



Frege on the Ontological Presuppositions of Scientific Discourse

Frege acerca dos pressupostos ontológicos do discurso científico

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Abstract: According to the standard conception of ontological commitment, which goes back to Quine, we are ontologically committed to acknowledge those and only those entities whose existence is a condition for the truth of our theories. Frege has sketched, in the context of his critique of the idealist interpretation of scientific language, a more complete approach according to which we are committed to accept also those entities whose existence is a condition for successful communication in science. He argued, for instance, that we must acknowledge a Platonic realm of objective senses because the existence of such entities is a condition for communicating non-trivial scientific discoveries. The aim of this paper is to reconstruct and defend Frege's approach. The main thesis defended is that, although Frege's analysis of ontological commitment is largely obsolete, his general approach to derive our ontological commitments from both the truth and the success conditions of scientific discourse is correct.

Keywords: Ontological commitment, Quine, Frege, success conditions of scientific discourse, linguistic solipsism

Resumo: De acordo com a concepção padrão do compromisso ontológico, que remonta ao Quine, estamos ontologicamente obrigados a reconhecer aquelas e apenas aquelas entidades cuja existência é uma condição para a verdade das nossas teorias. Frege esboçou, no contexto da sua crítica à interpretação idealista da linguagem científica, uma abordagem mais completa segundo a qual estamos obrigados a aceitar também as entidades cuja existência é uma condição para o sucesso da comunicação na ciência. Ele argumentou, por exemplo, que devemos reconhecer um reino platônico de sentidos objetivos porque a existência de tais entidades é uma condição para a comunicação de descobertas científicas não triviais. O objetivo deste artigo consiste em reconstruir e defender a abordagem do Frege. A tese principal defendida é que, embora a análise do Frege do compromisso ontológico seja largamente obsoleta, a sua abordagem geral de derivar os nossos compromissos ontológicos tanto das condições de verdade como das condições de sucesso do discurso científico é correta.

Palavras-chave: Compromisso ontológico, Quine, Frege, condições de sucesso do discurso científico, solipsismo linguístico

INTRODUCTION

For Quine, ontology is the theory of what there is. Its task is to specify which sorts of entities exist. His methodology of ontology tell us under which conditions we have to recognize a given sort of entities in our ontology and under which conditions we have to reject this. It mainly consists of two complementary principles. The first is the ‘principle of ontological economy’, according to which we must not recognize a given sort of entities in ontology when these entities are ‘dispensable’ (or ‘not necessary’ or ‘redundant’) in science, and the second is the ‘principle of ontological commitment’, according to which we have to recognize the entities that are indispensable (or ‘necessary’) in science. Quine uses the first principle to reject the ontological recognition of impure numbers and the second to justify his realism about abstract objects.

The task of his theory of ontological commitment is to explain more closely under which conditions we are obliged to recognize a given sort of entities in our ontology. It mainly claims that we must recognize all entities whose existence is presupposed by the sentences that are affirmed in the rest of our overall theory of the world. This norm can be derived from the norm of logical consistency. It would be incoherent to assert the sentence ‘Some unicorns are black’ in biology and to deny the sentence ‘There are unicorn’ in ontology. The reason is that the truth of ‘There are unicorns’ is a condition for the truth of ‘Some unicorns are black’.

The core of Quine’s theory of ontological commitment is his criterion of ontological commitment. It reads:

(C) A theory is committed to those and only those entities to which the bound variables of the theory must be capable of referring in order that the affirmations made in the theory be true. (Quine 1948, p. 13-14)

Note that (C) contains two criteria: one for semantic ontological commitment, and one for pragmatic ontological commitment. The semantic criterion explains the ontological conditions for the truth of sentences. They are semantic relations between sentences and the world that are more adequately called ‘ontological presuppositions’. Thus, the truth of ‘There are prime numbers’ presupposes the existence of at least one prime number. According to the quantificational criterion in (C), the truth of a sentence presupposes the existence of those entities that are necessary to fulfill its Tarskian truth conditions.

However, in order to explain the ontological commitments of a theory, it does not suffice to explain the ontological truth conditions of its sentences. We must also specify which speech acts in science commit us to share the ontological commitments of the sentences we utter. Although, for instance, the language of arithmetic contains the sentence ‘The largest natural number is odd’, arithmetic is not committed to accept the existence of the largest natural number. The reason is that this sentence is not affirmed in arithmetic. On the other hand, we affirm in arithmetic the sentence ‘There is a prime number between 5 and 11’. By making this assertion, we commit ourselves to the truth of this sentence. Since the existence of a prime number between 5 and 11 is a condition of its truth, we commit ourselves also to recognize the existence of such a number. Ontological commitments in this pragmatic sense are relations between acts: doing *x* commits a person to do or not to do *y*. Their primary bearers are speakers, and not sentences.

