

## Book Review

Bram Roth, *Case-based Reasoning in the Law: A Formal Theory of Reasoning by Case Comparison*. Ph. D. Thesis, The University of Maastricht, 2003. 181 pp.

Modelling how legal cases are reasoned with has been a central concern of AI and Law since its inception. The key line of work originates in the US with the HYPO system of Edwina Rissland and Kevin Ashley, which developed into the CABARET system of Rissland and David Skalak and the CATO system of Ashley and Vincent Alevan, and is currently represented by the Issue-Based Prediction system of Ashley and Steffie Bruninghaus. Other important work from the US includes the work of Karl Branting, especially the GREBE system. In all of this work the emphasis has been on implemented systems. European work, which starts from a more rule and logic orientated perspective, has tended to address this topic by attempting to provide a logical reconstruction of the styles of reasoning exemplified by these systems. Henry Prakken and Giovanni Sartor have explicitly provided a logical model of reasoning with precedents, while Jaap Hage and Bart Verheij have worked on Reason Based Logic which attempts to provide a formal basis for the reasoning that is used with cases. Bram Roth's thesis, as its subtitle indicates, is firmly within this European tradition, and in particular follows on from the work on Reason Based Logic.

The structure of the thesis is straightforward. After a brief introduction in which three research questions are identified, the second chapter gives an overview of case-based reasoning in AI and Law. The heart of the thesis is Chapter 3 in which Roth's formal theory is presented. Chapter 4 provides an excellent and illuminating discussion of previous work, including all the systems cited in my opening paragraph, in the light of the proposed model, and the final chapter offers a brief evaluation in the form of discussion of the strengths and weaknesses of the proposed model.

The central idea of the formal model is that use should be made of the dialectical structure of cases in their comparison. Cases are modelled in terms of factors – states of affairs relevant to the drawing of some conclusion concerning the case – and these factors are organised into a dialectical tree structure rooted in a main conclusion and descending through intermediate conclusions to basic factors. At each level the children offer reasons to conclude that their parent is true or false. The factors give the basis of case comparison and the structure allows cases to be compared in terms of the

dialectical support they give to a conclusion (or its negation). This comparison can be made both for intermediate conclusions and for the conclusions for which they in turn offer dialectical support. Precedents licence conclusions through *a fortiori* reasoning: if a particular conclusion was drawn in a precedent, then it can be drawn also in a new case which offers the same, or more, dialectical support for that conclusion. All of this is well set out in Chapter 3, with careful definitions and illustrative examples.

The dialectical structure has many similarities with the abstract factor hierarchy of CATO, which organises factors into levels with the less abstract factors providing reasons for and against the presence of more abstract factors. It does, however, differ in two ways. First, in Roth's model we can use the method of *a fortiori* reasoning to say which of the more abstract factors apply according to the precedents, whereas in CATO reasoning is done in terms of the basic factors, the role of the abstract factors being to determine when differences in the basic factors present in a case are significant to the overall conclusion. More important is the notion of the *entangled factor hierarchy*, which is, in my opinion, the most significant contribution of this thesis. For Roth, factors may not only provide reasons for and against the presence of a more abstract factor, but may also support and attack the connection between factors. To take an example: in determining pensionable age in the UK, which is over 65 for men and over 60 for women, the sex of the person is significant, but only if the age is greater than 60 but not greater than 65. Thus while gender is a factor, it is not on a par with other factors, since it has impact only for a certain age range. We therefore need to be able to represent that falling outside of this age range renders gender insignificant. The distinction is rather like the distinction between undercutters and rebuttals found in argumentation theories, and is well worth making, so as to capture within the representation the fact that one factor depends on another for its significance.

The most important limitation of the model is a limitation of *a fortiori* reasoning itself. Where the new case offers more dialectical support than the closest negative conclusion but less than the nearest positive conclusion we cannot decide the case. Similarly if the precedents are not well ordered so that the current case offers more dialectical support than some positive precedent but less than some negative precedent, we cannot decide. Arguably this is proper: we might wish to say that such cases cannot be decided by precedents. Such hard cases have, however, been addressed by some other approaches to reasoning with precedents in AI and Law: indeed it is often suggested that such reasoning must be concerned with how we extend precedents to cover cases which are not decided by applying *a fortiori* reasoning. Even if precedents do not give the answer, any answer must be made, in some sense, consistent with the precedents. Moreover, the model takes a cautious approach to *a fortiori* reasoning, in that factors are

compared in terms of set inclusion and there is no attempt to deal with notions of weights or priorities, which again are often an important part of reasoning with precedents. Finally, by dealing with factors (as used in CATO) rather than dimensions (as used in HYPO), the model does not address certain classes of legal argument which often play an important role in the application of precedents. Such concerns, however, take us beyond the scope of this thesis, which aims essentially at providing a formal model of a conception of *a fortiori* reasoning with cases described in terms of factors. This is in itself worthwhile since this is the central case of reasoning with precedents, where precedents can give a unequivocal answer. It is important to understand these clear situations thoroughly before moving on to treat the more ambiguous and contestable uses of precedent. The formal model presented here offers a firm base on which extensions can be built.

The discussion of related systems in Chapter 4 is very interesting and I recommend it to anyone interested in reasoning with cases in AI and Law. This chapter clearly shows the benefits of producing the formal model which provides a clear and explicit perspective from which to discuss these other systems, and enables some important similarities and differences between the various approaches to be highlighted.

Overall the book represents an excellent contribution to the study of case based reasoning in law. It is firmly grounded in previous work and shows awareness of previous contributions throughout. Its contribution is to provide a clear and precise articulation of one view of such reasoning, and deserves consideration by all those working in this area.

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