Argument Schemes for Factor Ascription

Trevor BENCH-CAPON and Katie ATKINSON

Department of Computer Science, University of Liverpool, UK

Abstract. Reasoning with legal cases by balancing *factors* (reasons to decide for and against the disputing parties) is a two stage process: *first* the factors must be ascribed and *then* these reasons for and against weighed to reach a decision. While the task of determining which set of reasons is stronger has received much attention, the task of factor ascription has not. Here we present a set of argument schemes for factor ascription, illustrated with a detailed example.

Keywords. argument schemes, explanation, factors, legal reasoning

1. Introduction

Reasoning with legal cases provides a paradigmatic example of reasoning involving the weighing of reasons for and against to come to a conclusion which will be consistent with decisions made in the past. It is a central feature of legal reasoning, and as such has been central to the study of AI and Law. The most successful approach has been to use *factors*, which were introduced in CATO [2] as a development from the dimensions introduced in HYPO [22]. Further developments are described in [5], and the most recent has been a summary of formalisations of this approach [18]. Such reasoning has received recent attention in [13] as a way of the explaining in the output of approaches using machine learning techniques to predict the outcomes of legal cases, such as [1] and [17]. The same techniques have also been used to explain classifications from machine learning systems in areas other than law [19].

Since [2], cases have been represented as sets of *factors*. Factors are stereotypical patterns of facts which offer a reason to decide for one or other of the parties to the dispute. Once cases are available in terms of factors, the reasoning becomes a matter of deciding which set of reasons is the stronger[1], given the need to be consistent with the preferences expressed in previous cases (the legal principle of *stare decisis*). Argumentation about a new case then typically involves the exchange of moves (shown in *italics* in the bullets below) structured in the form of a three-ply dialogue, as originated in HYPO:

- Plaintiff *cites* a favourable precedent case with factors in common with the current case;
- Defendant replies either by citing an unfavourable case with factors in common with the current case (*counter example*) or *distinguishes* the case, by pointing to factors favourable to the defendant in the current case but not in the precedent, or factors favourable to the plaintiff in the precedent but not the current case;

---

[1] Often the strength of a reason is seen in terms of the social values it promotes or demotes [10]

- Plaintiff rebuts by *distinguishing* the counter examples, or by down playing the distinctions by finding a factor to *substitute* for the missing favourable factor or *cancel* the unfavourable factor.

This three ply structure corresponds to the use of argument schemes as introduced by Walton [24], with the proposal of an argument scheme (*cite*) being answered with critical questions (*counter example* and *distinguish*), which are in turn responded to (*distinguish*, *substitute* and *cancel*). This style of argument has been formalised as a set of argument schemes in [20], and used to explain the output of machine learning systems in [19].

In order to reason with factors, however, factors must be ascribed to the cases. Reasoning with legal precedents is a two stage process, in which *first* factors are ascribed to cases and *then* weighed to see whether the reasons for the defendant or the plaintiff are the stronger (see e.g. [12] and [8]). Both these stages may be the subject of argument: it may not be clear whether or not a factor should be ascribed on the basis of the facts.

Moreover, precedents guide the ascription of factors. Whilst the systems which look back to CATO see precedents as determining preferences between sets of factors (e.g. [16]), some precedents are concerned with whether or not a factor should be ascribed: once the factors are ascribed, the balance between them is obvious. For example, in the domain used by CATO, US Trade Secrets – where cases cover the misappropriation (or not) of a trade secret – in the case of *Arco Industries Corp. v. Chemcast Corp (1980)* all the factors favoured the defendant, and so, once the factors had been ascribed, the case was entirely clear cut. The plaintiff had, however, argued that certain factors favourable to him *should* be ascribed, but his arguments were rejected: in particular the court rejected the argument that the defendant's product was identical to the plaintiff's, setting a precedent for how similar the products needed to be for the purposes of this factor. Similarly in *Technicon Data Systems Corp. v. Curtis 1000, Inc (1984)* , the case turned on whether or not the information was reverse engineerable. The court held that, given the time the defendant had expended on attempting to reverse engineer the information, the factor should not be ascribed. In doing so the Court set a precedent for how much effort precluded reverse engineerability. As a case where a disputed factor was held to be present, it was held in *Space Aero Products Co. v. R.E. Darling Co* (1965), that former employees who had acquired the information in the course of their employment were in a confidential relationship with the employer, even if they had signed no explicit non-disclosure agreement, again setting a precedent for future cases. Thus while some precedents guide preferences between factors, others, termed *ascription* precedents in [8], guide the ascription of factors.

