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# Hand or Hammer? On Formal and Natural Languages in Semantics

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## Introduction

This paper does not deal with the topic of 'the generosity of artificial languages from an Asian or a comparative perspective'. Rather, it is concerned with a particular case taken from a development in the Western tradition, when in the wake of the rise of formal logic at the end of the 19th and the beginning of the 20th century people in philosophy and later in linguistics started to use formal languages in the study of the semantics of natural languages. This undertaking rests on certain philosophical assumptions and instantiates a particular methodology, that we want to examine critically. However, that in itself is still too broad a topic for a single paper, so we will focus on a particular aspect, viz., the distinction between grammatical form and logical form and the crucial role it plays in how the relationship between natural languages and formal languages is understood in this tradition. We will uncover two basic assumptions that underlie the standard view on the

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distinction between grammatical form and logical form, and discuss how they have contributed to the shaping of a particular methodology and a particular view on the status of semantics as a discipline.

But before we turn to the topic at hand, a few more words on the general nature of the investigation are in order. Its general aim is to find out how semantics constructs its object, i.e., we are interested in what semanticists view as the proper object of study, how they think this object can best be approached, and how they view the relations between their own undertaking and neighbouring disciplines that deal with related, or even the same kind of phenomena, such as cognitive psychology, cognitive neuroscience, philosophy, anthropology. The background assumption is that, much like in other disciplines, semantics, too, does not have its object of investigation cut out for itself by nature, but constructs it in a complex process that involves empirical elements ('facts' being already too dangerous a term), philosophical assumptions, and borrowings from other disciplines. Another way of making the same point is to say that meaning, i.e., that what semantics is about, is not a natural kind. There are no brute semantic facts, neatly categorised and structured, waiting 'out there' for semantics to come and describe and explain them. There are certainly empirical elements involved, after all, semantics is about something, but exactly what that is, and what 'being about' means (description, explanation, ... ?) is underdetermined by empirical reality.

In these respects semantics is no exception, as work in the sociology of the natural sciences by Collins, Shapin and Schaffer, Latour, and others has made amply clear.[1] However, semantics seems special in this sense that different semantic theories often conceptualise their object, meaning, in strikingly different ways, often to an extent that the meaning concept of one theory cannot even be reconstructed within another, and vice versa. This appears to be different in other sciences, where strongly opposing theories do seem to share a common understanding of what the enterprise as such is supposed to be about. Elsewhere[2] we have argued that one of the factors involved is a fundamental unclarity about the relation between meaning and interpretation and a neglect of the normative dimension of these concepts. In this paper we will investigate whether this particular feature of semantics might also be due in part to the fact that many of its theories, more often than not implicitly, start from quite specific philosophical assumptions and preconceptions, which give rise to this diversity of meaning concepts. Such assumptions concern the nature of meaning, i.e., the kind of entity that it is, the way it relates to other entities such as information, thoughts, brain states, and the way in which it can be accessed, i.e., who has knowledge of meaning in what way. Together these assumptions produce a particular picture of what semantic data are, i.e., what it is that

[1] Cf., e.g., Collins (1992), Latour (1999).

[2] Cf., Stokhof (2002).

semantics tries to explain and to what kind of observations it may appeal to support a particular explanation.[3]

But it is not just empirical elements and philosophical assumptions that shape semantics, borrowings from other disciplines also play a role. These concern mainly methodology. Like other branches of linguistics, semantics models itself after the sciences. This means it regards itself as being concerned with an objective empirical reality in ways that satisfy what are assumed to be commonly accepted standards regarding objectivity, verifiability, and explanatory power. On that basis semantics also appeals to certain procedures, such as abstracting from irrelevant disturbing factors, and providing explanations in the form of abstract mathematical models. These elements of its self-constitution depend on semantics indeed being an empirical science, just like, say, physics, or neurobiology, i.e., a discipline that studies some part of on an objective empirical reality by means of methods of observations and explanation (and perhaps even, though only rarely, experimentation). As we shall see, there may be reasons to doubt this self-image, since it depends on a particular and questionable view of its main object, viz., meaning.

## Formal and Natural Languages

The topic of the present paper is the use of formal languages in the study of the semantics of natural languages, where particular formal languages are used as a means to provide natural language expressions with their assumed meanings. Formal language meanings are then used as models of natural language meanings. As we shall see, this dominant methodology is associated with the idea that there is a distinction between the logical form and grammatical form of an expression. A particular view of the nature of formal languages and natural languages lies behind this. They are assumed to be similar enough for the former to be a model of (relevant aspects of) the latter, whereas at the same time the difference between the two is such that by using a formal language as a model for a natural languages we actually gain a better understanding of the latter. It is worthwhile to linger a bit and look in somewhat more detail at a simple phenomenological observation that seems to support this perspective.

Speaking and hearing, reading and writing: in these everyday activities our language is usually unproblematic. We use our language and in this use it is completely transparent. It is like a medium in which we move rather than an instrument which we use. And in these activities thinking is included in very much the same way: as an everyday activity thinking seems indistinguishable from language. It is only when something goes wrong that a certain distance appears, that we become aware of our language and our thinking. When we

[3] Two such assumptions, one concerning the nature of the totality of meanings, viz., that it is infinite, the other concerning semantic competence, viz., that it is an individual property, are investigated in Groenendijk and Stokhof (2005).

try to verbalise a new insight or a particular experience, or when we are confronted with some unknown vocabulary. When familiar words and phrases are used in an unexpected way, for example in poetry. Or when due to some external influence, such as a certain type of brain damage, we are no longer in full possession of our verbal capacities. It is at these rough edges of our verbal and cognitive abilities that we become aware of our language as a separate entity, as something that is external to us, independent, as something that we cannot take for granted and that requires an effort on our part. In these respects our language is a bodily phenomenon: language is a part of our body, like our hands. Our hands, too, we use in an unreflective manner, without being aware of what we are doing, until we are confronted with a particularly complicated or unfamiliar task, or when, due to some injury, we lose control over them.

Here our everyday, natural language differs from a formal language, such as the languages used in logic or mathematics, or programming languages. A formal language is also an instrument, but its use lacks the transparency that is so characteristic for that of a natural language. No matter how much of an expert we are in the use of a formal language, it remains always at a distance. We decide to use a formal language, for a specific task, but no such decision seems to underlie our use of natural language. Of course, we can choose to speak a particular natural language, if we have mastered more than one, but that is not the point. Rather, what is at stake here is that we do not decide to use natural language, for example when we want to engage in an everyday conversation: here, there is no gap between the activity and the instrument wielded. Analogously, the use of a formal language does not seem tied to thinking in the intimate way that we observe with natural language. Certainly, we can express thoughts, pose queries, and perform other kinds of cognitive tasks by means of them, but in this case there is a clear distinction between the cognitive and the verbal—the former preceding the latter—which seems to be lacking in the case of natural language. So formal languages are also instruments, but in a different sense. They are more like tools such as a hammer or a pliers, and not like parts of our body.

These intuitions, or pre-theoretic observations, suggest that natural and formal languages are different. Now that seems too obvious an observation to make: of course they are different. Natural languages are natural and formal ones are formal: doesn't that say it all? The point is, however, that besides different they are also the same: they are both language. And for certain purposes, such as semantic description and explanation, people have assumed that natural and formal languages are alike in sufficiently many respects for them to be treated on a par. So the question remains what the relationship between natural and formal languages exactly is, and what justifies the assumption that the latter can be used fruitfully as a model for the former.

In what follows we will try to shed some light on this issue by considering two more or less concrete questions. How is the idea of an 'ideal' formal language, i.e., one that constitutes an improvement of existing natural languages, to be conceived of in the light of these observations? And, what are

we to think of the use of formal languages in the study of natural ones, as is common practice in formal semantics? What we hope to show is that many answers to these questions (in various ways) start from definite philosophical assumptions concerning the relation between language and thought. These assumptions, however, can be questioned, and that might throw a new light on the issue at hand. Notice that what we are after here is primarily an understanding of how semanticists have come adopt the particular view on what semantics is, including the role of formal languages therein. That is why we focus on particular material: on the historical ancestry as people see it, on handbooks and textbooks, because that is where the basic assumptions of a trade are codified.

