

Argument Schemes for Legal Case-based Reasoning

Adam WYNER^{a,1} and Trevor BENCH-CAPON^a

^a*Department of Computer Science, University of Liverpool, Liverpool, UK.*

Abstract.

In this paper we use the notion of argument schemes to analyse some leading approaches to case-based reasoning in Law. We identify a set of argument schemes that can express the argument provided by such systems and draw attention to some important differences between the various approaches.

Keywords.

Argumentation, Legal reasoning, Case-based reasoning, Precedent

Introduction

The most influential line of work to emerge in AI and Law concerns reasoning with legal cases, the key developments beginning with HYPO [1], followed by CATO [2], and more recently IBP [3]. This work has also been used as the model of case-based reasoning in work such as [4] and [5], and approaches to reasoning with cases as theory construction in [6] and [7].

In this paper we will present a reconstruction of Legal Case-Based Reasoning (LCBR) in AI and Law in terms of *Argument Schemes* (AS) designed to enable argument for or against a plaintiff winning an undecided current case on the basis of decided precedents. Our main point of reference for LCBR will be the CATO system, but we consider other approaches to LCBR, identifying key differences and relationships. We use a set of cases, factors, and comparisons between cases to instantiate the argument schemes from which we justify an outcome for the current case. Our analysis not only provides insights into LCBR, giving a very clear picture of what is happening in different approaches as well as comparisons between them, but more importantly integrates LCBR into Argumentation theories such as [8].

1. CATO

CATO [2], which was developed to teach law students how to reason with cases, represents a legal domain using a number of special entities. There are *cases*, which have a

¹Corresponding Author: Department of Computer Science, University of Liverpool, L69 3BX, UK. Tel.: +44 (0)151 795 4294; Fax: +44 (0)151 795 4235; E-mail: azwyner@csc.liv.ac.uk. During the writing of this paper, the first author was supported by the Estrella Project (The European project for Standardized Transparent Representations in order to Extend Legal Accessibility (Estrella, IST-2004-027655)).

plaintiff (P), a *defendant* (D), a set of *factors* present in the case, and an outcome for P or D. The factors are the features of the case which are relevant to the decision, which are either present in a case or not. Factors have a name and provide a reason to decide the case in favour of either the P or D. They are organized in a factor hierarchy, where the children of an *abstract factor* provide reasons for or against the parent appearing in a given case.

In this paper we construct arguments for P, though *mutatis mutandis*, we could construct arguments for D in a similar fashion. We need to compare cases. While CATO compares cases in terms of a lattice, we are concerned with the arguments that can be constructed on the basis of a precedent, rather than the evaluation of these arguments. We will, therefore, base our comparison method on the technique described in [5].

Given a current case (CC) and a previously decided case (PC), we compare them on the basis of their factors. As there may be several PCs that are used in reasoning to the outcome of a particular CC, we subscript them as in PC_i. Typically some factors will be common to both cases, others will be present only in one of the cases, and there will be factors present in neither case. It is also important whether the factors favour P (P factors) or D (D factors). When comparing two cases, we can therefore partition the factors into seven partitions as follows:

- **P1:** P factors in both CC and PC_i.
- **P2:** D factors in both CC and PC_i.
- **P3:** P factors in CC not in PC_i.
- **P4:** D factors in PC_i not in CC.
- **P5:** D factors in CC not in PC_i.
- **P6:** P factors in PC_i not in CC.
- **P7:** Factors not in either CC or PC_i.

P1 and P2 represent what is similar in the cases. For the PC_i to serve as a precedent for CC there must be at least one factor in at least one of these partitions. P3 and P4 represent aspects in which CC is stronger for P than PC_i. P5 and P6 represent aspects in which CC is weaker for P than PC_i. P7 contains the factors which are not relevant in the comparison.

1.1. Example

We use the following running example with the factors and the factor hierarchy of CATO. Table 1 lists the factors we will use, the side they favour, and their parents. Table 2 presents hypothetical cases, which are variations on *Mason v. Jack Daniels*. The cases are compared and factors partitioned in Table 3. With this, we can now proceed to consider the argument schemes that can be instantiated to argue for P with respect to the case comparisons.