Frege does not have an elaborate theory of ontological commitment. Nor does he have an elaborate ontology. Nevertheless, he uses more or less explicitly some partial criteria of ontological commitment in his criticism of the idealist interpretation of scientific language. These criteria refer both to the truth conditions of sentences and to the success conditions of the speech acts that are typical for scientific discourse. The speech acts considered by him are asserting, contradicting the opinion of an opponent, communicating a non-trivial scientific discovery, making a mere assumption without asserting it (in an indirect proof), and making a question. My aim in what follows is to reconstruct and defend Frege’s approach. My main thesis is that, although Frege’s criteria of ontological commitment are mostly obsolete, his general approach to derive our ontological commitments from both the truth and the success conditions of scientific discourse is correct.

1. THE ONTOLOGICAL TRUTH CONDITIONS OF SCIENTIFIC SENTENCES

Consider the sentence

(1) Fido is a dog.

There are basically two approaches to answer the question which entities are presupposed by the truth of (1), a Platonist and a nominalist one. According to the former, (1) contains two referential expressions, namely, the singular term ‘Fido’, which refers to an object, and the general term ‘is a dog’, which refers to a property

(or “universal”). On this interpretation, (1) can be reformulated as the second order predication

(2) The property of being a dog is exemplified by Fido.

The difference between (1) and (2) is a purely syntactical one that results from transforming the grammatical predicate of (1) into the subject of (2). The truth conditions of (1) and (2) are identical: they are true if and only if there is an object denoted by ‘Fido’ and a property denoted by ‘is a dog’ and this object exemplifies this property. Consequently, (1) implies both the sentence

(3) There is an object x such that x is Fido

and

(4) There is a property F such that Fido is an F.

This derivation is sound because the truth of (3) and the truth of (4) are conditions for the truth of (1).

According to the nominalist approach, which Quine favors, general terms are not referential terms, but syncategorematic (non-referential) ones.¹ They do not denote abstract objects, but they are satisfied or not satisfied by concrete objects. The truth conditions of (1) are that there is an object denoted by ‘Fido’ and this object satisfies the general term ‘is a dog’. As a consequence, the truth conditions of (1) do not coincide with the truth conditions of the second order predication (2). Since the truth of (4) is not a condition of the truth of (1), (1) does not imply (4), but only (3).

However, in Quine’s view, the sentences of natural language do not have clear and precise ontological presuppositions or implications.² In order to determine the ontological commitments of a given theory, we must hence translate its language into an ontologically transparent language. Quine thinks that the language satisfying this demand is the language of first order predicate logic with identity. On his construal, this language contains only one category of referential expressions, namely, first order variables. All other expressions, like the quantifiers, the truth functional connectives, the predicates and the functional signs, are considered as syncategorematic expressions. The singular terms are “explained away” by reducing them to definite descriptions in the way illustrated by the paraphrase of (1) as

1 Cf. Quine 1948, p. 10.

2 Cf. Quine 1953, p. 107.

(5) There is one and only one x that fidos and this x is a dog.³

This step shifts the burden of reference from the singular term 'Fido' to the variable ' x '. Quine's criterion of ontological commitment accordingly reads: "To be assumed as an entity is, purely and simply, to be reckoned as the value of a variable" (Quine 1948, p. 13).

According to Frege's analysis, the truth of a sentence presupposes, in the first place, that the names occurring in it have a *Bedeutung*. This criterion, which is the Fregean counterpart of Quine's criterion of ontological commitment, is formulated more or less explicitly in the following passage of "On *Sinn* and *Bedeutung*" (1892):

The sentence 'Odysseus was set ashore at Ithaca while sound asleep' obviously has a sense. But since it is doubtful whether the name 'Odysseus', occurring therein, has a *Bedeutung*, it is also doubtful whether the whole sentence does. Yet it is certain, nevertheless, that anyone who seriously took the sentence to be true or false would ascribe to the name 'Odysseus' a *Bedeutung*, not merely a sense; for it is of the *Bedeutung* of the name that the predicate is affirmed or denied. Whoever does not admit the name has a *Bedeutung* can neither apply nor withhold the predicate. (Frege 1892, p. 148; 1997, p. 157)

Frege's point here is that, when we take a sentence to be true or false, we are presupposing that the names occurring in it have a *Bedeutung*. His argument is that, in order to predicate a property P successfully of an object x , the act of reference to x must be successful. A success condition of the act of referring to the object x is that x actually exists. Consequently, when we assert a sentence ("affirm" or "deny" a predicate), we are presupposing the existence of the entities to which the proper names occurring in the sentence are supposed to refer.