Thus the explanation of an outcome in terms of the factors pro and con, and the preferences between them, may not be enough: an explanation of why the factors are considered present (or absent) may be what is needed.

In this paper we present a set of argument schemes to justify factor ascription. Our contribution is the articulation of four new schemes and their critical questions that demonstrate how factors can be ascribed, to enable the second stage of reasoning with legal cases to be undertaken. The new schemes complement the set presented previously in [20] to now provide full coverage of both stages of the process described earlier: this enables a *complete* explanation of *both* stages of the decision that was not previously available. Use and effectiveness of the schemes is demonstrated by walking through a detailed example.

Section 2 identifies different ways of ascribing factors, giving rise to different schemes to provide justification. Section 3 presents schemes for each of these types, with an extended example following in Section 4 and concluding remarks in Section 5.

2. Types of Factor Ascription

Factors are ascribed on the basis of facts. But the relationship between factors and facts is not always straightforward, since the cases exhibit an enormous variety of facts, which need to be mapped into a relatively small set of factors.

The most straightforward case is where the facts licence the ascription of the factor through an ordinary understanding of the words involved. Thus, in the often discussed wild animals property law cases introduced in [11] – where the cases concerned determining when an individual can be deemed to possess (or not) a wild animal being pursued – one factor was whether those involved were pursuing their livelihoods. In one case[2], Keeble rented a pond frequented by ducks which he regularly shot and sold at market. In another[3], Young was a professional fisherman looking for fish in his trawler. Both are clearly pursuing their livelihoods. In contrast, in *Pierson v Post* (1805)[4], Post was hunting a fox in pursuit of pleasure: fox hunting played no part in his professional activities. No special judgement, or knowledge of past cases, is needed to ascribe the factor. In these cases there are no issues as to extent: either the plaintiff was pursuing his livelihood or he was not.

But things are not always so simple: often the ascription of the factor does require knowledge of past cases. In HYPO [3], in the domain of US Trade Secrets Law, facts are used to position the case on a set of *dimensions*. One such dimension is *SecurityMeasures*, which relates to the steps taken by plaintiffs to protect their information. The measures taken in any given case will be very different. Moreover, the rigour of the measures will vary greatly: at one end of the dimension no measures will have been taken, which will be a reason to find for the defendant. At the other end, the very rigorous measures taken will be a reason to find for the plaintiff. Thus the dimension gives rise to two factors, one for each side, depending on the nature of the measures taken in the particular case. Between them there *may* be a neutral range in which neither side is favoured and no factor is applicable. At one end we have the pro-defendant factor *NoSecurityMeasures*, and at the other end the pro-plaintiff factor, *AdequateSecurityMeasures*. At some point on the dimension the measures will be sufficient to be no longer a reason to find for the defendant. At some, possibly later, point the measures will be sufficiently strong to be a reason to find for the plaintiff. These points are not a matter of ordinary language, but are determined in the context of actual cases, and dependent on past decisions. These points were discussed by Rigoni [21], who termed them *switching points*. *SecurityMeasures* has two factors: a pro–defendant factor, followed by a neutral range, followed by a pro-plaintiff factor. Other dimensions may differ. Some map to only one factor with the rest of the range neutral. Others may map to more than one factor for a given side: in Trade Secrets *DisclosuresToOutsiders* has a neutral range followed by a pro-plaintiff factor representing a significant number of disclosures, followed by a stronger pro-plaintiff

---

[2]*Keeble v Hickeringill* (1707) 103 ER 1127
[3]*Young v Hitchens* (1844) 115 ER 228
[4]*Pierson v Post* (1805) 3 Cai. R. 175, 2 Am. Dec. 264

factor if the information has been put into the public domain. For all factors of this type we have a dimension with ranges in which the factors that are applicable are demarcated by switching points constrained by precedents.

