

# Preface

This book develops ways of processing linguistic expressions to return what can be described as *meanings*. The linguistic expressions are from a series of related formal languages that capture properties of natural language in a controlled and systematic fashion. They also offer a wide perspective on natural language that is cross-linguistic by nature. While examples are related to the English language, applicability is expected to carry over to other natural languages, unless explicitly noted otherwise.

Much of this book involves presenting formal machinery and then working through consequences. Motivation is found with finding methods that are flexible but constrained to support processing structures close to expected conventional parsings of natural language. To help, computer programs are used to provide “hands on” experience. In fact, the formal definitions are already executable computer programs of the programming language Standard ML.

Having its origins as a meta-language for defining proof tactics in interactive theorem provers, Standard ML provides an excellent choice for implementing linguistic theories. Standard ML is a (mostly) functional language and so provides notation and concepts that are similar to those of mathematics, so much so that the programs of this book are written in a manner nearly identical to the formal mathematical spelling out of the theory, only with the advantage of being quite literally brought to life. While written for clarity rather than efficiency, the programs cope well with large-sized examples. Their simplicity makes them an ideal vehicle for further developments, and the reader is encouraged to experiment with them. They are available on the Internet at <http://www.compling.jp>.

The book is structured as follows:

Chapter 1 introduces predicate languages that are the basis for the formalization of linguistic expressions considered in this book. Preparing the ground for the rest of the book, this chapter defines syntactic trees enriched with the concepts of binding and scope, as well as some associated routines for gathering information, pretty-printing, and post-processing. The chapter also introduces the model theoretic semantics of first-order predicate logic, presenting models, assignments, and a Tarskian satisfaction relation.

The remaining chapters focus on developing the evaluation techniques that underlie the definition of satisfaction, only with limitation to the aim of realizing mechanisms for returning predicate language expressions as representations of meanings derived by evaluation from inputs that are ultimately conventional phrase structure parsings of natural language.

Specifically, Chap. 2 adds an `If` conditional to a recursive routine for evaluating expressions against an assignment function that stores accumulated binding information. Assignments are considered that assign sequences as values, so what is evaluated can be selected based on tests regarding lengths of assigned sequences. This allows for a robust interpretation of unknown lexical items and for feeding an automated regulation of binding information to leave little need for explicitly coding dependencies.

Chapter 3 develops utilizing the assignment as a source of information about the content of the expression under evaluation, with assignments governing where dependencies are located throughout an evaluation. This is achieved with a language that includes fine grained and often interdependent primitive operations of scope manipulation to support processing structures close to expected conventional parsings of natural language.

Chapter 4 describes and illustrates treebank annotation that with modest conversion serves as a syntactic base for feeding the evaluation mechanism of Chap. 3. This achieves a very broad coverage, with examples of passives, adverbial clauses, participial clauses, adjectives, adverbs, floating quantifiers, pronominal binding, covaluation arising because of embedding, *wh*-questions, relative clauses, free relative clauses, comparative clauses, tough movement complements, clause-adjoined relative clauses, phrasal conjunction, speech parentheticals, and nouns of address.

For readers not familiar with Standard ML, a concise summary of the core of the language is provided as an appendix.

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