Frege uses this criterion of ontological commitment in his criticism of the idealist interpretation of the language of science by his Neo-Kantian colleagues. From the idealist point of view, it is not legitimate, in science, to speak about objects that are not given to us in our consciousness, because we cannot be sure that such objects actually exist. The domain of science must hence be restricted to those objects which are internal to our consciousness, that is, to mental representations.⁴ Frege concedes that we do not have absolute certainty that the objects of the eternal world actually exist. But, he argues, the assertion of sentences referring to this world commits us to recognize these objects. Since the idealist does not recognize these objects in his ontology, he cannot assert these

³ Cf. Quine 1948, p. 8.

⁴ Cf. Frege 1892, p. 147, 1997, p. 156, and also Frege 1918a, pp. 354-358; 1997, pp. 337-341.

sentences as true or reject them as false, but he must treat them as fictional sentences that are neither true nor false. In the preface to *Grundgesetze* (1893), he argues as follows:

If the idealists were consistent, they would put down the sentence “Charlemagne conquered the Saxons” as neither true nor false, but as fiction, just as we are accustomed to regard, for example, the sentence “Nessus carried Deianeira across the river Evenus”; for even the sentence “Nessus did not carry Deianeira across the river Evenus” could be true only if the name “Nessus” had a bearer. (1893, p. XXI; 1964, p. 20)

To reconstruct Frege’s success condition for making true assertion more closely, we must briefly describe his analysis of the truth conditions of sentences in his first and his second system.

In Frege’s view, the grammatical distinction between subject and predicate is logically misleading, because it suggests that sentences like ‘Fido is a dog’ and ‘The property of being a dog applies to Fido’ have different judgeable contents. To correct this imperfection of natural language, he replaces the grammatical categories of subject and predicate by the logical categories of function and argument in his system. Thus, in his formal language, the formula ‘|—Dog(Fido)’ represents both the first order sentence ‘Fido is a dog’ and the second order sentence ‘Dogness is a property of Fido’.⁵ In § 3 of the early *Begriffsschrift* (1879), which contains his first logical system, he gives the following general description of the syntactical structure of the formal language:

Imagine a language in which the sentence ‘Archimedes was killed at the capture of Syracuse’ is expressed in the following way: ‘The violent death of Archimedes at the capture of Syracuse is a fact’. Even here, if one wants, subject and predicate can be distinguished, but the subject contains the whole content, and the predicate serves only to present it as a judgement. *Such a language would have only one predicate for all judgements, namely, ‘is a fact’.* [...] *Our Begriffsschrift is such a language and the symbol |— is its common predicate for all judgements.* (cf. § 3, partly my translation)

The imagined language is a fragment of Standard English that we may call Nominalized English. It contains only one syntactic predicate, namely, ‘is a fact’. Appropriate arguments for the predicate are sentence nominalizations like ‘the violent death of Archimedes at the capture of Syracuse’, ‘the whiteness of snow’, the love of Romeo for Juliet’, ‘the identity of x with x for all x’, and so on. These nominalizations do not contain any predicates but only functional signs like ‘the whiteness of x’ and ‘the love of x for y’.

⁵ Cf. Frege 1879, §§ 3, 9.

According to this approach, not only singular terms and general terms are referential expressions, but also whole sentences. Just as ‘snow’ refers to snow and ‘is white’ refers to whiteness, so ‘Snow is white’ refers to the circumstance or the states of affairs that snow is white. Frege is committed to this view because he construes the concepts and relations denoted by the predicates of Standard English as functions whose value is always a circumstance.⁶ Thus, the concept denoted by ‘is white’ is the function *the whiteness of x* (or *the circumstance that x is white*), whose value for snow as argument is the circumstance that snow is white. In ‘|— White(snow)’, the expression ‘White(snow)’ is hence a name of a circumstance, just as ‘snow’ is a name of an object and ‘White(x)’ is a name of a function. Consequently, from ‘|— White(snow)’ we can infer the existential claim ‘There is a circumstance x such that x = White(snow)’. On this “hyper-Platonic” view, the sentence ‘Snow is white’ implies not only the sentences ‘There is an object x such that x is white’ and ‘There is a property F such that snow is F’, but also the sentence ‘There is an x such that x is the circumstance that snow is white.’

