

## On the Concept of Logical Form in Frege\*

1. In three separate passages of *The Foundations of Arithmetic* (in the introduction, in par. 60 and par. 106). Frege states the following principle:

A) We must never try to define the meaning of a word in isolation, but only as it is used in the context of a proposition<sup>1</sup>. (Frege, 1884: par. 106).

I think it is hard to deny that principle (A) has had considerable influence on the contemporary development of the philosophy of language, but at the same time I am convinced that the principle has been often misunderstood. I will limit myself to one example: for Wittgenstein scholars it is almost a matter of common place<sup>2</sup> to associate with (A) proposition 3.3. of the *Tractatus*: "Only propositions have sense; only in the nexus of the proposition does a name have reference". It is truly surprising to note how this association

\* This paper is part of a larger research project on Frege's philosophy of language. Some parts of the fifth section have already appeared (in a different version) in Bonomi & Usberti (1971).

<sup>1</sup> More precisely, one could say that this principle is for Frege a consequence of the fact that "only in the context of a sentence does a word have a meaning". (Nur im Zusammenhange eines Satzes bedeutet ein Wort etwas). — In actual fact, the mere translation of the extracts in question has given rise to a divergence of positions. For while some hold that "Bedeutung" should be translated as "reference", others disapprove of this way out and claim that at the time he was drafting the *Foundations* Frege had not yet set up the distinction between *sense* and *reference*. To my mind this objection is unjustified, but I will not deal with this question here. For as will be seen, I hold that the semantic principle with which I am concerned is such that it is indifferent whether one is dealing with the extensional or intensional plane. However, in order not to compromise my hypothesis in any way, I have decided (perhaps wrongly) to render "Bedeutung" as "meaning": but it should be kept in mind, as I have already said, that the arguments put forward in this paper remain unaffected whichever way the above alternative is resolved.

<sup>2</sup> By way of example I need only cite Anscombe (1959: 75): "... It was of course on this pronouncement, and on that of Frege, repeated by Wittgenstein, that 'A name has reference only in the context of a proposition' that I modeled my statement about pictures..."; or Geach (1962: 25—26): "If Frege and Wittgenstein were right in supposing that a name stands for something only in the context of a proposition...". A particularly significant illustration of the misunderstanding involved is the case of Black (1964), who explicitly declares that one can leave aside the fact that while Frege speaks of words, Wittgenstein speaks of names.

fails to take into account at least two important facts: i) whereas Wittgenstein speaks, in a very *precise* fashion, of names (and we know that this term has an exact logical characterization both for Wittgenstein and for Frege), Frege speaks *generically* of words (we will see why later); ii) if correctly understood, a proposition such as that of Wittgenstein would not easily be compatible with the general position that Frege assumes with respect to semantics, as is indeed shown by his hesitance about contextual definitions in the *Foundations* and, later, by his explicit rejection of these definitions<sup>3</sup>, formulated for instance in the second volume of the *Grundgesetze der Arithmetik*: "We may not define a symbol or a word by defining an expression in which it occurs, whose remaining parts are known". (Frege, 1903: par. 66). In any case, even leaving out of consideration the reference to Wittgenstein<sup>4</sup>, the interpretation of (A) has called forth the most complex and disparate hypotheses, especially in view of the fact that it apparently contrasts with the general orientation of Fregean semantics. However I think that the meaning of this principle can be elucidated in a relatively simple manner by considering it in the perspective of the whole of Frege's philosophy of language. And this elucidation can serve as a first approach to several important problems regarding the semantics of natural languages, in particular as far as the relation between logical form and transformations is concerned.

2. Before proceeding in this direction however I would like to call to mind one of Frege's fundamental semantic principles, known as the principle of functionality:

B) The meaning of the whole is a function of the meaning of the parts. Now, the point is that principle (B), as is made clear above all in the article on "compound thought", is supposed essentially to account for the *recursive*<sup>5</sup>

<sup>3</sup> The fact that Frege rejects contextual definitions in works later than the *Foundations* has led some people to resolve this problem of interpretation by the claim that this problem of interpretation by the claim that principle (A), formulated in the *Foundations*, was later abandoned. But this is false, as is shown by the letter to Peano of 1896 to which I will refer in the text.