A third type of ascription arises when a pair of dimensions need to be considered together, because one may trade off against the other so that we need to strike a balance between them. For example, as discussed in [9], in the US Fourth Amendment which protects against unreasonable search, the privacy of the citizen must be balanced against the exigency of the need to enforce the law. If the life of the President is thought to be under threat, privacy will be respected less than if we are dealing with a minor offence. Neither exigency nor privacy can provide a reason to decide the case by themselves: they must be considered together. Thus the factor is something like *SufficientRespectforPrivacyGivenExigency*, and we can picture the dimensions as the x- and y-axes and precedents determining a line separating the area where the factor applies from where it does not, as discussed in [7] and [6]. Again, this line will be constrained by previous decisions as to the applicability of the factor. A diagram for the worked example is given in Figure 1.

The fourth type of justification we will consider is analogy. Here the problem is not whether the extent of some aspect of a case is sufficient, and so it *could* be a case for ordinary interpretation, but the facts do not allow the ascription of the factor on an ordinary interpretation, and so it is argued that the factor should be ascribed on the basis of an *analogy* between the situations. Analogy has often been seen as determining a relation between whole cases, as in [25] and [23]. We, however, argue that the analogy is rather between particular aspects of the case. In Steven's prime example in [23] the (hypothetical) case turns on whether a kindergarten teacher should be considered sufficiently analogous to the mother in the case of *Dillon v Legg*[5] to receive compensation for witnessing an injury to a child. In *Dillon* it was held that one factor was whether the victim and the emotional sufferer had "a close relationship"[6]. The case turns on the point because the other pro-claimant factors are in place, and so all that is at issue is whether being a kindergarten teacher enables the factor *CloseRelationship*, introduced to describe the mother-son relation, to be applied. In ordinary language most people would not say that a kindergarten teacher had a close relationship of this sort to the child, but Stevens argues that there is a possible analogy to be drawn on the basis that both love the child. In our opinion this analogy is too tenuous, but a similar analogy might succeed in the case of a more intimate non-blood relationship such as a wet nurse. Walton's key example is the well known *Popov v Hayashi* case[7] [4], in which there was a dispute over the ownership of a potentially valuable baseball, hit by Barry Bonds to set a home run record. Here the analogy is not with a particular case, but with the body of cases including *Pierson*, *Keeble* and *Young* discussed above, by drawing an analogy to a baseball hit out of the ball park and the wild animals of those cases [14]. Here what is at stake is the ascription of the factors relating to the quarry: once these factors have been ascribed, *Popov* can then be argued about with the other wild animals cases as precedents.

---

[5]*Dillon v Legg* 68 Cal. 2d 728 (1968).

[6]The Court had been deliberately vague, saying that it "cannot now predetermine the defendant's obligation in every situation by a fixed category; no immutable rule can establish the extent of that obligation for every circumstance in the future." It is quite normal for a Court to use a term which is clearly satisfied in the current case, but leave more precise lines to be drawn later.

[7]*Popov v Hayashi* WL 31833731 Ca. Sup. Ct. (2002). The case was the subject of a 2004 comic documentary film, *Up For Grabs*, https://www.imdb.com/title/tt0420356/.

3. Argumentation Schemes For Factor Ascription

In this section we will provide an argumentation scheme for the ascription of each of the types of factor discussed in the previous section.

3.1. Ordinary Meaning Scheme

The most straightforward scheme is where the facts of the case justify the ascription of a factor, on a ordinary interpretation of the terms involved.

Ordinary Meaning Scheme
Facts Premise: Facts $a_1...a_n$ are true in Case C_1
Usage Premise: As F is ordinarily understood, $a_1...a_n$ are sufficient for Factor F to be considered present in C_1
Conclusion: F is present in C_1

The following is a set of critical questions to enable the scheme's components to be questioned:

MCQ1: Does $a_1...a_n$ really justify the ascription of F? There might be some additional fact which is needed. For example we might require that the activity be sufficiently remunerative if it to be considered the person's livelihood.

MCQ2: Does some other fact, b, provide an exception which prevents the ascription of F? There might be some unusual feature in the situation which should prevent ascription. For example suppose a duck hunter takes a pot shot at a fox. Though out pursuing his livelihood, hunting that particular quarry is not really part of that pursuit.