For similar reasons, the rather 'humdrum' observations made above are not treated as some kind of hard empirical data concerning what formal and natural languages are. Rather, they need to be considered as simple observations about how the various ways of employment of these languages *strike us*. In other words, they are not empirical observations about what languages are, but phenomenological data concerning our way of 'living' with language. Hence they do not force a particular theoretical view on the nature of language on us, and the 'true theory' about that might very well give a completely different account than these observations might lead us to expect. Nevertheless, they do provide some measure of adequacy in this sense that any theoretical explanation should leave room for them. And our intention is to show that some current theories fail on this account.

To conclude a few words on terminology. We will speak of 'natural language' mostly in the singular. Although there are many natural languages, which differ widely in their syntax, morphology and phonology, it is not the variety between them but the unified concept that embraces them that interests us here. A natural language is a language that is 'natural' in at least the following sense: it can be acquired as a first language, and it is used by a community of language users as its primary means of expression and communication. By a 'formal language' we will mean any sufficiently complex and flexible system of expressions that is designed and used for specific purposes: the programming of machines; the formalisation of arguments and proofs; the specification of data structures; and so on. These are still vague descriptions, but they should rule out many other things that we sometimes denote with the term 'language': the language of the body; the language of colour; the language of the bee dance; and so on. For the latter may be symbolic systems in some sense, yet they lack the features of complexity and flexibility. 'Flexibility' indicates that the expressions of a language can be used in different situations, i.e., that they are not strictly tied to one particular entity or event. This type of flexibility presupposes a certain amount of structural complexity: since not all situations can be foreseen, language cannot anticipate them, and hence it has to have certain means that allow us to describe new situations with a limited set of expressions. Again, this is rather vague, but it should suffice for our purposes here.

## The Motivation for Formal Languages

If we look at the roots of modern formal semantics as semanticists see it, we basically need go no further back in time than the development of modern logic in the late 19th and early 20th century. That development itself, of course, has many roots in a variety of earlier developments, as exemplified in the work of people like Leibniz, Boole, De Morgan, Bolzano, and many others. But in outlining the canonical history of their trade, semanticists usually confine themselves to Frege, Russell and a few others.[4] In this period formal logic made great progress and also attracted the attention from philosophers with an interest in natural language, including some of the pioneers, such as Frege himself, the idea being that one could use techniques and concepts from formal logic in the analysis of natural language. There is a certain irony in this, since the progress that was made in logic was based on a distinction between formal language and natural language. Frege had managed to solve some obstinate problems in the analysis of relational judgements involving multiple quantified arguments by making a difference between the grammatical form of a judgement and its assumed logical form and by devising a formal notation that allowed him to treat that logical form in a precise manner. The success of that then spurned an interest in applying the same method to natural language. So right from the start there is a curious tension present in these efforts. Formal languages and natural languages are different, yet sufficient alike. And this tension expresses itself in a complicated view on how the two are related.

Basically, in the present historical perspective three different positions can be distinguished, which, to complicate things further, can often be found expressed by the same author, regarding the relation of a formal language to a natural one. It can be viewed as an *extension* of it, as an *improvement*, or as a *reform*. Let us first give a brief characterisation of each of these three positions, before turning to examples from the literature that exemplify them.

If one regards a formal language as an extension of a natural language, then one takes the former to extend the expressive power of the latter: there being things that cannot be expressed in the natural language, one defines a formal one that does allow for these things to be expressed. Potential examples of such extensions that might spring to mind are the extension of natural language with various kinds of symbolic systems, such as the calculus, or the periodic system. This first position sounds simple enough, but, as we shall see, it makes some rather complicated assumptions.

The second position, which regards a formal language as providing an improvement over a natural one, holds that there is something that, in principle, can be done using a natural language, but that is done better, or more easily, using a formal one. In this case there is an implicit or explicit reference to some kind of standard, such as precision, or efficiency, to which both

[4] Cf., Stokhof (to appear) for a detailed examination of the relation between formal semantics and the work of early Wittgenstein.

languages can be held and the results compared. Notation for simple arithmetic might serve as an example of such an improvement.

Finally, the third position is that formal languages are needed as reforms of natural ones, where a reform is thought of as an extensive overhaul of whatever is found lacking in a natural language in terms of precision, completeness, perspicuity and the like. This is the most far reaching position, one that is often expressed in terms the concept of an 'ideal language', with the formal language considered to be at least closer to that ideal than the natural language being reformed. This position is often motivated by listing principled defects of natural languages, i.e., properties that are found both intrinsic to it and necessary to overcome.

Although these three positions seem to range from modest to far-reaching, the more interesting division is between the first and the third on the one hand, and the second on the other. One could say that the second one is relatively 'innocent' as it instantiates a 'merely' pragmatic, instrumentalist concern: here one uses a formal language solely because it is a better tool in certain circumstances, no more, no less. The first and third positions, on the other hand, are 'ideological': they assume that natural language has an intrinsic defect, something it cannot do, or cannot do in a certain way, for principled reasons. These positions are also much stronger in that they assume that we are able to observe these defects, for example, that we are able to note that there is something that the natural language cannot express. Hence, these views seem to assume that we have access to thought that is not mediated by natural language, which is a strong assumption indeed. The formal language then becomes a norm, one that the natural language should meet, but fails to.

To a modern reader the ideas expressed in these positions may seem somewhat strange and removed from how we look at natural language and its role in philosophy today. Surely, one would be hard pressed to find philosophers explicitly subscribing to any of these views. But, as we hope to show in what follows, some elements survive in present day semantic theories, in particular in the form of two basic assumptions about the nature of meaning.

So let us now turn to the literature and see what views on the relationship between formal languages and natural languages are expressed there. In line with the nature of our investigation we will be looking primarily at the kind of writings that are used to define the trade: the canonical historical works, textbooks, handbooks, and the like. Frege's *Begriffsschrift* of 1879 belongs to the first category.[5] In this small work Frege not only gives one of the first

[5] In similar fashion, what follows is not an exercise in Frege-exegesis that attempts to sketch an historically correct picture of his ideas, but rather a 'pop Frege', i.e., an account of the reception of some key concepts and ideas in contemporary philosophy and semantics. In particular, Frege certainly was not the first philosopher to draw attention to the deficiencies of natural language vis à vis the expression of thought. In fact this is a stock complaint with many philosophers in the (later) modern tradition. But Frege was the one who inspired the tradition that we are interested here, and he did have one advantage over his predecessors: he had a powerful, well-defined formal language to back up his claims.

explicit formulations of modern quantificational logic, he also motivates the use of his 'ideography' in more general terms. Cf., the following passage from the introduction:

> ... I found the inadequacy of language to be an obstacle; no matter how unwieldy the expressions I was ready to accept, I was less and less able, as the relations became more complex, to attain the precision that my purpose required. This deficiency led me to the idea of the present ideography.[6]

The 'purpose' which Frege refers to in this passage is that of providing explicit and complete proof representations, i.e., representations in which each step in a proof is accounted for in an unambiguous manner. He deems the construction of a formal language necessary for this since natural language is inadequate ('unzulänglich') because it lacks the precision that he needs. Natural language, he writes in 'Über die wissenschaftliche Berechtigung einer Begriffsschrift' of 1882[7] although necessary for the complex mental life that is characteristic for humans, nevertheless 'proves to be lacking when it comes to preventing errors in thought'. Ambiguity is one obstacle to this, since it makes us miss logical distinctions, that are essential for determining the validity of arguments.[8] Another deficiency is a lack of explicitness: arguments presented in natural language usually depend on a large number of hidden assumptions and implicit steps, that, moreover, cannot be made explicit since this would go against our 'feeling for language' inasmuch as it would lead to an 'intolerable long-windedness'. Hence, Frege concludes, 'logical relations are only merely indicated in language, left to guesswork, never really expressed'.

This emphasis on the inadequacy of natural language, as a motivation for the use of a formal language that lacks the offending characteristics, places Frege squarely in the ideological camp: for him the replacement of natural language by a formal language is not a matter of convenience, but of necessity: natural language simply won't do for his purposes.