From the point of view of Frege’s second system, formulated in the *Grundgesetze* from 1893, the semantics of his first system confuses sense and *Bedeutung*. The sentence ‘Snow is white’ does not refer to a circumstance, but to a truth value; the circumstance is rather the sense of ‘Snow is white’, and not its reference. To take this into account, he construes concepts and relations in his second system as functions whose value is always a truth value. The concept denoted by ‘is white’ is not the function *the whiteness of x*, but *the truth value of: that x is white*, which maps an object x onto the True if and only if x is white, and onto the False otherwise.⁷ Accordingly, in ‘|— White(snow)’, the expression ‘White(snow)’ does not denote a circumstance, but a truth value.

Given this analysis, the sentence ‘Snow is white’ implies the existential statement ‘There is an object x such that x = the truth value of: that snow is white.’ In Frege’s view, we are presupposing the existence of the truth values whenever we make an assertion or a judgement. He writes, in “On *Sinn* and *Bedeutung*” (1892), about the truth values: “These two objects are recognized, if only implicitly, by everybody who judges something to be true – and so even by the skeptic” (1892, p. 149; 1997, p. 158).

6 Cf. Frege 1879, §§ 9 and 10.

7 Cf. Frege 1893, § 2. I have justified my interpretation of Frege’s first and second system in Greimann 2000 and 2008

An implicit premise in Frege's argumentation is the assumption that sentences can be treated as a species of proper names, namely, as proper names of a truth value. Since this premise is unacceptable, from the point of view of modern semantics, his partial criterion of ontological commitment that we presuppose the existence of the truth values whenever we make a judgement or assertion must be considered as obsolete.

2. THE ARGUMENT FOR THE ONTOLOGICAL RECOGNITION OF THE EXTERNAL WORLD

Frege assumes that the existence of a common universe of discourse for all speakers of the scientific community is a condition for successful communication in science. The idealist interpretation of science offends against this condition. For, the program of construing all sciences as branches of psychology includes the ontological reduction of all entities to mental ones. In the case of physical objects, this reduction is achieved by their identification with the mental representations we have of them. Since every individual has its own mental representations of the things of the external world, the language of each speaker has its own universe of discourse. There is no common domain of objects to which all speakers refer. As a consequence, proper names like 'the Moon' must be treated as *indexical* terms whose reference depends on who is speaking. In the language of speaker A, this name refers to mental representations in the mind of A, and, in the language of speaker B to mental representations in the mind of B. This conception is criticized by Frege on the ground that it implies a kind of *linguistic solipsism* that undermines the possibility of successful communication in science:

Thus everything leads into idealism and with perfect logical consistency into solipsism. If everyone designated something different by the name 'Moon', namely, one of his ideas [*Vorstellungen*], [...], then admittedly the psychological way of looking at things would be justified; but a dispute about the properties of the Moon would be pointless: one person could quite well assert of his Moon the opposite of what another person, with equal right, said of his. If we could grasp nothing but what is in ourselves, then a [genuine] conflict of opinions, a reciprocity of understanding, would be impossible, since there would be no common ground, and no idea in the psychological sense can be such a ground. (Frege 1893, p. XIX; 1997, p. 206)

Given the idealist interpretation of scientific language, every speaker is a solipsist in the sense that his world, considered as the domain of his language, contains only himself and the contents of his consciousness. A consequence of this approach is that it would be impossible to contradict successfully the opinion of

another speaker. The problem is that they cannot refer to the same objects. The “common ground” of which Frege speaks is the realm of reference, the external world of physical objects. Suppose that A affirms that the object *x* has the property *P*. B wants to contradict this opinion. A success condition of this act is that B is able to refer to the same object *x*. *Ex hypothesi*, this is impossible. Consequently, B cannot contradict any of A’s opinions.