2. Argument Schemes

Our notion of an argument scheme broadly follows Walton [9], where an argument scheme is a stereotypical pattern of reasoning, with a *claim* and a number of *premises*, the form of which are constitutive of the scheme. For our purposes, we distinguish three types of premise from which one draws a claim as a conclusion. *Assumptions* are ac-

Table 1. Subset of Factors used in CATO

| Factor Id | Factor Name | Side | Parent |
|-----------|----------------------------------------|------|-----------------------------|
| F1 | Disclosure in Negotiations | D | Efforts to Maintain Secrecy |
| F2 | Bribed Employee | P | Questionable Means |
| F10 | Secrets Disclosed to Outsiders | D | Info Known and Available |
| F12 | Outsider Disclosures <i>Restricted</i> | P | Info Known and Available |
| F15 | Unique Product | P | Valuable Product |
| F25 | Information Reverse Engineered | D | Questionable Means |
| F26 | Used Deception | P | Questionable Means |
| F27 | Disclosure in Public Forum | D | Info Known and Available |

Table 2. Summary of Cases in Example

| Case Name | P Factors | D Factors |
|-----------|-----------|-----------|
| Vanilla | F15 | F1 |
| Bribe | F2, F15 | F1 |
| Deceit | F15, F26 | F1 |
| Disclose | F15 | F1, F10 |
| Restrict | F12, F15 | F1, F10 |
| Bribe2 | F2, F15 | F1, F25 |
| Reverse | F15 | F1, F25 |
| Announce | F15 | F1, F27 |

Table 3. Selected Case Comparisons

| CC/PCi | P1 | P2 | P3 | P4 | P5 | P6 |
|-------------------|-----|----|-----|-----|-----|----|
| Bribe/Vanilla | F15 | F1 | F2 | - | - | - |
| Vanilla/Reverse | F15 | F1 | - | F25 | - | - |
| Disclose/Vanilla | F15 | F1 | - | - | F10 | - |
| Vanilla/Bribe | F15 | F1 | - | - | - | F2 |
| Deceit/Bribe | F15 | F1 | F26 | - | - | F2 |
| Vanilla/Bribe2 | F15 | F1 | - | F25 | - | F2 |
| Restrict/Vanilla | F15 | F1 | F12 | - | F10 | - |
| Announce/Disclose | F15 | F1 | - | F27 | F10 | - |

cepted as true and serve to *scope* the arguments; that is, assumptions cannot be questioned within the system under consideration. *Ordinary premises* must be shown to be true to presumptively establish the claim. If an ordinary premise of an argument is shown to be unjustified, the argument is not well-formed. *Exceptions*, if true, mean that the presumptive claim fails.

While this argument structure is related to [8], our proposal is a simplification in order to focus on what argument schemes are needed and how they can be used for LCBR. In particular, we do not address issues in [8] relating to *contexts*, *critical questions*, *burden of proof*, or *proof standards*.