The ideological point of view raises an interesting question: how do we know that a certain form of expression is inadequate? That we cannot express what we want in an adequate way, or perhaps even not all? Apparently, we are able to make such normative judgements, otherwise the idea of inadequacy would not arise with respect to natural language in the first place. It appears there is an assumption at work here, which is the following:

[6] Frege (1879, pp. 5–6). Page references are to the English translation in van Heijenoort (1970).

[7] Cf., Frege (1882); English translation in Frege (1964).

[8] One example Frege gives is that between an individual object and the species to which it belongs, which both are indicated by means of the same phrase, as for example in 'A horse is a grass-eating animal' and 'This is a horse', where the same phrase functions in logically completely different ways.

***Availability Assumption***
*Thoughts/meanings are accessible independent from language*

This is what Frege assumes when he reasons the way he does: there is something that he wants to express, some thought, that he cannot express in natural language; that conclusion is reached on the basis of access to the thought in question that is independent of its failed natural language expression; for only because of that can it serve as a normative criterion for the adequacy of its own expression. Mutatis mutandis the same applies in the case where the expression in natural language is adequate; here too, the judgement that it is, must rely on a comparison between the thought itself and the expression, and hence on availability of the thought that is independent from language.

In similar fashion, the search for an adequate expression in some formal language relies on the very same possibility. If we are looking for an unambiguous and complete expression of some thought, or piece of reasoning, and want to investigate whether certain formal expressions are adequate, we must be able to grasp the thought or reasoning in question independent from the formal language in order to make the comparison. Notice that in such a situation we cannot assume that the thought comes in the form of its natural language expression, for, by hypothesis, that is failed, and hence cannot serve as an adequacy criterion.

So, Frege, and anyone who motivates the use of formal languages in terms of inadequacies of natural ones, relies on this strong assumption, that thoughts are accessible independently from any form of linguistic expression.[9]

Of course, the acknowledgement of the need of a formal language raises the question what the relationship between such a language and natural language actually is, and Frege answers that question almost immediately after he introduces the notion of his ideography:[10]

> I believe that I can best make the relation between my ideography to ordinary language [‘Sprache des Lebens’] clear if I compare it to that which the microscope has to the eye. Because the range of its possible uses and the versatility with which it can adapt to the most diverse circumstances, the eye is far superior to the microscope. Considered as an optical instrument, to be sure, it exhibits many imperfections, which ordinarily remain unnoticed only on account of its intimate connection with our mental life. But, as soon as scientific goals demand great

[9] Unless of course, we appeal to some language of thought, which then by hypothesis must be unambiguous, completely perspicuous, et cetera, in short, one that is ideal. But this raises more questions than it answers: if we can access thought in such ideal form, why do natural languages sometimes fail? and why do we have such trouble finding the proper formal language? But it is a possibility that cannot be ruled out (yet). But although it does limit the Availability Assumption, it does so to precisely the cases that interest us in the first place: natural and formal languages. The appeal to a hypothetical language of thought does not change the fact that with respect to these kinds of languages thoughts are assumed to be independently available.

[10] Cf., Frege (1879, p. 6).

> sharpness of resolution, the eye proves to be insufficient. The microscope, on the other hand, is perfectly suited to precisely such goals, but that is just why it is useless for all others.

There are a number of things that need to be noted in this passage. First of all, Frege here hints at a crucial element in the discussion, viz., why we need to be told that we need a formal language, why its invention is a discovery, a step forward. The reason resides in natural language's 'intimate connection with our mental life'. Apparently, natural language has a more than purely instrumental expressive relationship with human thought: the relationship between the two is so tight that we do not recognise the inadequacies of natural language with respect to the very same thinking process and its contents. Whether or not this provides a reasonable explanation of our lack of awareness remains to be seen. But note that it introduces a problem of its own, for if the relation is that intimate, how exactly is it that we can come to be aware of natural language's weak points in the first place?

Second, the famous comparison of natural language to the eye—versatile and adaptable, but imperfect in certain ways—, and that of formal language to a microscope—up to the task, but to one task only—could suggest a purely instrumental view on the relationship between the two, a division of labour according to which each instrument is assigned its own set of tasks. However, also note the ideological overtones in the wording, natural language exhibits 'imperfections', which seems to refer to some independent standards that it fails to meet. These may be only relevant to certain purposes, as this particular comparison suggest, but that only means that the ideological point of view can be 'modest' in the sense of relative to a certain purpose. But even so, it is still fundamentally different from the non-ideological, pragmatic view.

In fact, as the next quotation, still from the same preface to *Begriffsschrift* illustrates, Frege seems to subscribe to the strong form of ideological motivation, the one that preaches not just improvement, but actual replacement:[11]

> If it is one of the tasks of philosophy to break the domination of the word over the human spirit by laying bare the misconceptions that through the use of language almost unavoidably arise concerning the relations between concepts and by freeing thought from that with which only the means of expression of ordinary language, constituted as they are, saddle it, then my ideography, further developed for these purposes, can become a useful tool for the philosopher. To be sure, it too will fail to reproduce ideas in a pure form, and this is probably inevitable when ideas are represented by concrete means; but, on the one hand, we can restrict the discrepancies to those that are unavoidable and harmless, and, on the other, the fact that they are of a completely different kind from those peculiar to ordinary language already affords protection against the specific influence that a particular means of expression might exercise.

[11] Cf., Frege (1879, p. 7).

This is a clear expression of the ideological, reformist stance. Chiming in with the common complaint that what stands in the way of true philosophical insight is the hold of language over thought, Frege once more asserts that natural language leads to misconceptions and that therefore the human mind needs to be freed. The turn to formal language is what will allow us to achieve this, if only partly. For, to be sure, formal languages will not solve all problems automatically, they will contribute their share of misrepresentations, but these are somehow under our control and therefore 'harmless'.

The crucial question is, of course, how we have access to this ideal, how we know in what way to set up a formal language in order to ensure that we can restrict its discrepancies vis à vis the reproduction of ideas in 'pure form' to those 'that are unavoidable and harmless'. And the answer surely must rely on the Availability Assumption: somehow we have to be able to contemplate thoughts in their pure form and compare that to the expression given by them in some candidate formal language, much as we must be able to compare them to their natural language expressions in order to note the distortions and misconceptions these give rise to.

At this point we must note a certain ambivalence in Frege's position. On the one hand natural language is assumed to be so closely and intimately related to human thought that misconceptions arise 'almost unavoidably' due to the inherent inadequacies of natural language, thus pressing the need for reform. On the other hand, we are able to recognise these inadequacies, in the first instance using nothing but natural language, so why is a reform in the guise of the construction and use of a formal alternative needed? To make the same point differently, Frege clearly assumes that we somehow can construct adequacy criteria for formal languages that are yet to be constructed, i.e., in advance of their actual availability. But if natural language is as hopelessly inadequate as it is made to look, how is that possible?[12] So it seems that Frege's position is actually rather a predicament:

***Frege's Predicament***
*The Availability Assumption is incompatible with reform*

It seems not even Frege can have his cake and eat it too. Either we have access to thought independent of language but then there is no need for reform, although there might be room for improvement, but that is a different issue. Or the relationship between natural language and thought is as intimate as suggested in the motivation of the reformist position, but then we cannot state what the reform should be.

[12] Here it would also be relevant to examine the purported inadequacies of natural language in slightly more detail. Unfortunately, we cannot do so here, but we are confident that such an investigation would show that the misconceptions that natural languages give rise to are not very shocking (the ambiguity of the verb 'is' as and expression of identity and of existence and as a copula, is one of the stock examples) and often were already recognised and dealt with long before the advent of the kind of formal languages that Frege has in mind.

Another example of someone who might be running into this problem is Russell. In *Our Knowledge of the External World*[13] he writes:

> Some kind of knowledge of logical forms, though with most people it is not explicit, is involved in all understanding of discourse. It is the business of philosophical logic to extract this knowledge from its concrete integuments, and to render it explicit and pure.

The assumption that we have 'knowledge of logical forms' reflects the Availability Assumption formulated above. The idea that this knowledge must be rendered 'explicit and pure' bespeaks a reformist attitude: apparently, this is not how it is expressed in natural language. But then the same problem arises as in Frege's case: why would it need to be reformulated in a formal language if it is accessible, if only with a little help from philosophy?

