The Dialectics of Case Comparison: a Formal Reconstruction

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Abstract. This paper is about the dialectics of case comparison as it unfolds in legal case-based reasoning, and its aim is to provide a representation of the phenomenon in formal terms. This is done by formalising argument moves in case comparison concisely in *argument schemes*, and specifying *attack relations* between the arguments and their corresponding counterarguments. A feature that is new in research on case comparison is, that in these argument schemes *dedicated case denotations* are used to refer to the cases under consideration, and that set-theoretic operations on cases appear in the formalised arguments.

1 Introduction

Legal case-based reasoning is an argumentation strategy in which a legal claim is supported by citing a favourable precedent and subsequently comparing it to the current fact situation. If one is able to establish a 'sufficiently good' analogy between a precedent and the present case, then according to the principle of *stare decisis* the past case should be followed and the same conclusion should hold. For this reason a legal debate will often focus on the issue how good the analogy between the past and present case actually is. The party who has cited the precedent will try to *support* the analogy by emphasising the similarities between the past and the present case, a move that is often called 'analogising'. The other party will instead *attack* the analogy by pointing out relevant differences, and this is usually called 'distinguishing'. Thus the legal debate between both parties will involve both arguments for the analogy, and counterarguments against it. The debate on the quality of the analogy can therefore be seen as a *dialectical* process, and it is the purpose of this paper to propose a way to represent the dialectics of case comparison explicitly in formal terms.

The present paper extends the work in past publications (Roth 2000 [14], Roth 2001 [15]) in two respects. First, case comparison is presently treated as a dialectical process involving argument attack, while in earlier work only the possible types of argument move were studied, with no specification at all of attack relations between them. Second, the present paper provides a fully formalised representation of argument moves in case comparison, while

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in past publications this representation was done semi-formally. However, due to space and time limitations the present paper has to restrict itself to arguments on *analogy* between cases, while in Roth 2001 [15] more possible outcomes of case comparison were considered.

2 Dialectics in General: a Simple Model

Suppose a bank employee is dismissed and challenges his dismissal in court, arguing that he should keep his job. Furthermore, suppose that the facts of the case are as follows, where each fact formulation is preceded by an abbreviation as a capital letter:

C : the employee insulted the employer
D : the employee is highly esteemed as a colleague
E : the employee has children to raise
F : the employee once committed fraud
G : the employee's wife has got a good income
H : the employee once deceived his employer with a forged diploma
I : the diploma was not relevant for the job
J : the employee works for a bank and should therefore be trustworthy

Moreover, suppose that in this dismissal case the issue arises whether the worker "has always behaved like a good employee" (a general obligation for employees that is codified in article 6:611 Dutch civil code), and let the sentence expressing that this is the case be abbreviated as 'A'. Then the employee will obviously argue in favour of conclusion A, while the employer will try to establish the opposite conclusion. This results in a process in which a number of arguments and counterarguments is exchanged, and it is the purpose of this section to provide an abstract formal account of this process.

For dialectics in general and for case comparison in particular, it is crucial that facts are not neutral but can play certain *roles* as *reasons*[1]. In the following, facts will be assumed to play one of two basic roles, namely that of a reason *supporting* a conclusion and that of a reason *detracting from* a conclusion. To express this supporting and this detracting role, respectively, the connectives '$\nearrow$' and '$\searrow$' are introduced. Suppose, for instance, that being highly esteemed as a colleague (D) 'supports' the conclusion A. Then this supporting role can be expressed as 'D$\nearrow$A'. Furthermore, suppose that if one has once deceived one's employer with a forged diploma (H), then this 'detracts from' A. Then one can express by 'H$\searrow$A' that the fact expressed by 'H' plays this detracting role.

The supporting or detracting roles of facts can *themselves* in turn be *supported* or *detracted from* by other facts[2]. For instance, suppose that if it is known that (I) an employee's forged diploma was not relevant for the job, then this detracts from the role of H as a reason

[1] In this section the complication is ignored that often more than one fact go into a reason (see e.g. Hage 1997 [8], p. 13-14). See, however, the discussion on *compound* reasons as they appear below in the formalisation of arguments in case comparison.

[2] Verheij includes comparable mechanisms in what he calls 'naïve dialectical arguments'. See the draft of 'DefLog-a logic of dialectical justification and defeat', to be found at http://www.metajur.unimaas.nl/∼bart/publications.htm. See also Verheij 2000 [18], p. 212 or Verheij 2001 [19].

detracting from A. Then by introducing brackets in the notation this role of I can be expressed straightforwardly by means of the nested construction 'I↘(H↘A)'. This mechanism of detracting from another fact's role as a reason underlies the undercutting type of attack on arguments, which will be introduced below.

