# Connections between default-assumption and preferential approaches to defeasible reasoning

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## Abstract

Owing to the research program of Artificial Intelligence, in the last decades a big effort has been undertaken in order to develop interesting models of human reasoning by means of logical tools, receiving contributions from various fields, as Philosophy, Mathematics and Computer Science. One of the main problems has been the characterization of defeasible inference, i.e. that kind of inference, modeling common-sense reasoning, in which an agent draws tentative conclusions, using as supplementary information what he maintains as holding in most normal situations. Such conclusions are open to revision in case more complete information about the actual situation becomes available to the agent.

This thesis focusses on defeasible logics (or nonmonotonic logics). In particular we analyze the connection between two of the main approaches to the formalization of defeasible reasoning: the default-assumption and the preferential formalizations. On the basis of such connection we can have a deeper understanding of both approaches, and use the tools provided by each approach to work in the other one.

In the first two chapters the thesis presents the main problems and the main formal approaches to the development of logical models for defeasible reasoning. We briefly present the main proposals in the field of nonmonotonic logics and delineate the consequentialist view to the study of defeasible reasoning, i.e. an approach focused on the analysis of the behaviour of the inference relations generated by the different types of logical systems. In particular,

following the recent literature, we delineate three main views, the default-assumption, preferential and default-rule approaches, distinguished by the kind of formalization used to represent default information (i.e. information about what normally holds).
In the third chapter we show that there is a correspondence between the basic formulations of the three different approaches, in particular stressing a strong connection between the preferential and the default-assumption ones, the former referring to a preference order defined over the set of the semantic valuations of the language, the latter using a set of formulae as background information, to be added to actual information as extra-premises. We shall refer to such a connection all along the thesis.
The fourth chapter is dedicated to a brief presentation of the main results in the study of defeasible reasoning from a consequentialist point of view, presenting the main representation theorems, relating the satisfaction of desirable properties of the inference relations to particular classes of preferential models.

In the fifth chapter we isolate an interesting class of inference relations, weakly rational inference relations, that we shall use in the following chapters, and prove a representation theorem connecting such inference relations to the class of optimal preferential models.
The content of the sixth chapter is directly connected to the correspondence between the default-assumption and the preferential approach: we show how it is possible to use the default-assumption approach in order to build interesting preferential models, defining well-behaved inference relations.
In the seventh chapter we use the correspondence between default-assumption and preferential approaches in order to define in a precise way the behaviour of default formulae, by means of a normality operator. In the end of the chapter we present a generalization of a model of stereotypical reasoning proposed by Lehmann.
In the last chapter we move into the field of belief revision, defining a possible approach to the revision of default information, referring as a starting point

to the main results of the AGM approach, one of the cornerstones in the field.