Note that this a predicament, not a genuine dilemma, for there is a way out, and that way out is actually quite simple. In his preface to the *Tractatus*[14] Wittgenstein states a view that is is crucially different. Referring to the problems that philosophy deals with he says that 'the reasons why these problems are posed is that the logic of our language is misunderstood'. This squarely puts the blame on us, not on language. Apparently, natural language does not fail us, we fail it, by lacking a correct insight into its workings.

Wittgenstein was well aware that his view differed from that of Frege and Russell. In the *Notebooks 1914–1916,*[15] in an entry dated 02/09/1914, he indicates this clearly when he enters the following remark:

> Frege says: Every well-formed expression must have meaning, and I say: Every possible sentence is well-formed, and if it does not have meaning that can only be because we have not assigned a reference to certain parts of it. Even if we believe that we have done so.

The sentiment expressed here is the same as the one we noticed in the preface of the *Tractatus*: it is in the use that we make of natural language that things go wrong, which means that it is not the language as such that is at fault, but that we rather have to blame ourselves, for not 'getting' its logic. To be sure, Wittgenstein does acknowledge that natural language plays a role in the occurrence of these misunderstandings. But this is because its logic is not apparent, not because it lacks any. So, there are discrepancies between grammatical form and logical form that are conducive to these misunderstandings,[16] but these discrepancies are a matter of expression, not existence. Natural language is 'alright', Wittgenstein states, in the sense that it has the logic that it has, and that logic does not stand in need of any extension or

[13] Cf., Russell (1914).

[14] Cf., Wittgenstein (1961).

[15] Cf., Wittgenstein (1979).

[16] Cf., *Tractatus* 4.0031, where Wittgenstein credits Russell for drawing attention to this fact.

reform.[17] It is just that its surface grammatical form is designed for other purposes than that of exhibiting this logic in a perspicuous way. Natural languages are means of communication, and hence their surface forms are shaped according to the requirements that being employed as such a means brings along.[18] Consequently, logical analysis is needed to make this logical form explicit and a formal language is used to perform this task. Logical analysis does not construct a logical form that is missing, but uncovers one that is already there and gives it a completely perspicuous representation. This actually gives us a fourth view on the relation between natural language and formal language, in addition to the three distinguished above: formal languages are used as a means to lay open to view the logic that is inherent and complete in natural language, but not in an immediately transparent way. This view has not been very influential in the history of semantics, so it will not play a central role in the following sections. But we will have a chance to get back to it at the end of the paper.

As the above examples have illustrated, the way in which philosophers and logicians advocated the use of formal languages at the end of the 19th, beginning of the 20th century displays a firm conviction that the surface form of a natural language expression, its 'grammatical form', can be misleading as to what the proper representation of its semantic status or its role in an argument or inference is, or should be, as the case may be. Such a proper representation, its 'logical form', then has to be uncovered, or constructed, using a formal language. Thus two concepts become more or less intrinsically interwoven: the distinction between grammatical form and logical form, and the use of formal languages as representation medium of the latter. Together these two have deeply influenced the way in which philosophers and logicians have approached natural language, and have shaped important aspects of formal semantics as it developed in the late sixties, early seventies. In the following sections we will discuss a few representative examples that testify to this influence.

## Philosophy and Logic

The distinction between grammatical form and logical form has become one of the mainstays of 20th century analytic philosophy. Its influence is ubiquitous, it is a stock item in almost all philosophy introductory texts, and continues to play a role in philosophical research. It is usually connected with Russell, especially with his analysis of definite description in 'On Denoting', a paper that is discussed in practically every introductory textbook that deals with philosophy of language, logic or epistemology, and that is standard issue

[17] Cf., *Tractatus* 5.5563: 'All the sentences of our every day language are actually, the way they are, logically well-ordered'.

[18] Cf., *Tractatus* 4.002: 'Language dresses up thought, and in such a way that one cannot infer the form of the dressed-up thought from the outward form of the dress. For the outward form of the dress is shaped for completely different purposes than revealing the form of the body'.

in most readers of classical philosophical texts.[19] Cf., the following, illustrative quotation from a paper by Robert May:[20]

> On classical uses of the term logical form, as we find it in the grand tradition stemming from Frege, Russell, Wittgenstein, Tarski, Carnap, Quine, etc, there is a type of form which is distinct from logical form, namely grammatical form. In the classic example of Russell's Theory of Descriptions, the simple subject-predicate grammatical form of 'The present King of France is bald' cannot be its logical form, for if it were incorrect inferences would follow. Rather, through the method of contextual definition, the grammatical form can be 'translated' into another form, its logical form . . . from which the correct inferences follow.

Note that the Availability Assumption is operative here as well: independent of the grammatical form of sentences containing definite descriptions, such as 'The present King of France is bald', we are assumed to be able to determine what would and what would not constitute a correct inference. We can inspect such a sentence, determine what could be inferred from it and then judge these putative inferences on their correctness independently from the form in which the sentence presents itself. For only if we are able to do that can we state that this is a correct inference but that is not, and then look for a proper logical form that only allows all of the former but none of the latter. So there is a sense in which the 'proper' meaning, i.e., the one that determines the correct inferences, is somehow available, independent from the grammatical form.

Interestingly, May characterises the logical form of a sentence as 'its logical form', which suggests that having a particular, determinate logical form is actually a property of the sentence in question. This reinforces the presence of the Availability Assumption: both grammatical form and logical form are considered to be properties of an entity, the sentence itself, that is more abstract and that somehow determines its forms. Presumably this is also why May calls the transformation of the grammatical form of the sentence into its logical form a 'translation', which is actually a rather awkward phrase to use: the transformation really should change the semantic and logical properties, otherwise there would be no point in making it in the first place, but then it is hardly a translation in any conventional sense of the term.

Actually, this looks like Frege's predicament all over again. Either the transformation from grammatical form to logical is a real translation, i.e., a transformation 'salva significatione'. Then the question is how the first form but not the second can give rise to incorrect inferences. Or the transformation really changes the meaning, but then the question is what independent criterion we have for picking one rather than another transformation.

This points in a certain direction, viz., that the distinction between grammatical form and logical form, when it comes to *particular* logical forms, is not an empirical fact of the matter, but an issue that is intra-theoretical. That

[19] Cf., Russell (1905).

[20] Cf., May (1998).

would explain the ongoing debate about the proper analysis of definite descriptions, to some extent: everybody accepts the distinction between grammatical form and logical form that Russell's analysis relies on, but controversy about what that logical form is, and whether it is a matter of semantics proper or whether pragmatics has a role to play, are all (still) heavily debated issues.

Although Russell's theory of descriptions started out as part of philosophical theory (about epistemological and ontological issues), currently the debate is conducted on the interface between philosophy and linguistics, and draws contributions from both fields. In fact, according to some this is an instance of a more general developmental process, during which philosophy has 'given birth' to specialised disciplines. Cf., the following quotation from a fairly recent introductory text in philosophy of language by Peter Ludlow:[21]

> The philosophy of language, or at least a core part of it, has matured to the point where it is now being spun off into linguistic theory.

According to Ludlow, philosophy of language has developed into a state in which it depends on empirical data and theoretical insights from descriptive and theoretical linguistics, thus 'naturalising' another part of philosophy, just like physics, cosmology, psychology, sociology and other disciplines have in the past. Of course, whether this actually makes a difference depends, among other things, on how much of an empirical science linguistics itself is. As the present paper aims to argue, this may hold for some parts of linguistics, such as typology, or phonetics, but it is not altogether obvious that it also holds for semantics, which arguably still depends on (too?) many philosophically contestable assumptions. The Availability Assumption is a case in point.

