

Preface

With knowledge representation we face more or less the same problem as Augustine (354–430) when thinking about time: if nobody asks what it is, it seems clear enough, but being asked it proves to be very difficult to provide an answer.

At the beginning of our research we thought that a solution for the problem of knowledge representation depends on a solution for the problem of natural language processing. But this was wrongly taken. Our experience with practical applications of grammars developed by linguists has shown that formal grammars, at least those we had access to, cannot capture the full complexity of language. As a consequence of an analysis of our ‘results’ we drew the conclusion that a reason for the fiasco we experienced must reside in the formal, i.e., *static, detached* character of our approach. Natural language and human communication in general are basically dynamic processes. We surmised that the sources for the dynamics of language can be found in two fields: in human information processing and in human communication. We also realized that any modeling of the first requires a theory of cognitive activity, and any understanding of the second needs a theory of signs. As the two fields are torn asunder, in the beginning it was not clear whether it is possible to establish a link between them. It was clear, however, that if we could find a solution for the problem of language interpretation, we would be able to find an answer for the problem of human knowledge representation as well.

This was the situation when we started our research in order to develop a model of knowledge representation that respects the properties of human information processing as well as the properties of signs. Soon we found out that a proper understanding of the relation between the theory of signs and the cognitive model of knowledge representation taken is harder than expected. Similar to experiences with problem solving in other fields, for instance, chemistry, which requires some understanding of the properties of chemical elements, we found that the definition of a model of knowledge representation asks for some understanding of the rules pertaining to the propagation of signs. We had to realize that signs are not some special kind of ‘things’, but consist in complex systems of dependencies.

A promising result of our research is the development of a theory that, in our view, provides an answer to our original problem. Results of various tests and experiments of our theory show that the approach taken could be correct.

About the book

This book consists of three parts. The focus of the first part is on the properties of signs and sign interpretation. This is followed by the second part, in which we introduce a model that complies with the conditions for sign processing set by the first part. In the final, third part we delve into various applications of our model. We concentrate on the presentation of a theory of knowledge representation and illustrate this theory with a number of examples. In order to assess the practical value of our theory, in past research we conducted a couple of experiments in the field of geometrical problem solving (by individuals) and problem elicitation (by a team of participants). Preliminary results of these experiments provide some evidence for a naturalistic interpretation of our model (Draskovic, Couwenberg, & Sarbo, 2010). Earlier presentations of the theory of this book can be found in (Farkas, 2008) and (van Breemen & Sarbo, 2009).¹

About the reader

As for the reader, we assume that (s)he has some interest in human information processing and knowledge modeling in different domains such as natural language, logic, mathematics and reasoning. Natural language is considered in the obvious sense, familiarity with linguistic theories is not required. Sign theoretical concepts are restricted to a manageable subset, which is introduced gently. Some familiarity with basic concepts of propositional and syllogistic logic may be useful.

Readers who would like to make acquaintance with the central ideas only may wish to read the chapters: Introduction, Signs and sign interpretation (Chapter 1), From signs to interpretant (Chapter 2), A world of signs (Chapter 4) and Reflexive Analysis (Chapter 10).

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¹See also www.cs.ru.nl/kif.

Preface

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