3. THE ARGUMENT FOR THE ONTOLOGICAL RECOGNITION OF PLATONIC ENTITIES IN SEMANTICS

Frege also assumes that the ‘objectivity’ of senses is a condition for successful communication in science: it must be possible that two different speakers A and B express in their languages with a given sentence exactly the same sense. To satisfy this criterion, senses must be publicly accessible, that is, it must be possible that A and B “grasp” the same sense, just as it is possible that A and B observe the same physical object. This presupposes that senses do not belong to the consciousness of an individual as their bearer; rather, they must belong to the Platonic realm of entities.⁸

The idealist logicians at Frege’s time identify the senses of words and sentences with mental representations. The sense of a sentence, a thought, is considered by them as a complex mental representation. Although the mental representation of two different individuals A and B may be of the same type, they cannot be numerically identical. An individual A cannot be the bearer of the mental representations of a different individual B. Moreover, mental representations are private entities to which only their respective bearer has epistemic access. Consequently, the idealist interpretation of the scientific language offends against the criterion of the objectivity of senses: two different speakers A and B cannot express one and the same sense in their languages, but each of them expresses a different sense in his language.

In “Thought” (1918a), Frege tries to show that the objectivity of the senses of sentences is a condition of the possibility of communication in science and hence of science itself. He argues as follows:

If every thought requires an owner and belongs to the contents of his consciousness, then the thought has this owner alone; and there is no science common to many on which many could work, but perhaps I have my science, a totality of thoughts whose owner I am, and another person has his. Each of us is concerned with contents of his

⁸ I am presupposing here the standard, Platonic reading of Frege. For an alternative reading, see Weiner 1995.

own consciousness. No contradiction between the two sciences would then be possible, and it would really be idle to dispute about truth; [...] (1918a, p. 353; 1997, p. 336)

Frege assumes here that a condition of the possibility that a person A contradicts the opinion of a person B is that A and B are able to grasp the same content. The contradiction arises when A takes a content to be true and B takes the very same content to be false, or vice versa. If thoughts were mental representations, then it is impossible that in the languages of two different persons a given sentence expresses the same content. As a consequence, it is impossible that one person contradicts the opinion of another. In the fragment “Logic” from 1897, Frege gives the following more elaborate but less known version of this argument:

A thought does not belong specially to the person who thinks it, as does an idea [*Vorstellung*] to the person who has it: everyone who grasps it encounters it in the same way, as the same thought. Otherwise two people would never attach the same thought to the same sentence, but each would have his own thought; and if, say, one person put $2 \cdot 2 = 4$ forward as true whilst another denied it, there would be no contradiction, because what was asserted by one would be different from what was rejected by the other. It would be quite impossible for the assertions of different people to contradict one another, for a contradiction occurs only when it is the very same thought that one person is asserting to be true and another to be false. So a dispute about the truth of something would be futile. There would simply be no common ground to fight on; each thought would be enclosed in its own private world [*Innenwelt*] and a contradiction between the thoughts of different people would be like a war between ourselves and the inhabitants of Mars. Nor must we say that one person might communicate his thought to another and a conflict would then flare up in the latter’s private world. It would be quite impossible for a thought to be so communicated that it should pass out of the private world of one person into that of another. (1897, p. 145; 1997, pp. 233-4)

Obviously, this argument applies also to such speech acts as to answer a question and to discuss a hypothesis. Thus, in order to answer a question of a speaker A, the speaker B must determine the truth value of the thought expressed in the language of A. But, given the idealist interpretation of language, B cannot express the same thought in his language. Hence, he cannot answer any question asked by A. Furthermore, it would be impossible for A and B to discuss any hypothesis, because there is no common hypothesis (“thought”) to which they can both refer.

The success condition of the objectivity of senses does not already commit us to acknowledge a Platonic realm of senses. We can consistently reject this realm and go on to contradict the opinion of an opponent. For, a referential semantics that identifies the senses of expressions with their referents satisfies the condition

of the objectivity of sense as well. An example of this is Davidson's "distal" theory of truth and meaning and also Frege's first logical system, in which the senses of sentences are construed as singular ("Russellian") proposition.⁹

In "Negation" (1918b), Frege discusses whether we should acknowledge in science only true thoughts or also false ones. He argues that we are committed to recognize false thoughts, because there are some important speech acts in science which presuppose the existence of such thoughts. Examples for this are the speech acts of asking a question and making a wrong assumption in an indirect proof. He writes:

We must recognize that there are thoughts in this sense [in the broad sense including false thoughts], since we use questions in scientific work; for the investigator must sometimes content himself with raising a question, until he is able to answer it. In raising the question he is grasping a thought. [...] There must, then, be thoughts, in the sense I have assigned to the word. Thoughts that perhaps turn out later on to be false have a justifiable use in science, and must not be treated as having no being. Consider indirect proof; here knowledge of the truth is attained precisely through our grasping of a false thought. (1918b, p. 364; 1997, p. 348)