Let us turn to another discipline in which the distinction between grammatical form and logical form is heavily used, viz., logic. Cf., the following quotation from a well-known and widely used text book in general logic, by Moore and Parker:[22]

> The first significant work in analysing and operating on claims with truth-functional logic is the work of translating them into symbolic form. Ultimately there is no substitute for a careful examination of what the claims are saying. Translating a compound claim into symbolic form means making its internal logical relations clear and precise. Because ordinary language often gives us compounds with implied or submerged logical relations, we have to begin by making sure we know what they mean. Especially with claims involving conditionals, a few rules speed up the process. When 'if' appears by itself, what follows is the antecedent of the conditional. When 'only if' appears as a phrase, what follows is the consequent of the conditional. The placement of clauses in a sentence is not a reliable guide to their placement in a conditional. (Logical form often departs from grammatical form.)

[21] Cf., Ludlow (1997).

[22] Cf., Moore and Parker (2005).

In this type of general logic, where application to arguments and reasoning conducted in natural language plays an important role, the distinction between the grammatical form of judgements and their logical form, is also a stock item. And as before, grammatical form is associated with expression in natural language and logical form with representation in a formal language. In fact, discrepancies between grammatical form and logical form ('Logical form often departs from grammatical form') are used to motivate the use of the formal languages of propositional or first order logic. In that respect, logic textbooks often stay remarkably close to Frege's original intention with his ideography. But there is a difference, too. Where, as we saw, Frege's main motivation turned out to be ideological, standard introductions to logic remain rather neutral in that respect, and take a more 'technical', pragmatic stance. In general, it is concluded, natural language expressions are not perspicuous, at least not with respect to those features that are relevant for reasoning, and in some cases they may be even be misleading

If one examines a number of textbooks, entries in encyclopedias, and other didactic material, which are a prime source for finding out the assumptions with respect to language and thought behind the common understanding of what logic is all about, then something like the following pattern emerges. The premises one starts from are the following. First of all, logic is introduced as the study of (validity of) reasoning, of what makes an argument logically compelling (or fails to do so). Second, it is observed that, for better or worse, most of our reasoning is done in natural language, that the premises and conclusions of arguments consist of natural language sentences, or small pieces of natural language discourse. The first point is definitory, the second a truism. The third premise, however, usually takes a bit of 'convincing', in that it makes a point that is not altogether obvious, viz., that the validity of reasoning depends on very specific features of natural language expressions of arguments, to wit a small stock of logical constants and operations (connectives, quantifying expressions, temporal expressions, and the like). The conclusion then is that we need to bring our those relevant features and disregard the ones that do not matter, and then it is usually a small step to introduce the use of a formal language. This conclusion is then reinforced by such observations as are made in the quotation above, concerning ambiguity, vagueness, and other features illustrating the 'unsystematic' nature of natural language.[23]

What should be noted is that the entire picture hinges on the reference to 'logical constants'. For this ties the subject mater of the enterprise to a particular choice of invariants over the whole of the meanings of natural language expressions. As such this is not objectionable, of course. Natural language meanings are very rich and very complex, and any systematic study would need to focus on specific aspects. Evidently, the particular choice that logic makes is rewarding in that is lays bare a substantial and important field of

[23] An additional, questionable assumption in many logic textbooks is that logic is basically a uniform concept: logic is classical first order logic. Other logical systems are either not discussed at all, or treated as variations that are measured against the standard that classical first order logic represents.

study. However, we would do well to keep in mind that it is a choice, a well-motivated one, but a choice nevertheless, not an empirical given. It is a choice that represents an interest in particular aspects of meaning, and as such it is historically and culturally contingent. This is also apparent from the fact that when it comes to logic in this sense, we can observe many historical and cultural differences. One example is given by classical Chinese philosophy, which displays a general lack of concern when it comes to the type of formal validity that modern logic in the Western tradition is so deeply concerned with.

In the present context the observation just made is important because it serves as a reminder that the distinction between grammatical form and logical form is not only intra-theoretical as to its content, as we saw above, but also contingent as such. In logic it arises from a focus on particular aspects of meaning, that are central to the concerns of logic, but may not be all that important if we are interested in other aspects of natural language meaning.

The presence of the Availability Assumption is obvious, and should no longer come as a surprise. In principle we are able to determine the features that are relevant for the validity of a piece of natural language reasoning independently from grammatical form, and judge the adequacy of the latter, its 'faithfulness' to true logical form, as such. The outcome then determines the next move, i.e., the representation of the logical form in a formal language.

So there is a standard that we can apply to the natural language expressions, allowing us to gauge their performance with regard to the task at hand and to come up with determinate formal representations that adequately represent the relevant features. This means that, beside Availability, there yet another assumption at work here:

***Determinacy Assumption***
*Thoughts/meanings are determinate, prior to their expression in language*

This says that what we can access, on the basis of the Availability Assumption, is in itself definite and determinate, it is what it is and in virtue of that can guide us to proper representations, true logical forms. One could say that Availability is (mainly) an epistemological assumption, in that it concerns what we are able to come to know. Determinacy is the ontological counterpart, in that it states something about the nature of what it is that we access: these are objects that have an independent existence and that because of that independence can play the role that we assign to them, viz., that of determining logical form. The two assumptions, Availability and Determinacy, are correlated, of course, but in principle independent.[24]

[24] An example of the Determinacy Assumption without Availability, or at least one in which the former is omnipresent, but the latter is clearly downplayed, might be provided by the *Tractatus*. Wittgenstein has no interest in epistemological issues, but the ontology he works with is determinate in principle: logical space as the totality of all possible meanings functions in his system as the 'rock bottom' of all analysis.

## Semantics

Let us now turn to the area we are interested in here, that of semantics as part of linguistics. In so far as linguistics is concerned with the empirical study of natural languages, one might expect that a distinction such as that between grammatical form and logical form, and the use of formal languages as means of representation that is based on it, are motivated with reference to empirical observations, i.e., by an appeal to independent empirical facts. However, as we shall see, certain philosophical assumptions continue to play a role, in a way that compromises the purported empirical status of semantics.

An illustration of the mixture of motivations that are given for the distinction between grammatical form and logical form is the following quotation of an encyclopedia article entitled 'Logical form in linguistics' by Robert May:[25]

> The logical form of a sentence (or utterance) is a formal representation of its logical structure; that is, of the structure which is relevant to specifying its logical role and properties. There are a number of (interrelated) reasons for giving a rendering of a sentence's logical form. Among them is to obtain proper inferences (which otherwise would not follow; cf. Russell's theory of descriptions), to give the proper form for the determination of truth conditions (e.g., Tarski's method of truth and satisfaction as applied to quantification), to show those aspects of a sentence's meaning which follow from the logical role of certain terms (and not from the lexical meaning of words; cf. the truth functional account of conjunction), and to formalise or regiment the language in order to show that it has certain meta-logical properties (e.g., that it is free of paradox, or that there is a sound proof procedure).

The concept of the logical form of a sentence is introduced here as a factual matter, as the representation of something that is an actual aspect or property of a sentence, viz., its logical structure, which is also characterised in factual terms, via a reference to the logical role it plays and the logical properties it has, as a matter of fact. However, some of the reasons given for the use of the concept are of a subtly different nature. The first one, with its reference to Russell's theory of descriptions, stays very close to the kind of motivation we have met above in connection with philosophical arguments for the distinction between grammatical form and logical form. The second one is perhaps of a more pragmatic nature, in that it introduces logical forms as a necessary prerequisite for the application of a particular kind of semantic theory. The same holds for the third, which is essentially the same kind of motivation we saw in connection with logic: logical form allows us to focus on particular aspects of meaning. To be sure, both may also involve non-empirical considerations. And the last reason that is given clearly displays a reformist view:

[25] Cf., May (1999).

the idea of regimentation of natural language is closely associated with that of its inadequacy.

So there is a definite tension between the factual manner in which the concept of logical form is introduced and the reasons that are given for its employment in semantics. 'To obtain proper inferences (which otherwise would not follow)' strongly suggests that the grammatical form of a sentence fails to give an account of inferential relations which should obtain. Both Availability and Determinacy are operative here: apparently we have access to all the inferences that should obtain, and we can use them as a standard, both to judge the adequacy of grammatical form, which fails in certain cases, and to determine the proper logical form, which is then needed for a proper account. As we shall see, this implies that semantics uses a particular methodology. Also, in as much as this view entails that in some cases grammatical form fails and logical form succeeds in accounting for particular facts, this view is distinct from a merely pragmatic one, according to which a sentence has the logical properties it has, and logical form is merely a more perspicuous representation of said properties than grammatical form. A lack of perspicuity of the way in which grammatical form accounts for the inferential properties of a sentence is evidently not the same as a failure to account for some of them. So it seems that not only the distinction between grammatical form and logical form is taken over in semantics from the logical and philosophical tradition but also part of its motivation.