As an example of a fact supporting another fact's role[3], let us suppose that if the person is a bank employee (J) and should therefore be trustworthy, then this supports the role of H as a reason detracting from A. Then by using brackets once again this supporting role of J can be expressed straightforwardly by means of the nested construction 'J↗(H↘A)'.

To specify the syntax of the sentences that are allowed under the present model in a concise way, let us adopt the convention to write metavariables for sentences as strings of characters in italics, starting with an uppercase (so as '*Fact*', for instance). Now all sentences must either be atomic or composite, where the composite sentences can be specified recursively as sentences of the form (*Fact1*)↗(*Conclusion1*) or (*Fact2*)↘(*Conclusion2*). Here *Fact1* and *Fact2* are atomic sentences while *Conclusion1* and *Conclusion2* can be either atomic, or be of a composite form themselves. Moreover, brackets will be omitted if there is no danger of ambiguities, just as was done in the examples above.

It must be noted that the notions of 'support' and 'detraction from' were only introduced informally above and will not be specified any further here. Accordingly, no semantics will be formulated for the connectives '↗' and '↘' that are used to express these mechanisms. The reason for this is, that the present account merely aims at formally *representing* the dialectics of case comparison, and that the status of legal claims is not evaluated. It therefore suffices here to have an intuitive understanding of the two mechanisms, so that the examples can serve as an explication of their intended meaning.

Still it must be said, however, that the aforementioned notions should not be construed as stating necessary or sufficient conditions for a conclusion or for its negation (see for a similar remark Aleven 1997 [2] p. 46 or Ashley 1991 [4] p. 757). The statement that D 'supports' the conclusion A, for instance, does not mean that D alone would be a sufficient condition for A. Likewise, if H 'detracts from' the same conclusion (A), then this does not mean that a necessary condition for A would be that H is not the case.

In the following it will be assumed that the *roles* of facts as supporting conclusions or detracting from them, are known in advance. In other words, these roles are assumed to be given as *background knowledge* that can be represented as a set of sentences of the formal language. It can also be made explicit by representing it graphically, however, as in Figure 2 below[4]. The representation in that figure constitutes a small part of what may be called an 'Entangled Factor Hierarchy' after the term 'Factor Hierarchy' used in CATO (Aleven 1997 [2], p. 44/5). It is called 'entangled' because unlike CATO's Factor Hierarchy, it contains arrows that point at other arrows, thus representing the mechanisms of supporting or detracting from other facts' roles.

With this background knowledge of the roles of facts as reasons, the following formalisation of dialectics can now be given.

[3]Cf. Toulmin's 'backings' of 'warrants' (Toulmin 1958 [16], p. 98f.).

[4]When inspecting this figure it may seem that the Entangled Factor Hierarchy is not a general representation of the domain under consideration, because it contains relatively factual expressions like "the employee insulted the employer." It must be noted, however, that each of these expressions can apply to a whole *class* of *different* cases, just as CATO's and HYPO's factors.

Arguments will be formally treated as sentences that are selected from the background knowledge. There are two possible ways in which arguments can *attack* each other. First, one can put forward a reason for a conclusion that is *incompatible* to the conclusion of the original argument. Suppose, for example, that an argument involves a fact D which *supports* the conclusion A: D$\nearrow$A. Then this argument can be attacked by putting forward the fact H, given that this *detracts from* the conclusion A: H$\searrow$A. As another example, consider an argument involving a fact I which *detracts from* the role of H as a reason detracting from A: I$\searrow$(H$\searrow$A). This argument can be attacked by putting forward the fact J, given that this *supports* the role of H as a reason detracting from A: J$\nearrow$(H$\searrow$A). In the literature (Pollock 1995 [11] p. 40 and 85, Hage 1997 [8] p. 167f., Verheij 1996 [17] p. 121/2) such an attack strategy is often called *rebutting*, and this term will be adopted here as well.

More generally, rebutting attacks can be represented as follows. An argument of the form

Fact1$\nearrow$*Conclusion*

can be rebutted by the corresponding argument of the form

Fact2$\searrow$*Conclusion*,

and vice versa. Note that if rebutting is formalised in this way, this results in a symmetric attack relation[5].

