

Preface

This volume is about Petr Hájek's contribution to Mathematical Fuzzy Logic. Petr Hájek is not only a great scientist, but also a wonderful human being, and hence it is a great honor for me to take care of this volume. However, commenting on his scientific work is not an easy job: although his scientific contribution is by no means limited to Mathematical Fuzzy Logic, his production in this field is so wide and so important that it is almost impossible to present a complete description of it. Hence, when I began to work on the volume, I started doubting about its success. After Petr's monograph *Metamathematics of Fuzzy Logic* and after the various books on Fuzzy Logic, including Gottwald's *A Treatise on Many-Valued Logics*, two more books, one about the work of Petr Hájek, entitled *Witnessed Years*, and one devoted to Mathematical Fuzzy Logic, the *Handbook of Mathematical Fuzzy Logic*, in which Petr is one of the Editors and one of the main authors, have been written. Moreover, when I told Hájek that we were going to write another volume for him, he replied: Too many honors! And although he added no comments to his response, I had the feeling that what he would really need now is not another volume in his honor, but rather some more health for himself and for his wife.

However, I am absolutely convinced that a new volume on Petr Hájek's work will be very useful, if not for himself, at least for the scientific community. Indeed, Petr's influence on the community of Mathematical Fuzzy Logic was simply great, and the best way we have to celebrate him is to continue his work writing good new papers, possibly developing his ideas. The invited authors of this volume are all prominent scientists, and spent many energies to make their papers as good as possible. Moreover, all papers in this volume discuss some problems that have been previously discussed by Petr and offer original contributions to them. These considerations make me optimistic about the success of the volume.

The volume begins with an Introduction, in which Esteva, Godo, Gottwald, and myself present and comment on Hájek's contribution to Mathematical Fuzzy Logic, and by a scientific biography by Haniková. The remainder of the volume is divided into five parts, with a final appendix containing a bibliography of Petr Hájek.

The second part deals with foundations of many-valued logic, and contains three papers, one by Běhounek and Haniková on Arithmetic and Set Theory over many-valued logic, another by Gottwald on theories of Fuzzy Sets, and yet another by Fermüller and Roschger about the connections between Fuzzy Logic and vagueness.

The third part deals with semantics, and consists of three papers. The first one, by Font, is about the semantics of preservation of truth degrees, which is alternative both to the algebraic semantics and to the standard semantics. With this new semantics, validity remains unchanged, but the consequence relation changes in a significant way. The second paper, by Mundici, proposes another alternative to the standard semantics for which the author is able to prove strong standard completeness, a property which fails for the usual standard semantics. The third paper on semantics, by Aguzzoli and Marra, discusses some general semantic principles and characterizes the three main fuzzy logics, Łukasiewicz, Gödel, and product logics, in terms of them.

The fourth part deals with the algebraic aspects of many-valued logics. In this chapter, algebraic tools are used. This part consists of two papers. The first paper, by Dvurečenskij, deals with the connections between many-valued logic and ℓ -groups, and the second paper, by Ledda, Paoli and Tsınakis, deals with another important property of algebras for many-valued logic, namely, prelinearity, and relates varieties of algebras for substructural logics to varieties of algebras for fuzzy logic.

The fifth part contains two papers, one by Bou, Esteva and Godo, and another by Cintula, Horčík and Noguera, and deals with some more recent developments, namely modal fuzzy logics and weak fuzzy logics. Modal fuzzy logics are discussed in one of the last chapters of Hájek's book, *Metamathematics of Fuzzy Logic*, but although the book presents many very interesting general ideas, it does not contain a complete development of this subject, which seems to be left to the future research. The second subject, weak many-valued logics, was begun already in Hájek's book, in which the author proposed BL as the basic fuzzy logic. But after the publication of the book, several weaker fuzzy logics (for instance, the monoidal t-norm-based logic MTL by Esteva and Godo), were investigated, and hence it makes sense to look for the really basic fuzzy logic.

I conclude this Preface by thanking several researchers, without whom this volume would have not existed. First of all, Petr Hájek, the scientist to whom the volume is dedicated; then Daniele Mundici, who suggested the idea for the first time; then, all the authors of the volume, who accepted to present their results here and to devote them to Petr Hájek; finally, special thanks are due to (in alphabetical order) Libor Běhounek, Petr Cintula, Francesc Esteva, Lluís Godo, Siegfried Gottwald, Zuzana Haniková, and Vincenzo Marra, who helped me either to collect the scientific material of Petr Hájek or to improve the format of the volume. In particular, Lluís Godo's assistance with the LaTeX was extremely useful.

All these people deserve special mention, and credits for this volume should be given to them more than to myself.



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