MCQ3: Do other facts $b_1...b_n$ justify the ascription of factor F_2, which is incompatible with F? For example if the person concerned was trespassing, then they might be considered to be engaged in an activity such as poaching, which would not be considered earning a livelihood.

3.2. Switching Point Scheme

The next scheme is based on Rigoni's notion of a *switching point* [21]. If we consider a dimension with a factor favouring the plaintiff at one end and a factor favouring the defendant at the other, there will be points (possibly the same) at which one factor ceases to apply and the other factor begins to apply. These are the *switching points*. Thus given a precedent more favourable on the dimension than the new case, we can say that the factor applies to the new case. Similarly, if the new case is less favourable, we can argue that the factor does not apply. We can use this notion as the basis of an argumentation scheme:

Switching Point Scheme
Precedent Premise: P_1 is a precedent with location L_1 on dimension D at which factor F is present.
Case Premise: C_1 is a case with L_2 on dimension D
Party Premise: F favours the plaintiff (defendant)
Value Premise: L_2 is more (less) favourable to the plaintiff (defendant) than L_1
Conclusion: F applies (does not apply) to C_1

We can question an instantiation of ths scheme with the following critical questions:

SCQ1: *Is L_2 so much more favorable that a different factor applies?* For example in the US Trade Secret domain of [2] there are two pro-defendant factors on the disclosures dimension, *DisclosedToOutsiders* and the stronger *DisclosedInPublicForum*.

SCQ2: When arguing that the factor does not apply because L_2 is less favourable: *Is L_2 sufficiently close to L_1 that the same factor applies?* It is possible that P_1 does not precisely identify the switching point, and that C_1 may become a new precedent for the factor, giving a more generous switching point.

SCQ3: *Is there another precedent, P2, which can ground an instantiation of the switching point scheme to give an argument that the factor does not (does) apply?*. It may be that some additional information is needed to say which precedent should apply.

3.3. Trade Off Scheme

The next scheme concerns trade-offs between two dimensions, as described in [6]. For example in the US Fourth Amendment domain there is a trade-off between being able to enforce the law and respect for privacy [9]. The factor involves balancing these two concerns and is something like "Sufficient respect for privacy while enabling enforcement". The idea in [6] is that a line, e.g $a.D_1 + b.D_2 + c = 0$, can be fitted to the precedents[8], separating the pro-plaintiff and pro-defendant regions of the case space. In the equation a and b are the coefficients of the variables D_1 and D_2, representing the values on the two dimensions. This determines the gradient of the line which indicates how much more D_1 is need to compensate for less D_2, and c is a constant showing where the line crosses the axes given these coefficients.

Trade Off Scheme

Precedents Premise: $P_1...P_n$ are precedent cases in which factor F is present.

Locations Premise: Precedent $P_i \in \{P_1.., P_n\}$ have locations D_{1_i} and D_{2_i} for dimensions $D1$ and $D2$,

Case Premise: C_1 is a case with L_1 on dimension D_1 and L_2 on dimension D_2

Line Premise: All $a.D_{1_i} + b.D_{2_i} + c \geq 0$

Point Premise: $a.L_1 + b.L_2 + c \geq (<) 0$

Conclusion: F applies (does not apply) to C_1

For this scheme we have the following key critical questions;

TCQ1: Is there a counter example, a precedent, P_{n+1}, such that $a.D_{1_{n+1}} + b.D_{2_{n+1}} + c < (\geq) 0$?. There might be a precedent which does not fit the line.

TCQ2: Can the line be drawn less (more) tightly? If the precedents are not precisely on the line the constant c could be adjusted to lower (raise) the line to allow (disallow) more cases to qualify unless this created a counter example.

---

[8]Of course more complicated curves can be used, but a straight line is the simplest.

3.4. Analogy Scheme

There are a number of schemes for analogy in the literature. Different schemes are given in [26], [25] and [23]. Here we give one tailored to our need to analogise between aspects of cases rather than cases as a whole.