A second way of attacking an argument[6] is by detracting from the role of the fact involved in it. Consider, for example, an argument involving a fact H which detracts from the conclusion A: H$\searrow$A. This argument can be attacked by putting forward the fact I which detracts from the role of H as a reason detracting from A: I$\searrow$(H$\searrow$A). This attack strategy is often called *undercutting* in the literature (Pollock 1995 [11] p. 41 and 86, Hage 1997 [8] p. 166, Verheij 1996 [17] p. 120/1), and this term will be used here as well. Note that this undercutting attack relation is an asymmetric one.

To represent undercutting attacks in a concise way, it is convenient to have a dedicated metavariable for the two connectives expressing the roles of 'support' and 'detraction from'. To this end the small italicised letter 'r' is used (for 'role'), which can be instantiated either as $\nearrow$, or as $\searrow$. Then any argument of the form

(*Fact3*) *r* (*Conclusion*)

can be undercut by the corresponding argument of the form

Fact4 $\searrow$((*Fact3*) *r* (*Conclusion*)).

[5] In the present account no weighing (Hage 1997 [8], p. 140f.) or priority (Prakken and Sartor 1998 [13], p. 254) information can be taken into account. Such information cannot be used here for dialectical purposes either.

[6] A third possibility would be to detract from the fact is put forward as a reason (see Roth 2001 [15] for a semi-formal account). This attack strategy is ignored in the present formal treatment, however.

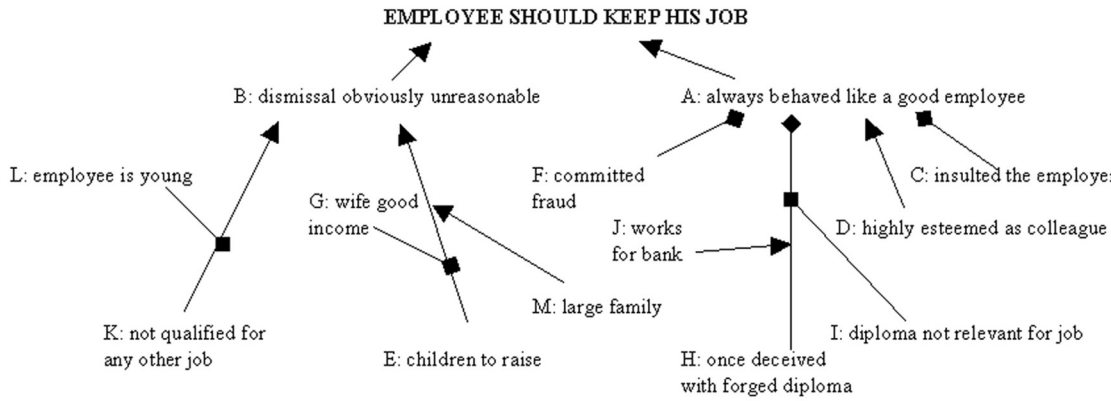

Figure 1: A portion of an 'Entangled Factor Hierarchy', a possible graphical representation of background knowledge. At the top of the picture one finds the main issue in bold capitals, that is, whether the employee should keep his job. Normal arrows stand for 'support', while arrows ending in a solid square stand for 'detraction from'. Note in particular the arrows pointing at other arrows, the graphical equivalent of nested sentences.

3 The Dialectics of Case Comparison: a Formal Reconstruction

In the following the dialectics of case comparison is formally accounted for by specifying attack relations between (schemes of) argument moves in case comparison and their corresponding (schemes of) counterarguments (viz. *rebutting* and *undercutting* attack, see previous section). The representation is not done in the form of a dialogue game (see for dialogue games, e.g., Lodder 1998 [10], Gordon 1995 [9]).

The syntax of the formal language has to be extended first. As remarked in the introduction, case comparison is treated as a debate on the analogy between cases. For a start one should therefore be able to express that two cases are analogous, and to this end cases will be denoted as terms[7] in the formal language. By convention these terms are (strings of) characters in bold type, starting with an uppercase. Thus, for instance, the expressions '**PastCase**' and '**PresentCase**' can denote the past and the present case under consideration, respectively. Moreover, to express that two cases are analogous the symbol '$\approx$' is introduced, so that the formula '**PastCase** $\approx$ **PresentCase**', for instance, says that the present and past case are analogous[8]. The analogy relation is assumed to be symmetric, so that formulas like '**Case1** $\approx$ **Case2**' and '**Case2** $\approx$ **Case1**' are equivalent.

Analogising moves can be treated formally as arguments in *support* of the conclusion *that two cases are analogous*, while distinguishing moves can be formalised as arguments *detracting from* that conclusion. As a result, the connectives '$\nearrow$' and '$\searrow$' can also be used in the present formal treatment of arguments in case comparison.