<sup>4</sup> As far as the relation with Wittgenstein is concerned, I think that one can sketch the situation in the following way. Between Frege's assertion that a word has a meaning only in the context of a sentence and proposition 3.3. of the *Tractatus* there lie substantial differences: while in the latter case we are confronted with a principle about the *theoretical* concept of a proposition (having as object names, in a very precise sense), in the case of Frege, as I will try to show, we are facing an assertion formulated in generic terms (for he is speaking of words) and whose scope is limited to natural languages. While in proposition 3.3. a *logical* property (of names) is set up, Frege's assertion merely takes note of a *de facto* situation in natural languages, and it is precisely this factual consideration that is behind the guideline expressed by principle (A).

<sup>5</sup> I use the word "recursive" in the broad sense in which Chomsky uses it when he speaks of the infinite use of finite means.

nature of language on the level of semantics. In other words, Frege asks himself how it is possible to obtain a virtually infinite number of sentences starting with a finite number of linguistic elements. Or again, in semantic terms, how can one account for the fact that, on the basis of *given* notions, one can build ever new combinations of thoughts? Frege's answer is as follows: "If we look upon thoughts as composed of simple parts, and take these, in turn, to correspond to the simple parts of sentences, we can understand how a few parts of sentences can go to make up a great multitude of sentences, to which, in turn, there correspond a great multitude of thoughts". (Frege, 1923:538). It seems therefore that for Frege the principle of functionality presupposes the assumption that the expressions which build up a sentence are endowed with a meaning *of their own*. The meaning of the whole would thus be derived by the composition of these constituent meanings. And in fact this assumption accords well with the general attitude of Frege, bent on setting up a structural homology between syntactic level and semantic level, so that to every well-formed expression there corresponds a meaning (in more exact terms: in every logically adequate language every expression must have a sense and a reference). And indeed, in the paragraph of the *Grundgesetze* cited previously in connection with the rejection of contextual definitions, Frege writes: "Any symbol or word can indeed be regarded as consisting of parts; but we do not deny its simplicity unless, given the general rules of grammar, or of the symbolism, the reference of the whole would follow from the reference of the parts, and these parts occur also in other combinations and are treated as independent signs *with a reference of their own*". (Frege, 1903;: Par. 66, my italics). But in this case is there not a contradiction between the requirement, forced upon Frege by the principle of functionality, of independent meanings for the various constituents of the sentence, — in such a manner that the meanings together with whatever rules of compositions are necessary would account for the recursiveness of language on a semantic level as well — and the denial of any independent meaning (outside the sentence context) in individual words, denial which is firmly expressed by principle (A)? My answer is as follows: i) the principle of functionality is a principle which is directly applied only in the case of formalized languages (where, as we will see, there is a close correspondence between logical form and grammatical form, and where the individual expressions have a meaning which remains constant in every sentence context). In the case of natural languages it does *not* have an *immediate* application, but rather it is a principle which has to do with the workings of these languages only insofar as it has direct bearing on several of their essential properties, namely, those properties which constitute the *logical* backbone of natural languages; ii) by the same token, if one accepts this approach, it seems natural to claim that Frege intended principle (A) to hold only for natural languages, where it now appears not so much as an alternative to the principle of functionality (which would hold for these languages too, though not in an imme-

diate manner<sup>6</sup>, in view of their compositive structure), but rather as a complement to it where needed. But however this may be, I think that the meaning and the significance of principle (A) can be expressed in the following terms: whereas in formalized languages every expression has a meaning of its own independent of the context in which it occurs, in natural languages one cannot ask about the meaning of an expression in isolation, because the determination of this meaning requires that one should have determined the function of the word within the sentence. Therefore, in contrast, I repeat, to what is claimed in Wittgenstein (where one finds the formulation of a *theoretical* principle about the concept of a proposition in general), principle (A) is merely to be taken as a warning motivated by a *de facto* situation in natural languages, which does not correspond at all to what one would expect of a "logically perfect" language: for example, we cannot assign to the expression "is", taken on its own, a univocal and constant meaning, because in some sentences it acts as sign of identity, in others as a simple copula, etc. One thus has to consider the sentence in its totality. We will see shortly that this problem is related to the problem of the non-correspondence between logical form and grammatical form.