According to Frege, there are also true assertions that presuppose the existence of false thoughts, namely, true negations (like 'It is false that snow is black') and true hypothetical assertions whose antecedent is false (like 'If snow is black, then snow is not white'). He writes in the same essay:

A false thought must be admitted, not indeed as true, but as sometimes indispensable: first, as the sense of an interrogative sentence; secondly, as part of a hypothetical thought-complex; thirdly, in negation. It must be possible to negate a false thought, and for this I need the thought; I cannot negate what is not there. (1918b, p. 366; 1997, p. 350)

The assumption that "we cannot negate what is not there" implies that the speech act of negation commits us to acknowledge the existence of false thoughts. This assumption is highly questionable, again. In order to negate that snow is black, we must deny that the predicate of being black applies to the object snow, but we need not affirm that the predicate of being false applies to the thought that snow is black. Consequently, the existence of false thoughts is not really a success condition for true negations.

Famously, Frege argued that the existence of Platonic senses is also a condition for the communication of non-trivial scientific discoveries. He assumes

⁹ Cf. Davidson 1990 and Frege 1879.

that only intensional languages have the expressive power we need to communicate informative identities like

(5) The morning star = the evening star.

Let L be a purely extensional language whose semantic structure is limited to the assignment of extensions to the terms of L in the common way. The definite descriptions are proper names in L . Then the sentences (5) and

(6) The morning star = the morning star

convey exactly the same information (or “thought”). Both say of Venus that it is identical to itself. As a consequence, the assertion of the former sentence in L does not permit us to communicate the scientific discovery of the identity of the morning star with the evening star in a successful way. From this Frege concludes that the existence of senses providing sentences with the necessary informational value (“cognitive value”) is also a success condition for the successful communication in science. In the case of proper names, these senses are modes of presentation. He writes, in “On *Sinn* and *Bedeutung*”:

If the sign ‘ a ’ is distinguished from the sign ‘ b ’ only as an object (here, by means of its shape), not as a sign (i.e. not in the manner it designates something), the cognitive value of $a=a$ becomes essentially equal to that of $a=b$, provided $a=b$ is true. A difference can arise only if the difference between the signs corresponds to a difference in the mode of presentation [*Art des Gegebenseins*] of the thing designated. (Frege 1892, pp. 143-4; 1997, p. 152)

We know from Russell’s work that the existence of Fregean senses is not really a condition of the possibility to communicate non-trivial scientific discoveries in a given language. The expressive power of a language whose sentences express Russellian propositions is already sufficient to communicate successfully the discovery of the identity of the morning star with the evening star.¹⁰ Consequently, Frege’s argument is fallacious, again.

4. FREGE’S INSIGHT

As we have seen, Frege’s analysis of the semantic structures that are presupposed by the successful communication in science is in large part obsolete. Nevertheless, his analysis contains an important insight that is still valid: we are committed to recognize the semantic structures that are presupposed by the

10 Cf. Russell 1905. Even in Frege’s first system, whose semantic structure does not contain modes of presentation, it is possible to communicate this discovery successfully. We need only construe ‘The morning star = the evening star’ and ‘The morning star = the morning star’ as second order predications whose arguments are the concepts of being the morning star and being the evening star.

successful communication of scientific theories. Just as it is incoherent to affirm the sentences of a theory T and to deny, simultaneously, that the entities presupposed by the truth of these sentences exist, so too it is incoherent to affirm these sentences and to deny, simultaneously, that the semantic structures that are presupposed by the successful affirmation of these sentences exist. Thus, we must not accept an ontology that implies the kind of solipsism criticized by Frege. A common universe of discourse is indispensable in science.