However, if one treats analogising and distinguishing as putting forward reasons in support of and detracting from the analogy, respectively, then the question arises which fact types

[7] Cf. the use of terms to denote cases in Reason-Based Logic (Hage 1997 [8], p.133/4).

[8] The establishment of an analogy may depend on the particular conclusion at stake. One could account for this by adding the disputed conclusion, say C, as a subscript: '$\approx_C$'. Presently this complication is ignored, however.

can actually play these roles as reasons. As will become clear from the informal examples below, the role in case comparison of individual case facts is partly determined by their *role as a reason* according to the background knowledge. This means that in formalising argument moves as reasons affecting the analogy, in these reasons reference must be made to the supporting or detracting role of the individual case fact involved.

The examples below will also show that for argument moves on analogy it is relevant whether an individual fact occurs in *only one* of the cases or in *both*, because this partly determines whether this fact can be used to distinguish or to analogise. This means that in the reasons in support of or detracting from the analogy, one must also specify the *precise origin* of the case fact involved.

To accomplish this, cases will be treated simply as collections of facts from now on. Using standard set-theoretic notation the formula 'X $\in$ **Case1**', for instance, then says that the fact expressed by 'X' is present in the case denoted as **Case1**. Furthermore, in order to be able to say that a fact is present in one case but not in the other, the set-theoretic symbol '$\setminus$' is introduced. This symbol stands for *set difference*, and the expression '**Case1**$\setminus$**Case2**', for instance, represents the set of all the facts that occur in **Case1** and *not* in **Case2**. The formula 'X $\in$ **Case1**$\setminus$**Case2**', for instance, then says that X occurs in **Case1** and not in **Case2**. Moreover, the set-theoretic symbol '$\cap$' for intersection is used to express that a fact is shared. The expression '**Case2**$\cap$**Case3**', for instance, then represents the set of all the facts that occur both in **Case1** and in **Case2**. Accordingly, a formula 'X $\in$ **Case2**$\cap$**Case3**' says that X is there in both **Case2** and **Case3**.

Argument moves on analogy can now be expressed as ones in which a *compound* reason is put forward which involves both the location of a case fact, and this fact's role as a reason according to the background knowledge[9]. Naturally enough, the representation of a compound reason will therefore contain two expressions, one for the case fact's location and one for its role as a reason. By convention both expressions will be separated by a comma and placed between brackets. In this way an expression like '(X $\in$ **PresentCase**$\setminus$**PastCase**, X$\nearrow$Z)', for instance, represents a compound reason that is made up by two states of affairs. The first of these is that the fact expressed by 'X' occurs in the *present* case *only*, while the second is that this fact gives support to the conclusion expressed by 'Z'. Given this representation for this particular compound reason, the formula

$$(\mathrm{X} \in \textbf{PresentCase}\setminus\textbf{PastCase}, \mathrm{X}\nearrow\mathrm{Z}) \searrow (\textbf{PresentCase} \approx \textbf{PastCase})$$

then expresses that this reason detracts from the analogy between the past and the present case. In other words, the formula says that the two cases are *distinguished* by pointing out X in the *present* case *only*.

Metavariables for case denotations will be written in italics and remain written in bold type, just as the case denotations themselves. As an example, the expression '***Case1***' can thus be used as a metavariable for case denotations. As the examples below suggest, it comes in handy to be able to refer to the *same* and the *other* case. To accomplish this the two metavariables ***Case1*** and ***Case2*** will be used as denotations of the two cases involved in the comparison process, with the additional convention that these metavariables will always stand

[9]One of the referees suggested that by including *values* in the representation, the present model can very readily be extended for *teleological* reasoning with cases (see, e.g., Bench-Capon and Sartor 2001 [7]).

for *different* cases. Thus, if ***Case1*** is instantiated by the denotation **PastCase** for the cited past case, then ***Case2*** stands for **PresentCase** for the case at hand, and vice versa.

Finally, as was done above, the small italicised letter 'r' is used as a metavariable for the two connectives '$\nearrow$' and '$\searrow$'.

Suppose one has to deal with the same dismissal case as in the previous section (see the list of facts on the first page), but suppose that the employee now cites a similar dismissal case to support the claim that he should keep his job. Let the facts of the past case be as follows, where each fact formulation is again preceded by its abbreviation as a capital letter:

C : the employee insulted the employer
D : the employee is highly esteemed as a colleague
E : the employee has children to raise
K : the employee is not qualified for any other job
L : the employee is still young and capable of retraining
M : the employee has a large family

Regarding the question whether the employee should keep his job, one issue is once again that which was abbreviated above as 'A'. Another issue is, whether "the dismissal was obviously unreasonable" (7: 681 paragraph 2 Dutch Civil Code), and the sentence expressing this will be abbreviated as 'B'.