Analogy Scheme
Base Premise: A situation S_1 is described in precedent P_1.
Derived Premise: Factor F is plausibly ascribed to P_1 on the basis of S_1.
Case Premise: Case C_1 contains situation S_2
Similarity Premise: As it relates to F, situation S_2 is similar to situation S_1.
Conclusion: Factor F is plausibly ascribed to C_1.

The following set of critical questions is based on the account given in [26] for the basic scheme for argument from analogy.

ACQ1: Are there respects in which P_1 and C_1 are different that would tend to undermine the force of the similarity with respect to F? For example, the kindergarten teacher has a transient relationship, whereas the maternal relation is permanent.

ACQ2: Is the similarity sufficient for F to be ascribed? The love felt by a kindergarten teacher might not be considered to have the same quality as mother-love.

ACQ3: Is there some other precedent P_2 that is also similar to C_1, but in which F was not ascribed? Suppose there was a precedent with a nanny, where the relationship was not considered sufficiently close.

In the next section we will give an extended example to show these schemes in action.

4. Change of Domicile Example

Our example will be based on the example used in [15]. The idea is that a person has applied for a change of fiscal domicile, for tax purposes. A decision will be taken in the light of the particular facts of the case, which will be very varied as people have many different reasons for changing country, and many different ways of arranging their lives as they transition from one place to another. We will suppose the following facts are relevant. Some will be *dimensional*, the particular fact representing a point on a dimension, while others will be Boolean.

- **Absence**: The length of absence (dimensional).
- **IncomeSource**: The percentage of income earned abroad (dimensional).
- **Spouse** Whether there are family connections with the new country. For example the spouse may be a national of that country (Boolean).
- **Age**. The age of the person concerned (dimensional).
- **Dwelling**: Whether links with the old country had been maintained. For example a house may still be owned there (Boolean).

From these we can form the following factors. The dimensional facts will give rise to *switching point* and *trade off* factors. Boolean factors may be argued for either on the basis of a literal interpretation or an analogy. The conflicting principles are that tax should be paid where income is earned, but that tax should be paid where benefits are

Table 1. Facts of Example Cases

Case	Absence	IncomeSource	Spouse	Age	Dwelling
LowPay	48	20	No	35	Timeshare
HighPay	6	100	No	17	No
Married	36	60	Spouse	26	No
Owner	60	20	No	48	House
NewCase1	54	20	Spouse	66	Caravan
NewCase2	36	60	Partner	18	No

Table 2. Factors Present In Precedent Cases

Case	F1 suff	F2 Insuff	F3 Family	F4 Working	F5 Minor	Links
LowPay		X		X		
HighPay	X				X	
Married	X		X	X		
Owner	X			X		X

received, and so the current domicile should receive tax until the connection has been severed by prolonged absence and abandoning other connections.

F1 **SufficientAbsence**. This will mean that the absence is sufficient with respect to the amount of income earned abroad. This is a *trade off* factor. In general, the higher the percentage earned abroad the shorter the absence required. The factor will favour *change*.

F2 **InufficientAbsence**. If the absence is not sufficient, this can mean that a pro *noChange* factor is present.

F3 **Family**. There are close family ties with the new country. This favours *change*. Here there is no corresponding *noChange* factor: lacking family ties is no reason to decide for *noChange*.

F4 **WorkingAge**. If a person is of working age, this favours no change.

F5 **Minor**.If a person is a minor, this favours *change*, since minors are held to have no control of their domicile. Note, however, that being retired is neutral: thus, some points on the age dimension are neutral.

F6 **Links**. This is a Boolean factor favouring *noChange*. It applies if the claimant has maintained links such as property in the old country.

We now consider a set of precedent cases, with facts as shown in Table 1. The factors ascribed to the four precedent cases are shown in Table 2. We are now presented with a new case, *NewCase1*, with facts as shown in Table 1.

We now consider how these factors should be ascribed to *NewCase1*. First we will consider the income/absence trade off.

