

Preface

In this book I will study defeasible reasoning. There are many facts of reasoning that are captured under the term defeasible. Sometimes we argue on the basis of typicality, normality, sometimes we make inductive generalizations, etc. We “jump to conclusions” in different ways. It is not my intention to give an exhaustive characterization of all possible forms of defeasible reasoning. Hence I will paradigmatically examine various contexts in which defeasible reasoning is useful, such as default reasoning (Part II), reasoning in the context of argumentation (Part III), and normative reasoning (Part IV).

Still, my perspective is a unificatory one. It is gained by the choice of a specific formal logical framework. With the help of this framework I will develop logical models of forms of defeasible reasoning. The framework is that of *adaptive logics* which originates in the work of Diderik Batens. The standard format of adaptive logics provides a unified characterization of a class of logics that, as will be demonstrated and argued for in this manuscript, are decent tools in order to model defeasible reasoning.

The merits of the study offered in this book are two-fold.

First, it offers a deeper understanding of (forms of) defeasible reasoning. On the one hand, the logics that are introduced in this manuscript deepen our understanding of the formal properties (particular forms) of defeasible inferences, of retracting inferences, etc. On the other hand, formulating them in a unificatory framework offers possibilities to compare them and to identify formal properties they have in common.

Second, the book affirms and substantiates the status of adaptive logics as a generic formal framework for defeasible reasoning. It does so by offering case studies stemming from various contexts of defeasible reasoning. In addition, as will be shown, there are various metatheoretic advantages of adaptive logics compared to many other logics or logical frameworks that model defeasible reasoning.

The Structure of the Book

This book is structured as follows:

In Part I we begin with a general introduction into defeasible reasoning (Chap. 1). After that, adaptive logics (in short, ALs) are introduced (Chap. 2). It is demonstrated that they offer an intuitive and powerful framework to model defeasible reasoning. ALs are discussed in their *standard format*. It is argued that the standard format comes with an attractive meta-theory. In Chap. 3, it is shown how ALs can be combined. Chapter 4 contains joint work with Diderik Batens and Peter Verdée. We argue that ALs offer a transparent model for defeasible reasoning since elegant and intuitive criteria are available to decide whether (extensions of) premise sets are equivalent. Finally, in Chap. 5, it is demonstrated how the standard format can be generalized while keeping its metatheoretic merits intact. This is joint work with Frederik Van De Putte.

Part II contains two applications of ALs in the context of default reasoning. Let $A \rightsquigarrow B$ express that from A normally/usually/typically/etc. (depending on the application) follows B . Note that Modus Ponens is not unrestrictedly valid in such a context. This is due to cases of specificity. Where b stands for “being a bird” and f for “flying”, we have $b \rightsquigarrow f$ (“Birds usually fly”). However, where p stands for “being a penguin”, we also have $(p \wedge b) \rightsquigarrow \neg f$. Now suppose we have both premises, p and b . If Modus Ponens would be valid we would be able to derive both f and $\neg f$. Obviously this is not desired. In Chap. 6, I will propose a defeasible handling of Modus Ponens by means of ALs.

In [1] Lehmann, Magidor and Kraus tackle the question “What does a conditional knowledge base entail?” by means of a sophisticated semantic selection procedure, the so-called *Rational Closure* of a knowledge base. Chapter 7 offers an AL interpretation of Rational Closure. This way we gain a full logic for Rational Closure, one that is equipped with a (dynamic) proof theory. The semantic selection of [1] is very much in the spirit of Shoham’s semantic selections (see e.g., [2]). Hence, the logic developed in Chap. 7 offers a paradigmatic demonstration that ALs are able to represent logics defined by semantic selections in the style of Shoham. This in turn substantiates the claim that ALs offer a very generic and unifying framework for defeasible reasoning.

In Part III, ALs are used for the modeling of argumentations. Dung presented in [3] a highly influential account of abstract argumentation. Arguments are represented as abstract entities and the relationships between arguments are modeled by an attack relation. The two elements define abstract argumentation systems. Dung offered a number of clear and intuitive semantics for selecting arguments from argumentation systems. Chapter 8 presents joint work with Dunja Šešelja in which we develop a unifying AL framework for abstract argumentation. Our family of logics models all the semantics proposed by Dung and moreover provides a dynamic proof-theory for each. In Chap. 9 I generalize the AL framework in accordance with Nielsen and Parsons’ generalization of Dung’s framework [4] in such a way that joint attacks are possible, i.e., attacks in which several arguments

attack several arguments. This paradigmatically presents one of many possible enhancements to the systems introduced in [Chap. 8](#).

Part IV features various applications of ALs in the context of deontic logics. Most of the systems presented in this part are heavily influenced by the work of Lou Goble. One of the main challenges for deontic logicians is to develop systems that are conflict-tolerant. That is to say, logics that do not exhibit explosive behavior when confronted with conflicting norms such as “You’re obliged to bring about *A*” and “You’re obliged to bring about not-*A*”. Goble suggested an attractive way of tackling this problem, namely by restricting the so-called inheritance rule that allows to derive from the obligation to bring about *A* the obligation to bring about *B* in the case in which *A* necessitates *B*. [Chapter 10](#) presents joint work with Joke Meheus and Mathieu Beirlaen in which we point out certain problems with Goble’s systems and improve on them by strengthening them by means of ALs.

The remaining sections in Part IV feature applications in the context of conditional deontic logics. [Chapter 11](#) generalizes and enhances the results of [Chap. 10](#) for the conditional setting. In [Chap. 12](#), I tackle a similar problem as in [Chap. 6](#). The majority of conditional deontic logics does not allow for the factual detachment of conditional obligations. That is to say, given the commitment *A* under the condition *B* and the factual information *B*, in many circumstances it is desired that we derive the ‘actual’ and unconditional obligation to bring about *A*. However, similar as in the context of default reasoning, here we have to deal with cases of specificity as well. Moreover, we also have to take into consideration contrary-to-duty obligations. This motivates a defeasible handling of detachment. It is realized by means of ALs.

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