As the past case is cited by the employee, his employer will now seek to distinguish both cases. This can be done, for instance, by pointing out the fact (F) that there is a case of fraud in the *present* case *only*. This fact is a relevant distinction because it *detracts from* the legally relevant conclusion A: F$\searrow$A. Another way to distinguish both cases is to point out the fact (K) that the bank employee was not qualified for any other job, which occurs in the *past* case *only*. This fact also constitutes a relevant distinction because it *supports* the legally relevant conclusion B: K$\nearrow$B.

This pattern of distinguishing can be generalised and formalised as follows. Let ***Case1*** and ***Case2*** be the denotations of the two cases involved in the comparison, and let *Fact1* be a fact that occurs in ***Case1***$\backslash$***Case2*** and that plays role r as a reason relative to some conclusion *Conclusion*. Then one can take

$$(\textit{Fact1} \in \textbf{\textit{Case1}}\backslash\textbf{\textit{Case2}},\ (\textit{Fact1})r(\textit{Conclusion})) \searrow (\textbf{\textit{Case1}} \approx \textbf{\textit{Case2}})$$

as a general scheme of distinguishing arguments of the kind that is presently under consideration.

The employee can now respond to the distinguishing move involving C by pointing out that in *both cases* the employer was insulted (C), a fact which *detracts from* A in the *past case as well*: C$\searrow$A. And the distinguishing move involving K can be attacked by pointing out that in *both cases* there were children to raise (E), a fact which provides *support for* B in the *present case as well*: E$\nearrow$B.

More generally, one can attack a distinguishing move by pointing out a fact which occurs in *both* cases and which plays the *same* supporting or detracting role as the fact involved in the original distinguishing move. More formally, if the original distinguishing move involves a fact occurring in ***Case1***$\backslash$***Case2*** and playing role r as a reason relative to conclusion *Conclusion*, then the response makes use of a fact (*Fact2*), which occurs in ***Case1***$\cap$***Case2*** and

plays role r as a reason relative to conclusion *Conclusion* as well. Since this way of attacking involves a shared fact it will be formalised as an analogising move, and since analogising is presently treated as supporting the analogy, the present attack strategy is a *rebutter*. Formally, this means that if

$$(\mathit{Fact1} \in \boldsymbol{\mathit{Case1}} \backslash \boldsymbol{\mathit{Case2}}, (\mathit{Fact1}) r (\mathit{Conclusion})) \searrow (\boldsymbol{\mathit{Case1}} \approx \boldsymbol{\mathit{Case2}})$$

is once again a scheme of distinguishing arguments, then

$$(\mathit{Fact2} \in \boldsymbol{\mathit{Case1}} \cap \boldsymbol{\mathit{Case2}}, (\mathit{Fact2}) r (\mathit{Conclusion})) \nearrow (\boldsymbol{\mathit{Case1}} \approx \boldsymbol{\mathit{Case2}})$$

is a scheme representing the corresponding rebutting analogising counterarguments.

If the employee uses E to analogise the cases in response to a distinguishing move, then the employer can in turn distinguish in two different ways. The first way is by pointing out that although E occurs in both cases, its role as a reason supporting B is *detracted from* by the fact (G) that the wife of employee has a good income, which occurs in the *present* case *only*: G$\searrow$(E$\nearrow$B). Another way of distinguishing at this point is to point out that while E is shared by both cases, its role as a reason supporting B is itself *supported* in the *past* case *only* by the fact (M) that the employee had a large family: M$\nearrow$(E$\nearrow$B).

The employee can also attack his employer's distinguishing argument by pointing out the fact (L) that the employee was young and capable of retraining, which also occurs in the *past* case and which *detracts from* the role of K as a reason supporting B: L$\searrow$(K$\nearrow$B).