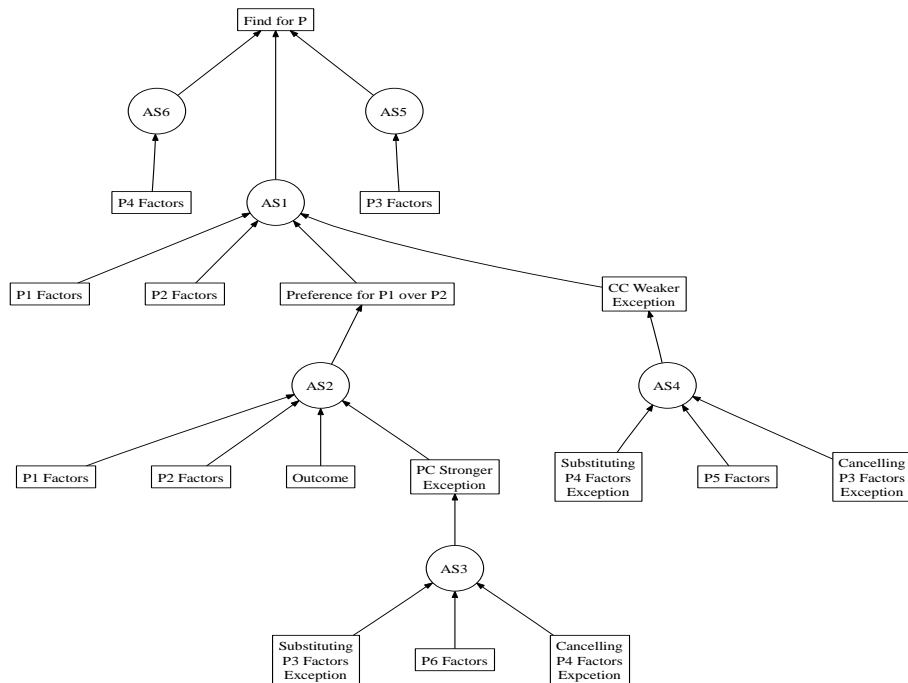


Figure 1. Argument Graph for Legal Case Based Reasoning

2.1. Basic Argument Schemes

We present our reconstruction as a cascade of argument schemes, as presented in Figure 1. We will proceed depth-first, from **AS1** to **AS6**. Figure 1 shows the premises, exceptions, and claims of each argument scheme: the claim is established if the premises are true and the exceptions are false. Premises and exceptions referring to partitions can be seen to be true by inspection of the case comparison, while others must be justified by argument. All leaf nodes are, therefore, justifiable by inspection.

In **AS1**, we introduce the CC in which it is presumed that in virtue of a preference of *some* of P factors over *some* of D factors in a PC_i, the case is decided in favour of P.

AS1: Main Scheme

- **P Factors Premise:** P1 are reasons for P.
- **D Factors Premise:** P2 are reasons for D.
- **Factors Preference Premise:** P1 was preferred to P2 in PC_i.
- **CC Weaker Exception:** The priority in PC_i does not decide CC.
- **Claim:** Decide CC for P.

We can instantiate this scheme with *Bribe*, having compared it with *Vanilla*. We argue: *That the product was unique is a reason to find for P (F15), and the disclosure in negotiations is a reason to find for D (F1). However, following Vanilla, we give priority to the uniqueness of the product over the disclosure in negotiations. Therefore, we find for P in Bribe.*

We need an argument to justify the **Factors Preference Premise**, and we do so with an instantiation of the argument scheme **AS2**, which claims that the preference holds based on a precedent using the same selection of factors. **AS1** also has an exception: the claim holds presumptively so long as the premises hold and **CC Weaker Exception** does *not* hold, which are D factors in the CC that are not in the PCi. This is justified by **AS4**, which we return to after having considered **AS2** and its components.

In **AS2**, we have the following:

AS2: Preference-From-Precedent Scheme

- **P Factors Premise:** P1 are reasons for P.
- **D Factors Premise:** P2 are reasons for D.
- **Outcome Premise:** PCi was decided for P.
- **PCi Stronger Exception:** PCi cannot be used for P in CC.
- **Claim:** P1 was preferred to P2 in PCi.

We can instantiate this scheme following an instantiation of **AS1** with *Bribe* as CC and *Vanilla* as PCi: *In Vanilla there was a unique product (F15) and disclosure in negotiations (F1), and Vanilla was found for P. Vanilla is a precedent for Bribe given P1 and P2. So P factors are preferred to D factors.*

The preference in **AS2** only holds presumptively where the **PCi Stronger Exception** does not hold. Thus, one way to attack the presumptive conclusion is to justify this exception, which we do with **AS3**.

P6 factors are one way to *distinguish* the precedent from the CC, for they are P factors in PCi but not in CC. Thus, the preference claimed in **AS2** may have relied on factors *present* in PCi but *absent* in CC. Given this, we cannot be sure that the factors which the two cases share are sufficient to conclude that the preference of P1 over P2 holds. In this sense, factors in P6 can be understood as exceptions to **AS3**. We suppose variables over factors F_x, F_y, F_z .