4.1. Trade Off Between Absence and Income Percentage

NewCase1 has the same amount of income as the unfavourable *LowPay* and the favourable *Owner*. But the length of absence is midway between the two. So argument is required. Suppose first that the advocate of no change wishes to argue that F1, *SufficientAbsence* does not apply. He can draw a line separating the favourable from the
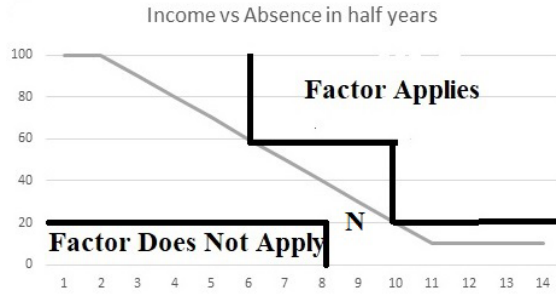
Figure 1. Trade off between absence and income

unfavourable precedents as shown in Figure 1. The line shown is $3 \times income + 5 \times absence - 360 = 0$. We can now instantiate the **TradeOff** scheme.

> *Precedents Premise*: *Married* and *Owner* are precedent cases in which factor *SufficientAbsence* is present.
> *Locations Premise*: These precedents have locations (36,60) and (60,20) on the absence and income dimensions.
> *Case Premise*: *NewCase1* has location (54,20)
> *Line Premise*: For *Married* and *Owner* $3 \times income + 5 \times absence - 360 \geq 0$
> *Point Premise*: $3 \times 20 + 5 \times 54 - 360 = -30$ and $-30 < 0$
> *Conclusion*: *SufficientAbsence* does not apply to *NewCase1*

We can now consider how we might challenge this argument. In *HighPay*, we have a negative value for $3 \times 100 + 5 \times 6 - 360$, and yet it was held that *SufficientAbsence* applied to *HighPay*. This counter example to the Line Premise allows us to pose TCQ1. The proponent would likely argue that the relationship is not linear for extreme values, as shown in Figure 1, so that 100% income will mean that *any* absence is sufficient. The court would have to decide whether this rebuttal was effective, or whether *NewCase1* should also be included in *SufficientAbsence*.

The line in Figure 1 has been drawn very tightly on the precedents, and so there is scope for challenging this argument with TCQ2. If the constant factor is reduced to 330, *NewCase1* would now lie on the line, and the two precedents would remain included, while the counterexample *LowPay* would remain excluded. This would have the additional strength of including *HighPay* with no need to make it a special case, and so represents a powerful challenge. A rebuttal would have to argue in terms of the values promoted: that the new line does not give enough weight to the claims of the current domicile.

4.2. Switching Point on Age Dimension

The factors for which this is the argument scheme are *WorkingAge* and *Minor*. Let us first consider *NewCase1*. Here a proponent of no change would instantiate the scheme using *Owner*.

> *Precedent Premise*: *Owner* is a precedent with location 48 on dimension *Age* at which factor *WorkingAge* is present.

> *Case Premise* :*NewCase1* is a case with 66 on dimension *Age*.
> *Party Premise*: *WorkingAge* favours no change.
> *Value Premise*: 66 is more favourable to no change than 48
> *Conclusion*: *WorkingAge* applies to *NewCase1*.

But we can pose critical questions against this, knowing that beyond *WorkingAge* on the *Age* dimension is a neutral area for the retired. So one can pose SCQ1, arguing that the difference between 66 and 48 is sufficiently great that we have entered the neutral range. We have no precedents setting the switching point here: if the court decides that a person of 66 should be considered retired so that *WorkingAge* does not apply, *NewCase1* will become a precedent putting an upper bound on *WorkingAge*.

The other two critical questions do not apply to *NewCase1*, so now consider *New-Case2*. Here *HighPay* can be used as a precedent to argue that *Minor* does not apply.

> *Precedent Premise*: *HighPay* is a precedent with location 17 on dimension *Age* at which factor *Minor* is present.
> *Case Premise* :*NewCase2* is a case with 18 on dimension *Age*.
> *Party Premise*: *Minor* favours change.
> *Value Premise*: 18 is less favourable to change than 17
> *Conclusion*: *Minor* does not apply to *NewCase2*.

Here we can pose SCQ2. We can argue that 18 is sufficiently close to 17 that *Minor* can also be taken to apply the *NewCase2*, raising the lower bound on the switching point for this factor. This could be supported by also posing SCQ3, using *Married* to argue that *WorkingAge* does not apply to *NewCase2*. The decision on the court could be made on the basis of the value concerned, namely the autonomy of the person with respect to place of residence of a person of that age, or by considering other legislation in the two jurisdictions concerning the age of majority.