More generally, if the two cases are analogised in response to a distinguishing move by pointing out a shared fact, then one can in turn distinguish in two ways. The first is by pointing out a fact, which *only* occurs in the *same* case as the fact involved in the original distinguishing argument and which *supports* the role of the shared fact that is pointed out in the analogising response. The second way of distinguishing involves a fact which *only* occurs in the *other* case than the fact involved in the original distinguishing argument and which *detracts from* the role of the shared fact used in the analogising move. More formally, if the original distinguishing move involves a fact (*Fact1*) occurring in $\boldsymbol{\mathit{Case1}} \backslash \boldsymbol{\mathit{Case2}}$ and playing role r as a reason relative to conclusion *Conclusion*, and the analogising response makes use of a fact (*Fact2*) which occurs in $\boldsymbol{\mathit{Case1}} \cap \boldsymbol{\mathit{Case2}}$ and plays role r as a reason relative to conclusion *Conclusion* as well, then one can in turn distinguish in two ways. The first is by pointing out a fact (*Fact3*) which occurs in $\boldsymbol{\mathit{Case1}} \backslash \boldsymbol{\mathit{Case2}}$ and which *supports* the role of *Fact2* as a reason. The second way of distinguishing involves a fact (*Fact3*) which occurs in $\boldsymbol{\mathit{Case2}} \backslash \boldsymbol{\mathit{Case1}}$ and which *detracts from* the role of *Fact2* as a reason.

Formally, this means that if

$$(\mathit{Fact1} \in \boldsymbol{\mathit{Case1}} \backslash \boldsymbol{\mathit{Case2}}, (\mathit{Fact1}) r (\mathit{Conclusion})) \searrow (\boldsymbol{\mathit{Case1}} \approx \boldsymbol{\mathit{Case2}})$$

is once again a scheme of distinguishing arguments, and

$$(\mathit{Fact2} \in \boldsymbol{\mathit{Case1}} \cap \boldsymbol{\mathit{Case2}}, (\mathit{Fact2}) r (\mathit{Conclusion})) \nearrow (\boldsymbol{\mathit{Case1}} \approx \boldsymbol{\mathit{Case2}})$$

is the scheme for the corresponding analogising counterarguments, then

$$(\mathit{Fact3} \in \boldsymbol{\mathit{Case1}} \backslash \boldsymbol{\mathit{Case2}}, \mathit{Fact3} \nearrow ((\mathit{Fact2}) r (\mathit{Conclusion}))) \searrow (\boldsymbol{\mathit{Case1}} \approx \boldsymbol{\mathit{Case2}})$$

and

$$(\textit{Fact3} \in \textbf{\textit{Case2}} \backslash \textbf{\textit{Case1}}, \textit{Fact3} \searrow ((\textit{Fact2}) r (\textit{Conclusion}))) \searrow (\textbf{\textit{Case1}} \approx \textbf{\textit{Case2}})$$

are schemes representing the corresponding distinguishing counterarguments.

If, as above, the employer distinguishes by pointing out K in the *past* case *only*, then the employee can also respond by pointing out a fact L which also occurs in the *past* case and which *detracts from* the role of K as a reason supporting B: L$\searrow$(K$\nearrow$B).

Another strategy to distinguish the two cases is to point out the fact H, which occurs in the *present* case *only*. This fact can also be used to distinguish because it *detracts from* the legally relevant conclusion A: H$\searrow$A. If the employer distinguishes in this way, then the employee can in turn attack this distinguishing argument by pointing out the fact I which also occurs in the *present* case and which *detracts from* the role of H as a reason detracting from A: I$\searrow$(H$\searrow$A).

More generally, one can always attack a distinguishing move by pointing out a fact which occurs in the *same* case as the fact involved in the original distinguishing argument and which *detracts from* the latter's role as a reason. More formally, if the original distinguishing move involves a fact (*Fact1*) occurring in $\textbf{\textit{Case1}} \backslash \textbf{\textit{Case2}}$ and playing role r as a reason relative to conclusion *Conclusion*, then the present way of attacking involves a fact (*Fact2*) occurring in ***Case1*** and detracting from this role of *Fact1* as a reason. Furthermore, for reasons to be explained below this way of attacking will presently be treated as an *undercutting* attack on the original distinguishing move, and not as an analogising move in its own right. This means that if

$$(\textit{Fact1} \in \textbf{\textit{Case1}} \backslash \textbf{\textit{Case2}}, (\textit{Fact1}) r (\textit{Conclusion})) \searrow (\textbf{\textit{Case1}} \approx \textbf{\textit{Case2}})$$

is once again a scheme of distinguishing arguments, then

$$\begin{array}{l}(\textit{Fact2} \in \textbf{\textit{Case1}}, \textit{Fact2} \searrow ((\textit{Fact1}) r (\textit{Conclusion}))) \searrow \\ ((\textit{Fact1} \in \textbf{\textit{Case1}} \backslash \textbf{\textit{Case2}}, (\textit{Fact1}) r (\textit{Conclusion})) \searrow (\textbf{\textit{Case1}} \approx \textbf{\textit{Case2}}))\end{array}$$

is the corresponding scheme of undercutting counterarguments.

