Preface

This book originates from the desire to summarize some advances in computational linguistics which have been made during the last two decades. Computational linguistics, in the sense developed here, is not simply "natural language processing", but a way of reflecting the fact that language is, in many respects, *computing*. To understand language amounts to applying algorithms which are not only implemented "in the mind", but also given with our whole background as humans living in society, sharing interaction-based knowledge and endowed with a high-level competence in handling symbols. This book therefore mixes several approaches coming from at least three disciplines: linguistics, logic and computer science. If we adopt the idea that logic is a part of mathematics, that also puts this book in this field. In many respects, language is concerned with mathematical structures. This has for instance been emphasized by the mathematician Jim Lambek who wrote, as early as 1958, a seminal paper entitled "The Mathematics of Sentence Structure". Generative grammar also emerged in the 1950s from mathematical reflections on "What is a language?" This aspect has been lost in its more recent evolutions where mathematics is suspected of spurious formalization which brings nothing valuable to the comprehension of language seen as a mental organ. I think it is a pity, since even nowadays biologists examine mathematical theories.

To sum up this book, I could say that it starts from the present state of the art in formal semantics, strongly based on the Fregean paradigm (truth values and compositionality), and then tries to move smoothly towards other views which have been developed recently (even if the "meaning as proof" approach proposed by A. Ranta dates from the early 1990s, and the game semantics approach from the sixties!).

What changes the study of meaning is of course the evolution of logic. I think that it has not been well taken into account yet, and I hope it is an originality of this book to try to make this connection clear.

Let us then recall that in the history of logic, research on the conditions for a theoretical discourse to be coherent and rigorous, mainly initiated by G. Frege, was followed in the mid-twentieth century by a new approach, inspired by the computing revolution, focusing on the study of programs and their transformations. The view, according to which programs could be seen as the proofs of the statements expressing their correctness, made logical formalisms valuable objects of study for computer science. Among such logical frameworks, intuitionistic logic was considered an attractive system because of its constructiveness, which takes the form of a famous correspondence between programs and proofs, known as the Curry–Howard correspondence (Howard, 1980). After this discovery, the possibilities of extending such a correspondence were explored, and denotational semantics began to give more attention to the interpretation of proofs than to the interpretation of formulae.

Around the beginning of the 1990s, it became clear, mainly through the seminal work of A. Ranta based on Martin-Löf's type theory, that the semantics of proofs could provide the foundations for a view on natural language semantics going beyond the simple truth-conditional approach usually taken within the Montagovian tradition. Constructive type theory for instance turned out to be a suitable basis for an account of anaphora in so-called *donkey sentences*. Nevertheless, although the view of a sentence meaning as the set of its proofs allows for more fine-grained distinctions than a strict Fregean conception, it remains a *static* view. *Interaction*, which is the key point of *dialogue*, was still ignored. Pragmatics in type-theoretical frameworks remains concentrated on the agent's judgements, which are viewed as mainly *static*. The frameworks of linear logic and then ludics, developed by Jean-Yves Girard, have provided new ways of thinking about dynamic processes and interaction. In some respects, such an approach converges with previous game-theoretical views such as Hintikka's game-theoretical semantics and Lorenzen's dialogical logic, although it also differs from these in many respects.[1] Game-theoretical semantics (GTS)

[1]Particularly because the aims of these different frameworks are not identical: Lorenzen's dialogical logic was an attempt to show that intuitionistic logic was the most natural logic; Hintikka's GTS is also based on *a priori* rules but mainly aims at providing a basis

has helped us to study linguistic phenomena from a game viewpoint, thus leading to the emergence of a notion of *strategic meaning*, a notion which deserves much attention. Nevertheless, from our viewpoint, it lacks a *dynamical* dimension. As is claimed by Hintikka himself, game moves in GTS must never be seen as sequences of speech acts, but as mere games for "searching and finding". For instance, this theory reflects quite well the mental behaviour of a reader trying to find the reference of some proper name in a text. We could also say that GTS has mainly an *epistemic* perspective, and does not try to reflect the dynamics of the interpretation process. Compared to GTS, ludics is neither based on *a priori* rules, nor on some evaluation procedure which would lead to putting various weights on issues. It aims at showing that rules themselves are determined by more general considerations like *symmetry* and *orthogonality*, that is, *geometrical* considerations, so that it is possible to play with the rules of a game themselves, something important when confronted with dialogue situations.

The possibility of interpreting the same objects in two ways — as proofs, and as strategies in a game — is another important point which emerged with ludics, and allows us to combine the advantages of two approaches covered by this book: the "meaning as proof" theory and the game semantics theory.

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for analyzing knowledge from this viewpoint; ludics is prior to any set of logical rules since it aims at providing new foundations for logic itself.

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