Chapter 1
Introduction

What lies in front of you, the reader, is a monograph appropriately called 'Dynamic Semantics'. After reading it, it will, I hope, be clear to you why it is called so, but before reading it the title may need some clarification. A most obvious interpretation of the term "Dynamic Semantics" may be that it is concerned with a dynamic style of semantic linguistic theorizing. If one would think of this monograph as exhibiting such a type of linguistic theorizing I would be very much flattered, but I don't think I could agree with the qualification, really. The monograph is dull, and intended to be dull. A less likely, but equally inappropriate, interpretation of the title would be that this monograph is concerned with a semantic theory of dynamic objects, like actions, processes, arrows and pop stars. This monograph, and the subjects it covers, are definitely not about that, even though arrows and pop stars, like stamps, numbers, and thoughts, are not excluded from the domains this monograph wants to include in its semantics. But in no way do these dynamic objects figure as primary targets. A more likely interpretation of the title would be that the monograph exemplifies a sort of semantic theory according to which meanings are dynamic. This, as well, is not the correct interpretation, but it deserves some special attention.

There are good, philosophical, linguistic, and computational, reasons for thinking of meanings, whatever they are, as some sort of dynamic entities. Meanings can be conceived of as proofs, or processes, or computations, or patterns, or potentials. There is a whole variety of dynamic objects which, as has been argued for in the literature, constitutes the kinds of things we are concerned with if we talk about meanings. Honestly, I am very sympathetic to these ideas, and I subscribe to them, but this conception of meaning is still not the one intended when I talk about dynamic semantics in this monograph. Such a dynamic conception of meaning will be left untouched throughout this monograph, even though it may, throughout, replace the static conception employed or assumed in the monograph. The monograph is NOT about dynamic meanings, even though you can, if you want, construe it that way.

So, then, what is the dynamic thing about the semantics which this monograph talks about, granted that we have some understanding of the term semantics? I will adopt a very conservative understanding of the term "semantics", which deals with the

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interpretation of "expressions" in some independently motivated domain of "meanings". This assumes an abstract domain of expressions, to be uncovered by some syntactic theory, and a domain of meaning and use, to be covered by a pragmatic theory. The two assumptions are highly controversial, and will also not be left undisputed in the remainder of the monograph, but they are not the target of discussion. They provide a good starting point, if only from the current theoretical linguistic state of the art, and for the moment I would like to leave it at that. The "dynamics" of the semantics in this monograph does not lie in the meanings assigned to well-formed expressions, but, rather, in the composition of these meanings.

In accordance with a very intuitive and well-established tradition, and appropriately attributed to the mathematician and philosopher Gottlob Frege, linguistic constructions are composed of their parts, and so are their meanings. There are various reasons to get bewildered by this quite obvious observation. One of these is the equally obvious observation that the same constituent expression may figure in different compound constructions; another is that one and the same (compound) construction may contain multiple occurrences of one and the same constituent expression. (This does not happen with houses and the bricks they are built from.) This means that, even though we can agree on the idea or the notion of a constituent expression, and of its meaning (provided that we can make sense of these notions anyway) we still can question and discuss the various ways in which an expression with its meaning can combine or conjoin with another constituent expression. What some have labeled the dynamics of natural language, comes down to precisely this dynamic composition, or conjunction, of expressions and their meanings.

Almost all semantic theories are, willingly or unwillingly, dynamic. All theories consciously or inadvertently agree that interpretation is dependent on context, if only on the agent performing the interpretation, or on the language employed. Some may have doubts about the significance of this, and prefer to abstract away from this type of context dependence, but it can hardly be denied that interpretation processes, and co-occurring belief states are essentially indexical. We don't want to go as far as proving that one exists from the premise that one believes, but it surely seems to be a presupposition that a spoken word cannot do without a speaker, that a written word doesn't come without a writer, and that an interpretation requires an interpreter. Some universal features of natural language essentially reflect these facts. It appears that all natural languages have either grammaticalized their personal, spatial and temporal dependence, if they haven't made it part of their default meaning. And also all interpreted formal languages, if fully and appropriately specified in the right handbooks, have to relate their key concepts relative to a language and a model for that language—normally the language with its interpretation *currently* discussed in the handbook. Some things are so essential that they easily go unnoticed.

First and second person pronouns, indexicals or demonstratives, third person pronouns, tenses and temporal adverbs, all display essentially contextual aspects of meaning, which, nevertheless, work in a cross-contextual way. We can quite successfully state the meaning of the Dutch first person pronoun "ik" by saying that it, always, refers to the speaker. This may be many speakers, an in principle unbounded number of them, but it is still one meaning. Yet it appears that "ik" never

means, or should be intended to mean, what "the speaker" means. When I say that it is not surprising that I am short-sighted, for instance because it is not surprising that I am, I do not mean that it is not surprising that the speaker of my utterance is short-sighted, because why should a short-sighted person suddenly say so? Basically the same observations pertain to the temporal reference in Arthur N. Prior's "Thank Goodness that's over." Or to take an example from Peter T. Geach, if everybody thinks that he is clever, so if I think I am clever, and you think you are clever too, and everybody thinks so, then what exactly is the very same thing that everybody is thinking?