Things are slightly different when we turn to a second kind of use that is made of the distinction, which is to motivate the application of formal languages in natural language semantics. The idea is that we can use the semantics of a suitable formal language to specify the meaning of natural language expressions by means of a translation of the latter into expressions of the former. This indirect way of specifying the semantics of a natural language is a very common methodology in many varieties of formal semantics.[26]

Again we introduce the issue with a quotation from a textbook, as such sources are often the best displays of commonly held views. The following passage comes from an introduction to natural language semantics by Henriëtte de Swart:[27]

> Given that direct interpretation of natural language with respect to the outside world (or some model of it) is not always easy, many semanticists opt for the indirect approach. We know that a translation can sometimes help us to determine the meaning of an expression. Suppose I speak French, but you don't, and we both speak English. In that case, I can teach you something about the meaning of a French expression by translating it into English [...] The same 'trick' can be used with the

[26] The first widely accepted model is that of Richard Montague's 'The proper treatment of quantification in ordinary English' Montague (1973). Note that Montague also explored the possibility of providing a model-theoretic semantics of natural language directly, cf., his Montague (1970a).

[27] Cf., de Swart, (1998).

> translation of natural language into some formal language. Suppose I can describe the meaning of an English expression by translating it into an expression of a formal language. Because there will be a full and explicit interpretation procedure for the expressions of this formal language, I will immediately have grasped the meaning of the English expression. Of course, I will only have access to it in an indirect way, namely via a translation procedure, but as long as the translation is perfect, the exact meaning will be captured.

First of all, we may note the implicit reliance here as well on the by now familiar assumption of Availability. In fact it plays a role here both with respect to the meanings of the expressions of the formal language as well as with those of the natural language. Both are needed for otherwise there would be no way to judge the correctness of the translation, and this is essential if the methodology of indirect interpretation via translation is to succeed. This means that prior to the specification of the translation both are assumed to be given: we need to know what the meanings of the natural language expressions are and what meanings are assigned to the formal language expressions before we can start defining the translation or judge the correctness of any attempts. Consequently, what such an indirect specification of meanings does, at best, is representing them in another way than is done by the original natural language expressions themselves. This may very well lead to a more perspicuous representation, or one that has other, technical advantages, but the one thing this methodology will not do is to actually provide meanings for natural language expressions.

To make the point (slightly) more concrete, suppose the question is whether two sentences $S$ and $S'$ are equivalent, or not. And suppose we try to answer this question by the indirect method, i.e., by translating the sentences in question into expressions of a suitable formal language, say $\phi$ and $\phi'$ respectively. Now suppose we observe that indeed $\phi$ and $\phi'$ are equivalent (under the interpretations assigned to them). Can we conclude that, indeed, $S$ and $S'$ are equivalent as well? Well, only provided we can ascertain independently that the translation of $S$ into $\phi$ and that of $S'$ into $\phi'$ are indeed correct. So? There seem to be two possibilities here. One is that the equivalence[28] of $S$ with $S'$ is part of the meaning of $S$ and $S'$. In that case we can indeed rest assured that the translation is correct. But it also means that grasping the meaning of $S$ and that of $S'$ involves grasping their equivalence, in which case the translation is not needed, at least not for establishing the equivalence as such. Rather we need independent, direct knowledge of the equivalence in order to judge the correctness of the translation in the first place, so in fact it does not add anything, except perhaps another form of representing what we already know. Or, and this is the other possibility, it may be that the equivalence of $S$ with $S'$ is not part of their meanings in the

[28] Or non-equivalence, that case is completely similar.

first place, in which case it is not a matter of semantics anyway. Does this mean that nothing of interest happens when we go about in this way? Not necessarily, as already indicated, it may be that the translation serves a practical purpose, but what does not happen is that in this way we actually discover (a relevant aspect of) the meaning of natural language expressions. That is what this methodology cannot do.

The conclusion must be that the combination of the Availability and Determinacy Assumptions are fatal to the idea of using a formal language to provide meanings for natural language expressions. Although the analogy with real translation suggests otherwise, we cannot learn meanings of natural language expressions from a translation in a formal language. But what about real translation, i.e., translation from one natural language to another? The analogy used in the passage quoted above, which is one that can be found in a number of places, breaks down precisely at the point of availability. As we just saw, in the case of the use of a formal language we need access to the meanings of the formal language expressions in order to judge the correctness or incorrectness of candidate translations. The case of real translation is different since when we deal with natural languages there are other means of making meanings available, for example by means of an appeal to behavioural data. So the appeal to availability in those cases is innocent, in the sense that we may assume, in fact should assume, that at some point each chain of translated languages ends with one of which the meanings are given by non-linguistic means. In the case of formal languages, however, such means are missing, and that is why the appeal to availability in those cases is not innocent, but actually prevents the method from delivering what it is supposed to, viz., a means of specifying meanings.

In order to see more clearly what the methodological consequences of the use of formal languages in natural language semantics are, let us look in some detail at another statement, also from an introductory textbook, this time from Gennaro Chierchia and Sally McConnell-Ginet:[29]

> Is it possible to regard logical form so construed as providing us with a theory of semantic interpretation, with a theory that characterises what we grasp in processing a sentence? This question is very controversial. For many the answer is no. We think it is possible, as our logical forms do meet the main requirements that semantic representations are generally expected to meet.

Chierchia and McConnell-Ginet are a bit more cautious about the standard methodology of doing semantics 'by proxy', i.e., by translation into a formal language, aware as they are that in the generative tradition in linguistics (the 'many' in the passage just quoted) any form of referential, model-theoretic semantics is rejected on account of it giving an account of meaning that is externalistic, i.e., too much concerned with the outside reality instead of the cognitive domain, and hence does not fit the strongly internalistic view on

[29] Cf., Chierchia and McConnell-Ginet (2000).

language that is dominant in that tradition. As we shall see, this needs qualification.

According to Chierchia and McConnell-Ginet a proper semantic theory has to fulfil certain requirements: it must provide a distinction between lexical semantics and structural semantics, it must be compositional,[30] it should account for speakers' intuitions about semantic properties and relations such as contradictoriness, analyticity, entailment, and the like. Thus the choice of a suitable formal language (or family of languages) is dictated by what they consider to be empirical constraints, directly derived from empirical properties of natural language. For example the formal language should have a core of Boolean operation since coordination in natural language is Boolean; it should allow for quantification, have certain semantic categories, and so on, because the counterparts can be found in natural language. This determines a particular methodology that is in essence the same as the 'translation approach' we encountered above, it only starts at the other end. Here the idea is that we first select a formal language with a property and regard that as stating an hypothesis about natural language, viz., that it has that property too. Then we check whether the natural language we are interested complies and if so we regard the claim embodied in the choice of formal language as corroborated, and if not, we reject it as falsified. Of course, Availability and Determinacy are again crucial: without independent access to determinate semantic properties of natural language the whole enterprise would be pointless.

So how do we gain this access? For Chierchia and McConnell-Ginet, as for De Swart and many other semanticists working in this tradition, the answer, or at least a substantial part of it, is: through an appeal to the intuitions of native speakers of the language in question. This has important consequences for the status of semantics, as we hope to show shortly.