It can be shown that Quine's behaviorist conception of language leads to solipsism in Frege's sense. According to Frege's "mentalist" approach, the semantic facts consist basically of the correlation of sentences with thoughts in the speaker's head. The meaning of a sentence is the thought that the speaker expresses by means of it. According to Quine's behaviorist approach, on the other hand, language is a public institution. The semantic facts do not consist in the unobservable correlation of sentences with thoughts, but in the publicly observable correlation of sentences with verbal behavior. In "Ontological Relativity" (1968a), he criticizes the mentalist approach as follows:

Uncritical semantics is the myth of a museum in which the exhibits are meanings and the words are labels. To switch languages is to change the labels. Now the naturalist's primary objection to this view is not an objection to meanings on account of their being mental entities, though that could be objection enough. The primary objection persists even if we take the labeled exhibits not as mental ideas but as Platonic ideas or even as the denoted concrete objects. Semantics is vitiated by a pernicious mentalism as long as we regard a man's semantics as somehow determinate in his mind beyond what might be implicit in his dispositions to overt behavior. It is the very facts about meaning, not the entities meant, that must be construed in terms of behavior. (1968a, p. 27)

The core of Quine's behaviorism is a supervenience principle according to which there is no semantic difference without a corresponding behavioral difference. If two speakers have the same dispositions to verbal behavior, there is no semantic difference between their languages. Typical formulations of this principle are:¹¹

[...] if two speakers match in all dispositions to verbal behavior there is no sense in imagining semantic differences between them. (Quine 1960, p. 79)

There is nothing in linguistic meaning [...] beyond what is to be gleaned from overt behavior in observable circumstances. In order to exhibit these limitations, I propounded the thought experiment of radical translation. (Quine 1987, p. 5)

¹¹ See also Quine 1968a, p. 29 and Quine 1990, p. 110.

It is just that the factuality [of semantics] is limited to the verbal dispositions themselves, however elegantly or clumsily codified. Such, for me, are the facts of semantics. (Quine 1986, p. 155)

To show that an alleged semantic structure does not supervene on the dispositional structure of language, Quine uses his thought experiments of the indeterminacy of meaning and reference. They aim to show that the semantic structure in question can be permuted without affecting the dispositions to verbal behavior. Take, for instance, the correlation of terms with their extensions. The thought experiment of the indeterminacy of reference shows that this correlation can be permuted without affecting any linguistic disposition. This result implies that it is possible that in the languages of two speakers the correlation of terms with extensions is not identical, although the speakers match in all dispositions to verbal behavior. Since this outcome contradicts the supervenience principle, the correlation of terms with extensions cannot be accepted in Quine's ontology of semantics: there are no facts determining what the extensions of terms are. The predicate 'x is the extension of the term t in L' must accordingly be considered as a scientifically non-respectable predicate that does not have an extension.

In *Word and Object* (1960), Quine explains more closely what the semantic facts are, in terms of the notion of stimulus meaning.¹² Formally, the stimulus meaning of a sentence is the ordered pair consisting of its positive and its negative stimulus meaning. The positive stimulus meaning is the class of stimuli that prompt the speaker to assent to the sentence when he is asked; the negative stimulus meaning is accordingly the class of stimuli that prompt him to dissent. The stimuli are considered by Quine as types, not as tokens.¹³ It is hence perfectly possible that, in the languages of two different speakers, a sentence has exactly the same stimulus meaning. Thus, Frege's objection against the idealist interpretation of language that it implies that meanings are private objects does not apply, *mutatis mutandi*, to Quine's behaviorist interpretation.

The notion of stimulus meaning can be considered as an adequate explication of the meaning of observation sentences, in Quine's view; their meaning consists in their stimulus meaning.¹⁴ But the same does not also apply to theoretical sentences: since there are no or only very few stimuli prompting the speaker to assent or to dissent to such sentences, they have almost all the same stimulus meaning.

12 Cf. Quine 1960, chap. 2, especially p. 39.

13 Cf. Quine 1960, p. 34.

14 Cf. Quine 1960, p. 42.

Theoretical sentences have meaning only in an indirect way, via the implication of observation sentences. Since, however, a theoretical sentence does not imply any observation sentence individually, but only together with other theoretical and observational sentences, it does not have meaning individually, but only holistically, that is, as a part of a larger system of sentences.¹⁵

From the behaviorist point of view, the basic language-world relation is the correlation of observation sentences with stimulus meanings. These sentences have a *holophrastic* contact with the world, and not a compositional one, that is, they are connected with the world only as whole sentences, and not by the mediation of words. The entities in the world with which sentences are correlated are the stimuli that prompt either assent or dissent to these sentences. This does not mean, of course, that an observation sentence like ‘This is a dog’ speaks about stimuli. Nor do these sentences speak about objects like dogs. Rather, they do not speak about anything because they do not contain any referential expressions at all. Considered as an observation sentence, ‘This is a dog’ does not say of an object that it is a dog, but only that “it is dogging”.