AS3: Precedent-Stronger Scheme

- **P6 Factors Premise:** $F_x \in P6$
- **Substituting P3 Factors Exception:** $F_y \in P3$ with the same parent as F_x .
- **Cancelling P4 Factors Exception:** $F_z \in P4$ with the same parent as F_x .
- **Claim:** PCi cannot be used for P in CC.

Consider *Vanilla* as the CC and *Bribe* as the PCi. *Bribe* reveals two P factors associated with the decision; we do not know *a priori* which of these factors to associate with the preference that underwrites the decision – F2, F15, or F2 together with F15. Yet, *Vanilla* does not have F2 in it. We can *distinguish* PCi from CC. Thus, if any set used to determine the preference in *Bribe* contains F2, then we cannot use the preference from PCi in CC for it may have been that F2 is a relevant factor in determining the preference in *Bribe*, but this does not appear in *Vanilla*. We argue: *Bribe may be distinguished from Vanilla, since in Bribe D bribed an employee, which is not the case in Vanilla. Therefore, the preference in Bribe cannot be used in Vanilla.*

However, we can undermine the presumptive claim in **AS3** by justifying the exceptions. We do so by comparing factors in F6 against factors in F3 or F4, for in CATO the effect of P6 factors may be neutralised by using factors in P3 and P4 to *downplay* the distinction. In order to make this move there must be factors in P3 or P4 with the same

parent as the factor in P6. In addition, we assume the following: suppose a parent factor F favours P; if there is a child factor F_x of F in the case which favours P, then F is a factor in that case as well; if there is a child factor F_y of F in the case which favours D, then F is *not* a factor in the case. Therefore, a P3 factor with the same parent strengthens CC *in exactly the same way* as the P6 factor strengthens PCi, so that the preference for P in PCi should also hold in CC. This is the **Substituting P3 Factors Exception**. Similarly the P4 factor will weaken PCi in precisely the same respect as the P6 factor strengthens it, so these factors can be seen to cancel one another out, again vindicating the preference in **AS3**. This is the **Cancelling P4 Factors Exception**. Where either is demonstrated, the presumptive claim in A3 does not hold.

For example, take *Deceit* as our CC, and *Bribe* as PCi. *Deceit* contains factor F26 in P3 with the same parent as factor F2 in P6 contained in *Bribe*, namely *questionable means*. F2 strengthens *Bribe* for P in exactly the same way as F26 strengthens *Deceit* for P, and so we can say that there is no distinction between the two cases. Thus, we have an exception to **AS3**.

Next consider *Vanilla* as the CC and *Bribe2* as PCi. Now we can argue that it is no longer clear that questionable means does in fact apply to *Bribe2*, since we have factors both for and against this abstract factor; D did not necessarily use questionable means in PCi. If F25 in P4 can be considered to cancel F2 in P6, assuming these have an equal strength, we can see *Bribe2* as establishing a preference ordering of F15 over F1. The rationale is that F25 is a factor in PCi in favour of D and F2 is a factor in PCi against P, yet P won in PCi, suggesting that these factors *balance* one another in PCi. Therefore, if these factors are absent from CC, *ceteris paribus*, the difference between the cases ought not to make a difference in the outcomes. This gives us another exception to **AS3**.

At this point, we can turn attention to **AS4**.

AS4: Current-Case-Weaker Scheme

- **P5 Factors Premise:** $F_x \in P5$.
- **Substituting P4 Factors Exception:** $F_y \in P4$ with the same parent as F_x .
- **Cancelling P3 Factors Exception:** $F_z \in P3$ with the same parent as F_x .
- **Claim:** The priority in PCi does not decide CC.

With **AS4**, we consider situations where P5 contains a factor, which is a D factor in CC which is not in PCi, for example where *Disclose* is the CC and *Vanilla* is the precedent. This situation means that the CC is weaker for P than PCi, and so enables a distinction between the cases to be made. The nature of the distinction is, however, different from the distinction above for **AS3**. The presence of a factor in P5 does not bear on the decision or preference revealed by *Vanilla*, where the additional factor does not appear. However, it does weaken the presumptive claim in **AS1**, since the additional D factor must be considered in CC. Thus, a factor in P5 is represented as an exception to **AS1**.

