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The Alternative Mathematical Model of Linguistic Semantics and Pragmatics

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Plenum Press, New York – London.
xiii + 204 pages.

Since Plato, meanings are usually conceived of as abstract objects inhabiting a "third realm of being" (additional to the realms of physical things and mental entities). Modern mathematics has provided a tool to get hold of such a realm in a very efficient and very plausible way, namely set theory. All abstract objects are considered as sets; the "third realm" is turned into the realm of conceivable sets and it thus loses much of its previous mysteriousness. This conception of the "third realm" presupposes only the existence of the most ordinary things and the possibility to group them together.

Modern theories of meaning embraced this set-theoretical turn almost universally; and the turn made it possible for modern semantics to make use of the vast apparatus of modern formal logic and mathematics. The first attempts at a set-theoretical capturing of meaning were based on the traditional extensional logic, subsequent theories accepted intensional logic introducing the concept of possible world. Then there appeared such theories as Barwise's and Perry's *situation semantics* or Kamp's *discourse representation theory*, which tried to model meanings by means of very sophisticated set-theoretical constructions.

All these theories accept the concept of set as a more or less unquestioned background – they concentrate on the problem of which particular set-theoretical constructions are to be employed to model meanings of particular expressions and they leave the problems of the underlying set theory for set-theoreticians and philosophers of mathematics. Novák, on the other hand, makes just these problems the central theme of his investigation – he questions the usual tacit assumption that the classical notion of set as developed by Cantor and his followers is capable of underlying an adequate theory of meaning and he proposes the replacement of the traditional concept of set by an alternative one, drawing especially on the ideas of Vopěnka's *alternative set theory* (AST).

The book consists of six chapters.

In Chapter 1, Novák exposes his basic claims and assumptions. He criticizes the usual uncritical acceptance of classical set theory and he outlines the basic tenets of AST and the way this theory can be employed to model meanings in frames of his *alternative model of linguistic semantics and pragmatics* (AML). He articulates the fundamental assumptions of his approach; he stresses that meanings of natural language expressions are "non-sharp" properties and that to model them we cannot make do with sets, but that we rather need semisets as provided by AST.

Next three chapters are devoted to the exposition of the theories which are mostly relevant for AML. In Chapter 2 the author surveys AST as developed by Vopěnka; he lists the axioms of the theory and proves the basic theorems, thus revealing the structure of the universe of sets of AST. In Chapter 3 he shortly outlines the theory underlying the linguistic side of his model, namely the *functional generative description of natural language* (FGD) as proposed by Sgall. Chapter 4 then is devoted to the exposition of fuzzy logic and fuzzy set theory as elaborated especially by Zadeh; Novák shows how the ideas underlying this approach relate to those constituting the basis of AST.

The most important part of the book is constituted by Chapter 5; there Novák presents the core of his AML. His basic assumption is that *lexemes (words) of natural language represent properties of sets, which are graspable as semisets of the extended universe of AML.*

He shows that in contrast to the traditional, Cantorian set theory, AST does not ignore the fact that properties encountered within the natural world are not sharply demarcated; and that the adoption of AST thus allows him to capture those important aspects of meanings which are often considered to be beyond the direct grasp of set-theoretical semantics, namely their essential vagueness and the fact that they rely on prototypes. A natural language expression like 'boat' does not classify things into two sharply distinguished groups, boats and non-boats: there are prototypical boats and there are lots of entities which are sure not to be boats, but there are things (e.g. rafts) that are somewhere in between prototypical boats and sure non-boats. Usual theories of meaning suppress this vagueness (often claiming that it is either neglectable, or directly detrimental to the functioning of language, and that it is hence desirable to suppress it); AST, on the other hand, takes it at face value.

Novák shows how to model the meaning of basic lexical units, namely nouns, adjectives, verbs, adverbs, quantifiers; and he shows how to build meanings of more complex expressions and of sentences out of those of their parts. The meaning of a lexical unit, taken as a stem plus grammatemes specifying the concrete form (in case of a noun, the grammatemes are *number* and *delimitation*), is reconstructed by means of applying set-theoretical operations (corresponding to the grammatemes) to the set-theoretical property (corresponding to the stem of the unit). Thus, the meaning of the lexical unit 'a man' would be the result of the operations corresponding to the grammatemes *sing* (a value of the grammateme *number*) and *indef* (a value of *delimitation*) applied to the class of men. As the operation corresponding to *indef* is the identical function and that corresponding to *sing* is a choice function (outputting an element of the set which is its input), the result is an element of the class of men. In the second half of the chapter, Novák indicates how it is possible to accommodate anaphora, context-dependence and related phenomena within his model; he also gives examples of analyses of simple sentences within AML.

The last chapter of the book discusses the possibilities of the practical application of AML and the possible ways of its further development. Novák concludes that his model is not one which could be directly employed by AI applications; however, he argues that it can nevertheless contribute to the pursuit of a computer model of human communication.

Novák's book clearly shows that AST provides for an adequate capturing of meaning, allowing to take vagueness of natural language at face value. However, this is not the real *novum* of the book – for this much is clear from the writings of Vopěnka. The really original contribution of Novák's book is to how an AST-based model of natural language semantics can be developed in detail; and that the AST-based approach can stand the confrontation with many peculiarities of natural language syntax and semantics. Novák takes a fully-fledged linguistic analysis of syntax of English and shows how it can be extended to the analysis of semantics, taking pains to show how the peculiarities of natural language can be accounted for. The resulting model, AML, yields the explicit formal definition of the syntax-semantics interface.

Certain aspects of Novák's AML suggest questions which are not answered within the book – let us mention at least two. First, Novák does not seem to pay much attention to concurrent trends in formal semantics – it would be surely interesting to see a detailed confrontation of his approach with those based, e.g., on intensional logic, or on the theory of situations. A more concrete example: Novák claims that AST allows to grasp the concept of possible world as an automorphism of the universe. This indeed seems to be an interesting idea, but it is not quite clear how it relates to the notions of possible world common within contemporary formal semantics (e.g. to the notion of possible world as something like a first-order structure). Also many other problems which are usually considered central to contemporary formal semantics are wholly circumvented by Novák.

Second, Novák's general notion of the nature of meaning appears to be rather super-

ficial. The author uncritically accepts the naively-representational conception of meaning maintaining that meanings are images of entities of the outer world within human mind; however, such a commonsense notion of the nature of meaning has been rejected by many of the most outstanding recent theoreticians of meaning (Frege, Wittgenstein etc.) – meaning is what makes an expression capable of serving as a tool of communication and hence has to be something intersubjective, something outside one's mind.

These critical comments are, however, not to diminish the positive qualities of Novák's pioneering work. He clearly shows that AST can serve as an adequate means of reconstructing meanings not only on the general level, but also on the level of confrontation with particular grammatical problems, which must be faced by anyone who would aim at a real formal description, let alone computerization, of language. He clearly points out why his model might lead to a more adequate formal picture of natural language semantics than one based on the Cantorian theory of sets. Moreover, it is also worth noting that in basing AML on FGD Novák accepts the dependency analysis of syntax – an approach to syntax which is usually neglected under the influence of American Chomskian linguistics, but which is traditionally characteristic of European and especially of Czech linguistics and which is in many aspects deeper than the prevailing, Chomskian approach.

All of this makes Novák's book an original contribution to formal semantics.

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