The reason for treating this attack strategy as undercutting is, that it involves compound reasons in which reference is made to only one of the cases, while it does not matter at all whether or not the fact is also present in the other case. This suggests that these attacking moves be not treated as analogising arguments. However, because they do attack the role of the fact involved in some distinguishing argument, they can be interpreted sensibly as undercutters of this distinguishing move.

At this point one reservation has yet to be made. As remarked above, the aim of this paper is to propose a way to represent the dialectics of case comparison in formal terms, and this was done in the form of argument schemes. This does not imply any claim, however, that the given schemes make up an exhaustive list.

4 Related Work[10]

Probably the most important accounts of dialectical case comparison are those in the work on HYPO (Ashley 1990 [3], Ashley 1991 [4]) and CATO (Aleven 1996 [1], Aleven 1997 [2]). HYPO makes use of pre-stored background knowledge on the tendency of factors to favour a certain party (Ashley 1991 [4], p. 775). CATO exploits a more sophisticated body of background knowledge in its 'Factor Hierarchy' (Aleven 1997 [2], p. 44/5). From the present perspective this Factor Hierarchy is a representation of the roles that case facts can play as reasons. However, these roles are assumed as self-evident background knowledge (Aleven 1997 [2], p. 46), so that no arguments *on* the roles of facts are possible. In contrast, in the present approach such arguments are possible, thanks to the mechanisms affecting other facts' roles. These mechanisms appear as the 'entanglement' of factors in the Entangled Factor Hierarchy that represents the background knowledge as it is presently used (see Figure 2 above).

Using its Factor Hierarchy, the CATO system can produce special arguments about the significance of a distinction, such as 'downplaying a distinction' (Aleven 1997 [2] p. 58). In the present framework these special CATO moves cannot yet be accommodated, but in Roth 2001 [15] a semi-formal account was given. This account relied on other possible outcomes of case comparison than that studied here, such as that one case is overall 'more favourable' to a conclusion than another one. A full formalisation of these ideas has to be left for future research, however.

Prakken and Sartor (Prakken and Sartor 1998 [13]) give an account of case-based reasoning within the framework of their formal dialogue game. The following features of this approach are most relevant to the present discussion.

The representation of precedents reflects their dialectical structure, that is, the arguments pro and con that appear in them. This is accomplished by representing past cases as collections of rules from which the arguments pro and con can be constructed (p. 256). The model allows for the following argument moves: *analogizing* and *distinguishing*.

Analogizing is treated as the extraction of a rule from a past case and making this rule applicable to the present case by omitting unfulfilled conditions. The resulting rule is then said to *broaden* the original one.

Distinguishing is only possible after a rule has been broadened. It can take place in two ways, viz. *strong* and *weak*. *Strong* distinguishing is treated as the introduction of a rule which states as its conditions that the ones omitted from the broadened rule are not explicitly satisfied, and which has an *opposite* conclusion.

Weak distinguishing is treated as the introduction of a rule that concludes to the *inapplicability* of the broadening rule on the basis of that rule's unfulfilled conditions.

As an account of case comparison, this approach has two shortcomings. The first is, that while the present model requires the establishment of an analogy *before* a legal conclusion can be drawn on the basis of some past case, in Prakken and Sartor's approach much more *direct* arguments are produced. Their analogizing move, for instance, provides an argument that pleads directly for the conclusion for which the past case is cited.

[10] Due to space limitations the discussion of a lot of relevant work has to be omitted (Bench-Capon and Sartor 2000 [5], Bench-Capon and Sartor 2001 [6], Henderson and Bench-Capon 2001 [7], Prakken 2000 [12]).

The second shortcoming is that Prakken and Sartor's model *abstracts* from the concrete cases by extracting rules from them, while in the present approach they are recognised as entities that can stand on their own. Accordingly, their special 'analogizing' and 'distinguishing' moves are treated as operations on *rules*, and no reference at all is made to the *cases* involved in the comparison process. In contrast, in the present account of the comparison process cases play a role in their own right, and a dedicated denotation is therefore used for them in the formal representation of this process.

5 Conclusion and Future Research

In this paper a very abstract and simple model of dialectics was taken as a background to give a formal account of the dialectics of case comparison, by specifying attack relations between arguments. Moreover, these argument moves were represented in a concise way by means of schemes of arguments and their corresponding counterarguments.