4.3. Ordinary Meaning Scheme

We now turn to the Ordinary Meaning Scheme. Consider here *NewCase1*, where the applicant has a spouse of the other nationality.

> *Facts Premise*: Applicant has a spouse of the appropriate nationality in *NewCase1*,
> *Usage Premise*: As ordinarily understood, spouse justifies the ascription of *Family*, which requires a close family tie.
> *Conclusion*: *Family* is present in *NewCase1*,

Since spouse is a paradigmatic close family tie, the only possibility of arguing against this is to find an exception, and pose MCQ2. For example if the couple were legally separated this would provide a possible reason to withhold the factor.

For the other critical questions, consider *NewCase2*. Here we have a partner, but no legal marriage, yet a partnership might well be considered effectively the same as a formal marriage. However, it is possible that additional conditions could be suggested using MCQ1. For example it could be argued that to be treated equally with marriage there should be some evidence of permanence, such as the relationship having existed for a significant period of time. For MCQ3 it might be possible to point to another concept such as *cohabitee*, which is treated differently from a spouse with regard to, e.g. inheritance and welfare benefits. Here it could be argued that a partner is more readily seen under this concept than as a spouse.

4.4. Analogy Scheme

We will discuss the analogy scheme and its relation to the *Links* factor, specifically whether a dwelling had been maintained in the country of origin, with Owner as the *precedent*. While the caravan in *NewCase1* would not be interpreted as a dwelling in the ordinary meaning of the word, it could be argued that there is a sufficient analogy to allow the *Links* factor to apply.

> *Base Premise*: A house in the country of origin is present in *Owner*.
> *Derived Premise*: *Links* is plausibly ascribed to *Owner* on the basis of the retained house.
> *Case Premise*: In *NewCase1* a caravan in the country of origin has been retained.
> *Similarity Premise*: As it relates to *Links*, a caravan is similar to a house since they can both be used to live in.
> *Conclusion*: *Links* is plausibly ascribed *NewCase1*.

This analogy can, of course, be questioned. Using ACQ1, it could be argued that there are significant differences between a house and a caravan, such as mobility and that the latter is used typically as a second home for short stays. ACQ2 is similar, but whereas ACQ1 could be answered by suggesting that the other caravans were in use as permanent dwellings, ACQ2 suggests that the similarity is still insufficient. For example that given the disparity in cost between retaining a house and a caravan, the caravan did not demonstrate a big enough commitment to qualify for ascription of the *Links* factor. Finally, for ACQ3 we can point to *LowPay*, where it was held that a Timeshare was not enough to ascribe the *Links* factor. This would allow the argument that the Timeshare is a better analogy for a caravan than a house.

5. Concluding Remarks

A full explanation of a decision in a legal case requires not only an indication of why one set of factors was preferred over another, as in [20], but also why these reasons were considered applicable to the case, and why others were not. To enable this kind of explanation we have provided a set of argumentation schemes for factor ascription. We have identified different kinds of factors, which require different kinds of justification. One key aspect is whether the factor is derived from a dimension or a Boolean attribute. Another is whether aspects of the case trade off against one another. We have identified four schemes, and their associated critical questions to enable critical discussion in the manner of [24], which can be deployed as a three ply dialogue as advocated in HYPO [22]. When coupled with the schemes of [20], a complete explanation of the reasoning in legal cases is enabled. We propose that these schemes could be used as in [19] to give a full explanation of the output of a machine learning prediction system, both in law and in other domains.

We have illustrated the schemes with an extended example, based on one in [15], but in future work we will analyse an actual body of case law using these schemes. One possibility would be US Trade Secrets, allowing comparison with a range of other work [5]. We anticipate that this may require us to expand our initial set of critical questions.

References

[1] Nikolaos Aletras, Dimitrios Tsarapatsanis, Daniel Preoţiuc-Pietro, and Vasileios Lampos. Predicting judicial decisions of the European Court of Human Rights: A natural language processing perspective. *PeerJ Computer Science*, 2:e93, 2016.

[2] Vincent Aleven. *Teaching case-based argumentation through a model and examples*. PhD thesis, University of Pittsburgh, 1997.