As with **AS3**, we have two exceptions to this argument which undermine the presumptive claim in **AS4**, and so are counterexceptions. A distinction can be downplayed if there is a factor in P3 or P4 with the same parent as the factor in P5 following reasoning similar to above. Consider a **Cancelling P3 Factor Exception** in **AS4**, where *Restrict* is CC and *Vanilla* is PCi. In *Restrict*, we have one factor for D and another for P, neither of which are in *Vanilla*, so the factors cancel one another in CC; thus, the presumptive claim in **AS4** does not hold. By the same token, consider a **Substituting P4 Factor Exception**,

where *Announce* is CC and *Disclose* is PCi. In *Announce* we have a D factor F27 not in CC (P4), while in *Disclose* we have a D factor F10 not in PCi (P5); furthermore, these factors have the same parent *Info Known and Available*; and we assume that the factors have equal weight. As the PCi is decided for P, despite the presence of a D factor, then *ceteris paribus*, CC can be decided similarly, despite the presence of D factor with the same parent as F27.

Note that our analysis here shows important differences between distinctions made on the basis of an additional P-factor in the precedent from an additional D-factor in the CC, one questioning the priority and the other questioning its applicability to the current case. No difference is considered in CATO, but we can now explain the difference first observed in [10].

Finally, we have two argument schemes which effectively strengthen the claim for P in the CC. Given a claim in **AS1**, an instantiation of **AS5** introduces more factors in the CC favour of P than in the PCi, thus strengthening the case. By the same token, an instantiation of **AS6** draws attention to the fact that there are more D factors in the PCi than there are in the CC.

AS5: Current-Case-Stronger Scheme ²

- **CC P Factors Richer:** P3 are reasons for P.
- **Claim:** Decide CC for P.

With *Bribe* as CC and *Vanilla* as PCi, *Bribe* contains an additional factor favouring P. We argue: *In Bribe, D bribed an employee (F2), which was not the case in Vanilla*. Similarly, we can strengthen the claim in favour of P in CC where the PCi has an additional factor in favour of D which is absent from CC.

AS6: Precedent-Case-Weaker Scheme

- **PCi D Factors Richer:** P4 are reasons for P.
- **Claim:** Decide CC for P.

The case comparison justifies the premise. For example, where *Vanilla* is the CC and *Reverse* is the PCi, we argue: *In Reverse, D reverse engineered the product, which is not the case in Vanilla*.

3. Assumptions

In the course of the presentation of the argument schemes, we have presented ordinary premises, exceptions, and claims. However, we also made assumptions along the way. We make these more explicit here. They represent what cannot be challenged within the system.

1. **Applicability Assumption (AS2):** PCi is a potentially applicable precedent for CC. The factors are partitioned as above.
2. **Equal Strength of Factors Assumption (The exceptions to AS3 and AS4):** All factors have equal impact on a case.

²AS5 and AS6 do not contain exceptions based on P5 and P6 factors, since these will have been accounted for as exceptions to AS1 and AS2.

We introduce **Applicability** since there might be a number of reasons why PCi is not a suitable precedent for CC even if they have factors in common: there may be differences in the jurisdiction, or the court level, or PC may have been explicitly overruled in a subsequent decision, for example. None of the existing LCBR systems have considered these possibilities. Instead, every case in the entire collection of cases is assumed to be usable as a precedent. Different systems differ as to what is meant by *usable*: CATO uses the precedents only to construct arguments for the consideration of users who may choose whether to accept or reject them, while other systems such as IBP [3] may rely on the principle of *stare decisis* to apply the precedents to decide CC. The conditions under which precedents apply, and the degree to which they are binding, are topics well worth investigating, but here we simply record the existence of the **Applicability** assumption. The **Equal Strength of Factors** assumption has played a role since we regard children of the same parents as interchangeable in the exceptions to **AS3** and **AS4**.