There are a number of shortcomings, leaving some problems for future research. First, in the present paper only reasoning by analogy was studied, and the moves in case comparison were treated accordingly as ones affecting the quality of analogy. As I suggested in earlier work (Roth 2001 [15]), though, it may be necessary to recognise more relations that may come to hold between cases once the comparison process is completed. One such relation, for example, may be that the present case is overall 'more favourable' to a legal conclusion than the past case, in which situation one can make an *a fortiori* argument. It is left for future research to extend the formal language in such a way that more relationships between cases can be represented, in order to accommodate the corresponding patterns of arguing with past cases.

The present framework allows for considering only one past case regarding its similarity with the present one, while in practice often more than one past case is cited. In the HYPO model (Ashley 1991 [4]), for example, one can 'trump' (p. 760, 761) one precedent by citing a 'better' (in the sense of the 'on pointness' ordering) one with an opposite outcome. A formal treatment of arguing with more than one past case has to be left for future research as well, however.

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References

[1] Aleven, Vincent (1996). How Different Is Different? Arguing about the Significance of Similarities and Differences. *Proceedings of the Third European Workshop, EWCBR-96*, 1-15.

[2] Aleven, Vincent (1997). *Teaching Case-Based Reasoning Through a Model and Examples*. Ph.D. dissertation University of Pittsburgh.

[3] Ashley, K.D. (1990). *Modeling Legal Argument: Reasoning with Cases and Hypotheticals*. Cambridge, MA: MIT Press/Bradford Books.

[4] Ashley, K.D. (1991). Reasoning with cases and hypotheticals in HYPO. *International Journal of Man-Machine Studies* **34**: 753-796, 1991

[5] Bench-Capon, T.J.M. and Sartor, G. (2000). Using values and theories to resolve disagreement in law. *Proceedings of the Thirteenth Annual Jurix Conference* (eds. Joost Breuker, Ronald Leenes and Radboud Winkels), 73-84.
[6] Bench-Capon, T.J.M. and Sartor, G. (2001). Theory Based Explanation of Case Law Domains. *Proceedings of the 8th International Conference on Artificial Intelligence and Law*, 12-21.
[7] Henderson, J. and Bench-Capon, T.J.M. (2001). Dynamic Arguments in a Case Law Domain. *Proceedings of the 8th International Conference on Artificial Intelligence and Law*, 60-69.
[8] Hage, J.C. (1997). *Reasoning with Rules. An Essay on Legal Reasoning and Its Underlying Logic.* Dordrecht: Kluwer Law and Philosophy Library.
[9] Prakken, H. and Sartor, G. (1998). Modelling Reasoning with Precedents in a Formal Dialogue Game. *Artificial Intelligence and Law* **6**: 231-287.
[10] Gordon T.F. (1995). *The Pleadings Game. An Artificial Intelligence Model of Procedural Justice.* Dordrecht: Kluwer Academic Publishers.
[11] Lodder, A.R. (1998). *DiaLaw. On legal justification and diolog games.* Doctoral dissertation Universiteit Maastricht.
[12] Pollock, J.L. (1995). *Cognitive Carpentry: A Blueprint for How to Build a Person.* The MIT Press, Cambridge (Massachusetts).
[13] Prakken, H (2000). An exercise in formalising teleological case-based reasoning. *Proceedings of the Thirteenth Annual Jurix Conference* (eds. Joost Breuker, Ronald Leenes and Radboud Winkels), 49-57.
[14] Roth, A.C. (2000). New reasoning patterns in analogical legal case-based reasoning: an informal investigation. *Proceedings of the Thirteenth Annual Jurix Conference* (eds. Joost Breuker, Ronald Leenes and Radboud Winkels), 113-122.
[15] Roth, A.C. (2001). A Typology of Moves Involved in Case Comparison. *Proceedings of the 8th International Conference on Artificial Intelligence and Law*, 129-138.
[16] Toulmin, S.E. (1958). *The uses of argument.* University Press, Cambridge.
[17] Verheij, B. (1996). *Rules, Reasons, Arguments. Formal Studies of Argumentation and Defeat.* Doctoral dissertation Universiteit Maastricht.
[18] Verheij, B. (2000). Dialectical Argumentation as a Heuristic for Courtroom Decision Making. *Rationality, Information and Progress in Law and Psychology* (eds. Peter J. van Koppen and Nikolas H.M. Roos): 203-226, 2000. Universitaire Pers Maastricht.
[19] Verheij, B. (2001). Legal decision making as dialectical theory construction with argumentation schemes. *Proceedings of the 8th International Conference on Artificial Intelligence and Law*, 225-226.