Since observation sentences are occasion sentences, their truth value depends on the context of utterance. The truth conditions of ‘This is a dog’, considered as an observation sentence, may be explained as follows:

The sentence ‘This is a dog’ is true in the context C is and only if the pattern of stimuli that the speaker receives in C belongs to the positive stimulus meaning of this sentence.

Note that the presence of a dog in C or the existence of any dog is not a condition for the truth of the sentence in C. Its truth depends only on the triggering of the receptors of the speaker in C. As a consequence, observational sentences cannot be used to speak about any kind of objects. The reason is that the correlation of sentences with stimulus meaning is a very poor semantic structure that does not allow us to refer to objects. Since theoretical sentences receive their meaning only indirectly from the stimulus meanings of the observation sentences they imply, these sentences cannot be used to speak about any kind of objects, either. Theoretical sentences are connected with the world only indirectly, via the implication of observation sentences, which are in turn connected with the world via their stimulus meaning. Consequently, theoretical sentences and the words

¹⁵ See, for instance, Quine 1968b, p. 79.

occurring in them are connected only with stimuli, but not with objects. In a language with a behaviorist interpretation, there are no referential terms at all.

It follows that the behaviorist interpretation of language collapses into Frege's linguistic solipsism. We saw that, on the behaviorist interpretation, the truth of a sentence in a context of utterance depends exclusively on the patterns of stimuli that the speaker receives in this context. We can imagine a situation in which a speaker A affirms a sentence which a speaker B denies and both A and B are right. Such a situation is described by Davidson in his critique of Quine's behaviorist (or "proximal") theory of meaning:

... let us imagine someone who, when a warthog trots by, has just the patterns of stimulations I have when there is a rabbit in view. Let us suppose the one-word sentence the warthog inspires him to assent to is 'Gavagai!' Going by stimulus meaning, I translate his 'Gavagai!' by my 'Lo, a rabbit' though I see only a warthog and no rabbit when he says and believes (according to the proximal theory) that there is a rabbit. The supposition that leads to this conclusion is not absurd; simply a rearranged sensorium. Mere astigmatism will yield examples, deafness others; little green man and women from Mars who locate objects by sonar, like bats, present a more extreme case, and brains in vats controlled by mad scientists can provide any world you or they please. (Davidson 1990, p. 74)

In the language of A, the truth value of 'Gavagai!' in a context C depends on the events taking place at A's sensory receptors in C, whereas, in the language of B, the truth value of the same sentence and in the same context depends on the events taking place at B's sensory receptors in C. Since the pattern of stimuli that the person with astigmatism receives when a warthog trots by belongs to the positive stimulus meaning of 'Gavagai!', this person is right to assent to 'Gavagai!' when a warthog trots by, although no rabbit is present.¹⁶ At the same time, we are right to deny 'Gavagai!' (or its translation 'Lo, a rabbit!') in the same situation, because the pattern of stimuli we receive when a warthog trots by belongs to the negative stimulus meaning of 'Gavagai!'. It is, therefore, impossible in a language whose semantic interpretation is restricted to the assignment of stimulus meaning that a speaker A contradicts the opinion of a speaker B. The problem is the lack of a "common ground" in Frege's sense: the truth values of the sentences of such a language are not determined by a common public world, but by the solipsistic worlds of each individual speaker.

CONCLUSION

¹⁶ Davidson (1990, p. 74) erroneously assumes that the person with astigmatism is wrong when he asserts 'Gavagai' in the situation described.

Quine's criterion of ontological commitment is an important tool for deciding what there is. It helps us to justify our ontological choices, especially with regard to the ontology of mathematics and physics. Frege's arguments for the ontological recognition of objective senses and objective *Bedeutungen* suggest that we are also committed to recognize the semantic structures that are presupposed by the successful communication of scientific theories. This additional criterion seems to be an important tool for deciding the questions of the ontology of semantics. It helps us to decide which semantic structures we should acknowledge.

Quine's extremely austere ontology of semantics is incoherent, because its successful affirmation presupposes the existence of semantic structures that are rejected by it. This does not imply that Frege's extremely rich ontology of semantics is adequate. For the ontological conclusions that Frege draws from his analysis of the success conditions of communication in science are mostly invalid, as we have seen. But there are intermediate ontologies of semantics such as Davidson's "distal" theory of truth and meaning. It remains to be seen whether these intermediate ontologies are more adequate than the extreme ontologies defended by Frege and Quine.

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