4. Alternative Treatments of Downplaying

In this section, we consider an alternative way to treat downplaying in **AS3** and **AS4**, starting with **AS3**, where we downplay a P6 factor with a P4 factor. While CATO does not work this way, it may be closer to what we want in the way of argumentation. Consider again *Deceit* and *Bribe*. It could be argued that the revealed preference is not that unique product is preferred to disclosure in negotiations, but that unique product *and* questionable means *together* are preferred to disclosure in negotiations. To adopt this view we would need to process the partitions further before beginning to construct the arguments: if we have a factor in P6 and a factor in P3 with the same abstract factor as parent, we can remove them and instead put the parent in P1. Now the argument from *Deceit* and *Bribe* becomes: *In Bribe there was a unique product, questionable means were used, and there was disclosure in negotiations. Bribe was found for P.*

This change in the priority must also be reflected in **AS1**. Now that P1 includes the abstract factor, **AS3** becomes: *That the product was unique and that D used questionable means are reasons to find for P, and while the disclosure in negotiations suggests finding for D, we should give priority to the uniqueness of the product and the questionable means over the disclosure in negotiations. Therefore, on the basis of Bribe, we should find for P in Deceit.*

If we adopt this latter approach, we have the advantage of stating the strongest case possible for P in the original argument, and remove the source of distinction from the opponent. In other words we pre-empt the distinction in situations where it would be possible to downplay it. This means that we can remove the *substitution exception* in **AS3**. Note that this strategy is not appropriate to situations in which the P6 factor is countered with a P4 factor: the argument there is that the abstract factor does not apply as it has a factor which promotes it that is cancelled by a factor which demotes it. We could, however, remove factors with common parents from both P4 and P6, effectively applying the cancellation before considering the arguments. While this is a possible approach, and would have the advantage of simplifying **AS3** by eliminating both exceptions, we prefer that the factors continue to appear in the presented argument. Thus we retain the **Cancelling P4 Factors Exception** in **AS3**.

Similarly in **AS4**, we can, if we choose, treat an abstract factor that could be used in the substitution exception as part of the reasons for D. This would involve processing the

case comparison to remove factors in P5 with a parent which also applies to factors in P4 from P4 and P5 and putting the parent in P2. Again this would have the advantage of including the abstract factor in the main argument and the priority, as well as removing one source of exception to AS1. Equally factors in P3 and P5 with common parents could be removed from these partitions, obviating the **Cancelling P3 Factors Exception**, but at the cost of suppressing these factors from the argument presented.

5. Counterexamples

Hitherto we have considered only attacks on the argument which derive from a distinction between the CC and the precedent. CATO also allows arguments based on citing a case to be attacked by counterexamples. There are two possibilities for a counterexample. It may be that in contrast to PC_i, we have a precedent PC_k which was decided for D rather than P and yet has the same factors in P1 and P2. Such a case would reveal a different preference with respect to P1 and P2, and so would be an argument against the claim that P1 is preferred to P2. Such counterexample precedents would thus appear as arguments con the preference claim in AS2. An alternative is that we have a precedent PC_j which has P1 and P2 non-empty, but for which P1 and/or P2 contain different factors from those identified by PC_i. This would represent an argument not against the preference but against the overall claim, based on a different priority premise. Such a counterexample would thus appear as an argument con the claim of AS1. The counterexamples will have the same structure as the original argument described above, and so will be open to the same kind of distinguishing and counterexample moves as the original argument.

6. Discussion

It has been useful to distinguish between assumptions, ordinary premises, and exceptions where assumptions scope the system, ordinary premises constitute the default rule, and the exceptions allow exploration of more refined argumentation.

We can compare our schemes with CATO, where the eight argument moves in the CATO system correspond to elements of the argument schemes described above. These are shown in Table 4.

There are several points to note. Distinctions made on the basis of an additional P-factor in the precedent are different from ones made on the basis of an additional D-factor in the current case. Downplaying a distinction appears in several places, depending on the nature of the distinction and of the downplaying, which can be either substitution, a cancelling factor, or a more abstract reason. Emphasising a distinction does not appear explicitly as an argument scheme since a distinguishing factor in P6 or P5 which could be emphasised will always ground a successful exception. Counterexamples also appear in two places in the structure: we do not, however, consider on-pointedness, except in so far as it is reflected in the partitioning of the factors in the case comparison, since this belongs to argument evaluation rather than argument construction.

