

The work in this paper was supported by a research grant from the Social Sciences and Humanities Research Council of Canada. I would also like to thank Floris Bex and Marcello Guarini for helpful comments and suggestions.