The pronouns from natural languages, and the variables from formal languages, share the feature of being so context-driven that they seem to be basically useless. In practice, they are so essential that it is difficult to do without them. It may require some first graduate training to indeed *read* the predicate logical formula "$\exists x(STUx \wedge \neg\exists y(PROy \wedge ADMxy))$" as a way of rendering the meaning of "Some student admires no professor." It takes, it seems, a genius to read Willard van Orman Quine's variable free equivalent $\mathcal{E}(\mathcal{R}(STU \times \mathcal{N}(\mathcal{E}(\mathcal{R}(\mathcal{I}(PRO \times ADM))))))$ the same way. (Quine's rendering only involves a couple of logical operations on the predicates STU, PRO and ADM.) Pronouns, I believe, are not only essential, but also essentially practical.

Historically, the discussion about the dynamic composition of meanings has focused on linguistic constructions with pronominal elements, or with open places, or expressions which are otherwise incomplete. Surely it is easy to make fun of a dynamic semantic enterprise by saying it deals only with pronouns which are words of length 3 ('she') or less ('he', or 'I', or '$\emptyset$'). But once one realizes the 'essential indexical' nature of natural language, as e.g., Saul Kripke, John Perry, David Lewis and recently François Recanati have observed, then the indexical, or referential, or anaphoric potential of expressions is not at all so trivial. The quite obvious fact that one and the same expression, even under one and the same analysis, may have different interpretations in different contexts has far-reaching logical consequences. Aristotle's most beloved syllogism Barbara fails in the presence of pronouns as we will also see in Chap. 2 of this monograph. If we act like those who followed Gottlob Frege, but not like Frege himself, we might blame natural language and its anaphoric devices for being imperfect, and get them out of the way; if we, however, want to live with our situated nature, we may have to face the logical complications of the practical merits of having pronouns. This is what this monograph is about. I hope to show to the reader that even a very superficial analysis of pronouns does complicate our logic, yet does not make it illogical, and that the phenomena do not to force us to change our concept of meaning, even if one may of course find other reasons to do so.

Formally speaking I do little more than the following. In Chap. 2 I extend the architecture of interpretation of predicate logic with a category of pronouns. Why do I do this? In the first place, first order predicate logic is the most minimal, well-behaved and well-studied logical formalism that can be taken to model natural language structures besides those of its logical connectives, or their counterparts. Taking a liberal view on the kinds of things one may quantify over, its expressive power is quite impressive indeed. Adding pronouns essentially means adding context dependence,

context change, and indexical reasoning. The major endeavour in this chapter is to see the logical consequences and practical merits of extending a standard architecture in a systematic and precise way.

The resulting system is dynamic, not because the meanings are dynamic, but because the composition of meanings is dynamic. In the basic system only the propositional conjunction is dynamic, and, as a consequence, the derived notion of implication is dynamic, as well as the ensuing notion of entailment. I will extensively discuss the logical consequences of extending first order predicate logic this way.

The next Chaps. 3 and 4 show that such a conservative and minimal extension paves the ground for generalizations in the same spirit: minimal and conservative. In Chap. 3 the reader will find an account of pronouns in updates of information and a speaker's support for the same kind of information. The extensional architecture from the first chapter is lifted to an intensional one in a fairly standard way, and it automatically generates a first order analysis of content, information and information exchange. One benefit is a fully formalized account of what has become known as "Peirce' Puzzle."

Chapter 4 discusses extensions with generalized quantifiers and first focuses on the dynamic composition of set denoting expressions. The main aim here is to show that, in spite of what is suggested by most rival approaches, no further complications need to arise from such extensions with generalized quantifiers. The so-called dynamics of generalized quantifiers entirely resides in the dynamics of composing meanings, if it resides anywhere, and not in their meanings.

In Chap. 4 also modal expressions are discussed, especially attitudinal operators and epistemic modals. This chapter heavily draws from Maria Aloni's sophisticated use of individual concepts, which are set to use in accounts of puzzles surrounding *Knowing Who*, *de re* knowledge and beliefs, including a treatment of Ortcutt-sentences and also Hob/Nob-examples and similar creatures. The chapter concludes with a classical treatment of modalities and a substantial treatment of (epistemic) modalities in discourse.

In the final Chap. 5 I will try and collect the findings of the previous ones. They are, first and foremost, that not only a Montagovian approach to the meanings of natural language expressions stands up to several challenges leveled against it, implicitly, or explicitly, but moreover that the challenging data brought to the debate are best tackled indeed from the given old-fashioned paradigms. Against all odds, the data can be handled without needing to resort to fancy conceptions of meanings that are dynamic, sentences which denote situations, or pronouns which are variables. A claim that is difficult to make hard and precise, but I hope which this monograph succeeds in communicating, is that the old paradigms even help in formulating the relevant issues more transparently than fancy alternatives do. Again I must qualify the last moral in the sense that I do sincerely believe that dynamic meanings and situations belong to a future we cannot escape from; my only point is that they should be conceptualized properly first.

This book is meant for both graduate students and colleagues working in logic, language and AI. The prerequisites are familiarity with first order predicate logic and

with intensional semantics. How to read (or not read;-) this book? Chap. 2 is crucial for the reader to decide to read or not read further. Most of the topics discussed in the next two chapters can be read independently of each other, but it may hamper the understanding of formal details—though hopefully not of the accompanying prose. Chapter 5 summarizes the findings as they have been alluded to in this introduction.