As well as expressing CATO in terms of Argument Schemes, the structure we have developed allows some comparison with other work in LCBR. For example we can look

Table 4. Comparing CATO Argument Moves and Argument Schemes

| CATO Argument Move | Argument Scheme |
|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Analogising CC with a PC with a favourable outcome | AS2 |
| Distinguishing a case with an unfavourable outcome | AS3, AS4 |
| Downplaying a distinction | Substitution and Cancelling Exceptions in AS3 and AS4 . Inclusion of abstract factors in factor premises AS1 and AS2 . |
| Emphasising a distinction | Where AS3 and AS4 have no exceptions |
| Citing a favourable case to emphasise strengths | AS5, AS6 |
| Citing a favourable case to argue that weaknesses are not fatal | Counterexample to counterexample |
| Citing a more on-point counterexample | AS2 con Preference Claim. AS1 con main claim. |
| Citing as an on-point counterexample | AS2 con Preference Claim. AS1 con main claim. |

at the use of assumptions **Applicability** and **Equal Strength**, which represent issues which cannot be debated within a given system. As far as we are aware, no existing work has addressed the problem relating to the applicability of precedents, which might be an interesting line for future research. The **Equal Strength** assumption is disregarded in some cases. IBP [3] has the notion of a *knockout (KO) factor*, a factor which is taken as decisive and so cannot be downplayed. In IBP, therefore, the assumption would become an Equal Strength *exception*, which is established if the P6 factor is a KO factor. This would apply to both the substitution exception and the cancelling factor exception. Similarly, this assumption cannot be made in HYPO since factors represent different points on dimensions which would require more complex argument schemes to take them into account. Chorley [7] reports several experiments in which factors are given different weights; for future investigation along these lines, it would be interesting to provide these additional schemes. We can contrast our **AS3** and **AS4** with Hage [11], where he accepts only *a fortiori* arguments as valid instances of them, essentially assuming that P5 and P6 are empty. This is a safe way to reason, but most previous systems, including CATO, have provided ways of debating whether the argument can survive the presence of such weakening factors. Finally, HYPO requires a number of further argument schemes since it enables argument about which factors apply to a case.

References

- [1] Ashley, K.: Modeling Legal Argument: Reasoning with Cases and Hypotheticals. Bradford Books/MIT Press, Cambridge, MA (1990)
- [2] Alevan, V.: Teaching case-based argumentation through a model and examples. PhD thesis, University of Pittsburgh (1997)
- [3] Brüninghaus, S., Ashley, K.D.: Generating legal arguments and predictions from case texts. In: ICAIL 2005, New York, NY, USA, ACM Press (2005) 65–74
- [4] Prakken, H., Sartor, G.: A dialectical model of assessing conflicting arguments in legal reasoning. Artificial Intelligence and Law 4(3-4) (1996) 331–368
- [5] Bench-Capon, T.: Arguing with cases. In Oskamp, A., et al., eds.: JURIX 1997, Nijmegen, Gerard Noodt Instituut (1997) 85–100
- [6] Bench-Capon, T., Sartor, G.: A model of legal reasoning with cases incorporating theories and values. Artif. Intell. 150(1-2) (2003) 97–143

- [7] Chorley, A.: Reasoning with Legal Cases seen as Theory Construction. PhD thesis, University of Liverpool, Department of Computer Science, Liverpool, UK (2007)
- [8] Gordon, T., Prakken, H., Walton, D.: The carneades model of argument and burden of proof. *Artificial Intelligence* **171** (2007) 875–896
- [9] Walton, D.: *Argumentation Schemes for Presumptive Reasoning*. Erlbaum, Mahwah, N.J. (1996)
- [10] Greenwood, K., Bench-Capon, T., McBurney, P.: Towards an account of persuasion in law. In: *ICAIL 2003*, New York, ACM Press (2003)
- [11] Hage, J.: Goal-based theory evaluation. In Breuker, J., et al., eds.: *JURIX 2000*, Amsterdam, IOS Press (2000) 59–72