First, we must point out that at this juncture it becomes clear that there is an important difference between the way formal languages are used in philosophy, and in logic, and the status they have in semantics. In philosophy formal languages are first and foremost constructs, they are set up with a certain purpose in mind, to make a particular philosophical point, and hence a discussion of their properties is not empirical but conceptual in nature. In semantics, however, the choice of a formal language is motivated by the wish to make empirical claims about natural language, so when properties of formal languages are discussed in semantics the discussion has empirical bite. This has consequences for one's reliance on the Availability and Determinacy Assumptions. In a philosophical context justification may be sought in conceptual considerations, but not so in semantics. There such reliance should, ideally, be justified via reference to something that is not only independent but also empirical in its own right. So what will do in a philosophical context. for example an appeal to an accessible realm of Fregean thoughts, will not be available in semantics, because such entities lack an independent empirical

[30] In order to account for the 'creativity' of language; cf., Groenendijk and Stokhof (2005).

nature. But what will do is indeed an appeal to intuitions, in much the same way as the Chomskyan tradition in linguistics does. This is the consequence:

***Formal Semantics' Surprise***
*Montagovians are closet Chomskyans (but they don't know it)*

With 'Montagovians' we mean people working in the tradition of formal semantics that started with the work of Montague, Davidson, Lewis and others. The surprise arises mainly because 'officially' formal semantics acknowledges Frege's anti-psychologism, at least to the extent that semantics is supposed to be neutral with respect to the psychological reality of the entities and mechanisms it exploits in the description and explanation of semantic phenomena. For Frege, the move away from the idea that logic is concerned with the study of actual reasoning, if only of its most general aspects, was essential for putting logic on its proper footing, to establish it as the science, not of how people actually do reason, but of how they should. On such a view logic is, as Wittgenstein puts it,[31] 'a normative science', an oxymoron according to the standard self-image of scientists. Frege's insistence that it is the task of logic to discover the 'laws of truth', but not those governing why people actually judge things to be be true[32] may have been necessary for the development of logic as an independent discipline, but there is no reason why semantics, which after all claims to be an empirical discipline, should follow suit. Sure, it borrows methods and concepts from logic, but does it also need to import its ideology?[33] Did semanticists simply make a mistake, and can they side with Chomskyans without a problem? As we shall see, things may not be quite that simple.

In the case of semantics, it seems to follow that if it is intuitions that justify Availability and Determinacy, then these intuitions must be based on some kind of implicit knowledge of language, much in the same way as this concept figures in the Chomskyan tradition with respect to syntax. Note, by the way, that the intuitive appeal of this position depends on the feasibility of maintaining a strict distinction between lexical semantics and structural semantics, or, more accurately, between structural aspects of meaning and content.[34] The crucial question now is, what is the relation between this intuitively accessible, but implicit knowledge of language and that what semantics is about?

This question is an instance of a general one, that defines to a large extent the identity of a scientific discipline: What is it about? And how is that what it is about accessed? Or, to put it differently: What are the data? And how are they gathered? In the case of semantics, if we start from the definition of

[31] In section 81 of the *Philosophical Investigations*, cf., Wittgenstein (1958).

[32] Cf., Frege (1919): 'In order to avoid any misunderstanding and prevent the blurring of the boundary between psychology and logic, I assign to logic the task of discovering the laws of truth, not the laws of taking things to be true or of thinking'.

[33] Which, many would say nowadays, has outrun its usefulness, even within logic as such. Cf., van Benthem (to appear) for argumentation to this effect.

[34] For lexical semantics, too, may have certain structural properties, e.g., those defining certain classes of lexical elements.

semantics as the study of meaning, these general question become particularised as: What are meanings? And how do we access them?

As we saw above, in the quotations from De Swart and from Chierchia and McConnell-Ginet, the agreed upon answer seems to be that formal languages provide meanings, in the sense that formal languages come with a semantic interpretation (usually of a model-theoretic variety, but that is not essential), and translation of natural language expressions into those of the formal language indirectly bestows those meanings on the natural language. This is the essence of Montague's general approach in 'Universal Grammar',[35] of which the various concrete models used in formal semantics are different instantiations.

But this answer will not do. The meanings assigned to formal language expressions are not meanings of natural language expressions. At best, they model such meanings, but they are a different kind of entity, if only because unlike their natural language counterparts meanings of formal language are intentionally constructed by us according to certain specifications. Moreover, in order to judge whether formal language meanings model natural language meanings adequately and correctly we already have to have access to the natural language meanings themselves, independent of the model we are assessing.

At this point the appeal to intuitions about meanings offers itself as a way out: such intuitions are empirical givens, and they may provide the necessary empirical basis for semantics: it is not meanings themselves, but intuitions about meanings that semantics is about. Thus, it is the conviction that semantics is empirical that commits it to psychologism, despite the anti-psychologism of some of its ancestors.[36]

So far, so good. Actually, one might think: so far, so much the better, because as we have noted above, the appeal to intuitions of native speakers is, or at least used to be, a commonly accepted methodology in generative linguistics, which strengthened formal semantics' claim to being a bona fide part of the generative enterprise. At this point it becomes necessary to distinguish between various forms of psychologism; in this case, the following two will do. First of all, we may understand psychologism as the claim that linguistic competence (including semantic competence) is a cognitive faculty. The second version of psychologism that is relevant in the present context states that linguistics is a descriptive and explanatory theory of linguistic competence.

The first version in this general form is hardly a controversial point of view, although it does have consequences that people may, and have, contested. It holds that language is part of the human cognitive system, which no-one would find a problematic claim, but this does not in any obvious sense preclude that important features of the language system can be studied fruitfully

[35] Cf., Montague (1970b); more on this paper below.

[36] Of course, there is an alternative conclusion that one may draw, viz., that semantics is not an empirical science, at least not in a straightforward sense. Space does not permit us to go into this alternative, cf., Stokhof (2002) for some more discussion.

independent from this general view. That is to say, acknowledging that language is a cognitive faculty does not prescribe a particular methodology for the study of various aspects of natural languages. Thus, one could study the historical development of a language's morphological system, or typological variety of syntactic structures without having to make any intrinsic appeal to the cognitive reality of language and linguistic competence.

This is different with the second version of psychologism, since that ties what linguistics does, and hence is, much more tightly to the contents and structure of cognitive reality. This form of psychologism is much closer to the Chomskyan variety, in which linguistics ultimately is part of an unified psychological–biological theory that describes and explains human cognitive structures. One crucial feature of that account is the concept of tacit knowledge of language.[37] This concept serves two purposes at the same time, and that is where the problems start. First of all, tacit knowledge of language is what the theory explains, since this tacit knowledge is what constitutes linguistic competence, it is what users of the language employ in production and reception. Second, it is also what constitutes the data of linguistic description and theorising. When the linguist appeals to his intuitions about the well-formedness of a certain sentence, about semantic properties and relations, such as ambiguity, entailment and the like, he employs that very same knowledge. But this is deeply problematic, for in effect it says that the phenomena we want to describe and explain, and the data on which we base our descriptions and explanations are really one and the same thing. Of course, there is no problem in using intuitions to 'bootstrap' and base an initial theory on. But the very same intuitions cannot be 'recycled' as evidence: if it is only intuitions that will be appealed to when testing the theory, they are not data, but normative constraints. So unless intuitions are justified by other means (experiments, repeated observations, collections of data recorded by other means), they are unable to put linguistic theorising on an empirical footing.

How is this different from other empirical disciplines? Does not the same apply in the case of physics or chemistry, or in biology or psychology? In natural sciences the object studied, physical and biological nature, provides data, but does not equal data. It is in the 'providing', mainly by controlled experiment, in some cases by repeated observation, that the distinction between what something is and what we know about that something is made. To put it perhaps somewhat paradoxically, science is not interested in its object as such, it is interested in knowledge about that object. Nature is what it is, and if we were interested in nature as such, that is about all there is to say. But if we want to know about nature, its laws and mechanisms, then we need to distance itself from it by distinguishing the data we have about it, what to the best of our knowledge we know about nature, and nature itself.

[37] A well-known reference is Chomsky (1986).

In as much as formal semantics, by its reliance on the Availability and Determinacy Assumptions, is committed to the use of intuitions as its primary methodology, it really finds itself in a difficult, actually impossible situation, that can only be remedied by making a choice. This is what we might call:

***Formal Semantics' Predicament***
*Abandon current methodology, or accept Chomskyan psychologism*

Like in Frege's case the situation formal semanticists find themselves in is a predicament, not a dilemma. There are a number of ways out. The first is to bite the bullet and to embrace Chomskyan psychologism. This is a possibility, although it would mean, contrary to Chomsky's intentions, that one should accept that linguistics is quite unlike the empirical sciences with which it 'officially' associates itself. Actually, whether the term 'empirical' applies in this case, becomes debatable. So, although this may be a way out theoretically, it would not do justice to what linguistics aims to be, viz., the empirical study of an empirical object.