[3] Kevin D Ashley. *Modeling legal arguments: Reasoning with cases and hypotheticals*. MIT press, Cambridge, Mass., 1990.

[4] Katie Atkinson, editor. *Special Issue on Modelling Popov v Hayashi*, volume 20:1 of *AI and Law*. 2012.

[5] Trevor Bench-Capon. HYPO's legacy: Introduction to the virtual special issue. *AI and Law*, 25(2):205–250, 2017.

[6] Trevor Bench-Capon. Using issues to explain legal decisions. In *Proceedings of XAILA 2021*. arXiv preprint arXiv:2106.14688, 2021.

[7] Trevor Bench-Capon and Katie Atkinson. Dimensions and values for legal CBR. In *Proceedings of JURIX 2017*, pages 27–32, 2017.

[8] Trevor Bench-Capon and Katie Atkinson. Precedential constraint: The role of issues. In *Proceedings of the 18th International Conference on Artificial Intelligence and Law*, pages 12–21. ACM Press, 2021.

[9] Trevor Bench-Capon and Henry Prakken. Using argument schemes for hypothetical reasoning in law. *AI and Law*, 18(2):153–174, 2010.

[10] Trevor Bench-Capon and Giovanni Sartor. Theory based explanation of case law domains. In *Proceedings of the 8th International Conference on Artificial Intelligence and Law*, pages 12–21, 2001.

[11] Donald H Berman and Carole L Hafner. Representing teleological structure in case-based legal reasoning: The missing link. In *Proceedings of the 4th International Conference on Artificial Intelligence and Law*, pages 50–59, 1993.

[12] L Karl Branting. Explanation in hybrid, two-stage models of legal prediction. In *XAILA 2020: EXplainable and Responsible AI in Law 2020*, pages 1–10. CEUR 2891, 2020.

[13] L Karl Branting, Craig Pfeifer, Bradford Brown, Lisa Ferro, John Aberdeen, Brandy Weiss, Mark Pfaff, and Bill Liao. Scalable and explainable legal prediction. *AI and Law*, 29(2):213–238, 2021.

[14] Paul Finkelman. Fugitive baseballs and abandoned property: Who owns the home run ball. *Cardozo Law Review*, 23:1609, 2001.

[15] John Horty. Reasoning with dimensions and magnitudes. *AI and Law*, 27(3):309–345, 2019.

[16] John Horty and Trevor Bench-Capon. A factor-based definition of precedential constraint. *AI and Law*, 20(2):181–214, 2012.

[17] Masha Medvedeva, Xiao Xu, Martijn Wieling, and Miche Vols. Juri says: An automatic judgement prediction system for the European Court of Human Rights. In *Proceedings of JURIX 2020*, pages 277–280, 2020.

[18] Henry Prakken. A formal analysis of some factor-and precedent-based accounts of precedential constraint. *AI and Law*, 29(4):559–585, 2021.

[19] Henry Prakken and Ratsma Rosa. A top-level model of case-based argumentation for explanation: formalisation and experiments. *Argument and Computation*, 13(2):159–194, 2022.

[20] Henry Prakken, Adam Wyner, Trevor Bench-Capon, and Katie Atkinson. A formalization of argumentation schemes for legal case-based reasoning in ASPIC+. *Journal of Logic and Computation*, 25(5):1141–1166, 2015.

[21] Adam Rigoni. Representing dimensions within the reason model of precedent. *AI and Law*, 26(1):1–22, 2018.

[22] Edwina L Rissland and Kevin D Ashley. A case-based system for Trade Secrets law. In *Proceedings of the 1st International Conference on Artificial Intelligence and Law*, pages 60–66, 1987.

[23] Katharina Stevens. Reasoning by precedent—between rules and analogies. *Legal Theory*, pages 1–39, 2018.

[24] Douglas Walton. *Argumentation schemes for presumptive reasoning*. Lawrence Erlbaum Ass., 1996.

[25] Douglas Walton. Similarity, precedent and argument from analogy. *AI and Law*, 18(3):217–246, 2010.

[26] Douglas Walton, Christopher Reed, and Fabrizio Macagno. *Argumentation schemes*. CUP, 2008.