The second way out is to give up the Availability and Determinacy Assumptions. As we already noticed above, the assumptions were inherited from a different tradition, that of logic and philosophy, which have no claim to being empirical sciences anyway, so whether semantics, which does aim to be empirical, should adhere to them in the first place is questionable in itself. But giving them up does require changing the standard methodology drastically.

Psychology provides an interesting analogy for linguistics, in that the role of introspection as a methodological tool, as a source of objective data about the object of investigation has been much discussed. Common opinion has come down against introspection, certainly as the *sole* source of relevant data. Most eschew the use of introspective data altogether, others allow it but only when thoroughly calibrated against data obtained in other, experimental or observational ways. For linguistics, including semantics, the same should hold. And in effect, in many branches of linguistics we do rely, not on intuitions, but on data in the proper sense of the term. Studies of language acquisition depend on systematic observations and controlled experiment, as do studies of various types of language pathologies. In computational settings one employs large corpora of actual language use as sources of relevant data, and in typological studies one often relies on descriptions which are obtained via non-introspective methods. This shift from a reliance on intuitions, often introspectively obtained, to data gathered in intersubjectively testable, empirical ways, such as experiments and repeated observations, seems the only way to guarantee the empirical status of semantics.

That is a principled break with the logical and philosophical tradition that has generated and fed semantics for such a long time. And one might well wonder what the consequences are for one of the main characteristics semantics has inherited from that tradition, viz., the use of formal languages in the description of natural language semantics.

## Concluding Remarks

We will end this paper with a brief sketch of what the consequences of these considerations might be for the way in which we can think about formal and natural languages and their relationship.

In order to do that, we first take a step back, to the origins of formal semantics. In his seminal paper 'Universal Grammar', which defined some fundamental principles that can be found, in one form or another, in most of the models that have been developed in formal semantics over the years, Montague starts with formulating a very specific view on formal and natural languages:[38]

> There is in my opinion no important theoretical difference between natural languages and the artificial languages of logicians; indeed, I consider it possible to comprehend the syntax and semantics of both kinds of languages within a single natural and mathematically precise theory. On this point I differ from a number of philosophers, but agree, I believe, with Chomsky and his associates.

When Montague states that there is 'no important theoretical difference between natural languages and the artificial languages of logicians' he makes two gestures that distance him from both the philosophical tradition and the linguistic one. Of course, his statement should not be read as denying the many actual differences that exist between formal languages and natural languages: the former are constructed, the latter develop over time; the first are mainly learnt as tools for specific tasks in advanced stages of learning, the latter are acquired as first languages and are probably the most general cognitive 'tool' humans have at their disposal; formal languages are changed, natural languages change; and so on. But apparently, for Montague none of these differences are 'important theoretical' ones. This bespeaks, of course, a particular view on what a theory of language is, and, perhaps more importantly, what it is not. That makes Montague's approach different from the philosophical tradition, which, as we saw earlier, emphasises differences rather than commonalities, apparently considers these differences to constitute the core of a theoretical comparison, and in some cases draws ideological conclusions regarding the need for improvement of natural languages and the role that formal languages have to play in that. Montague's view also differs from mainstream approaches in linguistics, in particular in the generative tradition that was very prominent at the time of Montague's writing. There natural languages are considered as constituting a natural kind, and are taken to be intimately connected with the defining characteristics of human psychology and biology. Language is likened to an organ, and not to a tool. Such an intrinsic connection between our human cognitive apparatus and formal languages is supposed to be lacking, and that clearly sets them apart as being of a, not just factually, but also theoretically completely different kind.

[38] Cf., Montague (1970b, p. 222); page reference to the version in Montague (1974).

It is clear that a point of view such as Montague's provides a strong endorsement of the use of formal languages in the semantics of natural languages, and it is one of the reasons that Montague's work has been so immensely influential. But as we argued above, if we put this methodology in practice and use formal languages as models for natural languages in what is intended as an empirical investigation of the latter's semantics, we must rely on the Availability and Determinacy Assumptions. And that has consequences of its own. If we want to avoid those, what alternatives are there? Do we need to disengage the study of natural language from that of other aspects of the human cognitive system and relegate it to what is basically a non-empirical, quasi-deductive discipline? That would be a third, alternative way of viewing the relationship between formal languages and natural languages, different from both the traditional philosophical approach and that of (generative) linguistics. However, adopting such a view would rob semantics of its status as an empirical discipline, which would be a consequence we also would like to avoid.

The core problem, it seems, is the implicit assumption that there is an intimate, 'natural' relation between language and thought. Frege made that assumption when he talked about natural language's 'intimate connection with our mental life', and the idea seems to be operative in many approaches in philosophy and linguistics. So what seems to be needed, and what, one might say, actually is presupposed by a view such as Montague's, is that we loosen that connection. We need to disengage the concept of natural language from the concept of a strictly individual-based cognitive system, and create room for other elements to co-determine meaning. In other words, we need a certain amount of externalism injected into the traditional, highly internalistic way of thinking. That will also allow us to re-think the relationship between formal languages and natural languages in such a way that we can both explain how the former can be used successfully in the study of the latter and maintain that semantics is an empirical discipline.

In the following passage from *Philosophical Investigations*, Wittgenstein invites us to re-think our concept of language in a way that is conducive to such a change in perspective:[39]

> [A]sk yourself whether our language is complete;-whether it was so before the symbolism of chemistry and the notation of the infinitesimal calculus were incorporated in it; for these are, so to speak, suburbs of our language. (And how many houses or streets does it take before a town begins to be a town?) Our language can be seen as an ancient city: a maze of little streets and squares, of old and new houses, and of houses with additions from various periods; and this surrounded by a multitude of new boroughs with straight regular streets and uniform houses.

The suggestion is clear: to conceive of the distinction between formal languages and natural languages as a dichotomy, as being based on a categorial

[39] Cf., Wittgenstein (1958, Section. 19).

difference between two fundamentally different kinds of entities is wrong. The two are interwoven, co-occur in all kinds of practical applications, and their differences are not so much based on a difference in kind as on a difference in function and origin. This is a very natural way of looking at things in Wittgenstein's approach, which is externalistic in that it does not start from the assumption that language and individual thought are intrinsically connected. His basic concept of a language game is interactive, oriented to action in a context and it encompasses both elements that we would classify as linguistic in the narrow sense as well as all kinds of non-linguistic elements, such as objects and tools, non-verbal actions, et cetera.

Of course, this does not mean that there is no such a thing as a language in the sense in which that concept is used in linguistics. But that concept is a theoretical one, not something that corresponds to a natural kind. And likewise, there is such a thing as individual competence, but again as a theoretical concept, not as an empirical given.[40] Language is connected with the individual human cognitive system, but also with other entities and other structures. It is connected with empirical reality, which determines a lot of its semantic content; it functions in a social setting, where it serves purposes of communication, establishing and maintaining social relationships and identities, and so on. It consists of linguistic elements in the narrow sense, but also of gestures, facial expression, formal notations, both invented on the spot and codified and transmitted via learning. For practical purposes it may make sense to focus on any one aspect at a time. But the methodology of the enterprise should never be restricted in such a way that it can only deal with certain aspects and therefore has to exclude others as 'not belonging to language'.

From that perspective the way in which we use formal languages in semantics is perhaps best viewed in the way that was suggested by Wittgenstein's reaction to Frege's and Russell's ideas of 'language reform'.[41] A formal language is a tool, a means to provide a 'perspicuous representation' of some aspect of a natural language, a way of laying out certain properties and relations that makes them accessible, amenable to a certain use, i.e., that serves a practical purpose. But we should not forget that natural languages render the same service to formal languages: they, too, need to be explained, made accessible, be applied. And a natural language is often the best tool for that practical purpose.

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[40] Is this is what Davidson meant when he claimed Davidson (1986) that 'there is no such thing as a language, not if a language is anything like what many philosophers and linguistics have supposed' ? On a charitable interpretation ...

[41] Cf., above, Section. ''The Motivation for Formal Languages''.

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