3. The plausibility of this interpretation is heightened by an extract from a letter to Peano (29th of September, 1896), in which Frege declares: "Natural languages essentially fulfil their functions if men, in their relationships, associate the same sentence with the same thought, or approximately the same. And for this and is *not* necessary at all that the individual words should have a sense and reference of their own, provided that the whole sentence has a sense. *But this no longer holds when one has to make deductions*: for in this case it is essential that the same expression should occur in two sentences, and that this expression should have the same reference in both. Such an expression must therefore have reference *of its own, independently* of other parts of the sentence<sup>7</sup>". (My italics). Thus, in contrast to what happens in formalized languages, in the case of natural languages a reasonable principle for individuating the meaning of an expression is to *not* limit oneself to the consideration

<sup>6</sup> For if the principle of functionality had no bearing on natural languages, it would be hard to understand why Frege (1892 b) calls on it to establish respectively the sense and the reference of a sentence within the scope of natural languages. One can sum up what is claimed here by saying that the logical backbone of natural languages, which links them to formalized languages, is an essential although *not the only* feature which must be taken into account if one wishes to examine them exhaustively.

<sup>7</sup> It is perhaps to principle (A) that one should relate the following sentence of Frege's (1892 b: 58), in which it is significant that one finds the very same contraposition of natural and formalized languages as that in the letter to Peano: "To every expression belonging to a complete totality of signs, there should certainly correspond a definite sense; but natural languages often do not satisfy this condition, and one must be content if the same word has the same sense in the same context."

of the expression on its own, but to refer back to the *whole* sentence. But why in particular to the sentence? *Because it is at this level that one can discover the logical form*, that is, the structure that is pertinent to the determination of the meaning of an expression, whereas the grammatical form *can be deceptive*.

Consider the contexts in which Frege states the three formulations of principle (A). Now, in all three cases Frege is intent on making a clear distinction between the meaning<sup>8</sup> of an expression and the psychological "representation" which accompanies it. But if one fails to consider the true logical structure underlying an observable sentence, one runs the risk of reducing its meaning to precisely this "representation", and what would result would then be a confusion between the psychological level (which somehow has to do with the "surface" form of sentences) and the logical level (in which it is the *thought* that is relevant, as an objective entity manifesting itself in the logical deep form of the sentence). In particular, Frege's intention in the contexts in question is to emphasize the non-reducibility of the notion of number to a psychological representation. But in order to do this he has, among other things, to show that the meaning of the numerals is not something that can be deduced from a consideration of the numerals themselves taken in isolation, or as they are given in the *observable* structure of the sentence. Therefore (par. 57), in a sentence such as "The number of Jupiter's satellites is 4", the expression "is" does not have the function of simple copula as it does in "The sky is blue" (in spite of what the *grammatical* form would seem to indicate), but rather has the logical function of a sign of identity, and will therefore be substituted in the logical form of the sentence by the expression "(is) equal to". Consequently, the numeral "4" can no longer be classed together with the predicative term "blue", since logically the predicate consists of the entire expression "(is) equal to 4", an expression of which "4" is only a part<sup>9</sup>. Many more examples could be given<sup>10</sup>, but I will content myself with recapitulating what in my

<sup>8</sup> For the sake of simplicity, I will continue to adopt the generic term "meaning"; however it is clear that what I say holds true both in the case of sense and in that of reference.

<sup>9</sup> For Frege numerals are proper names in that they refer to objects (numbers); therefore they cannot act as predicative expressions (which refer to "concepts"), but only as *parts* of these expressions. In contrast to what the grammatical form would seem to suggest, "4" is thus not a predicative expression like "blue" but a proper name: while in the one case "blue" is an authentic predicative expression (and "is" therefore only has the function of copula which can be ignored on the logical level), in the other case "4" is no more than a part of the predicate "(is) equal to 4".

<sup>10</sup> In the *Foundations* Frege writes for example: "It is true that at first sight the proposition 'All whales are mammals' seems to be not about concepts but about animals; but if we ask which animals than are we are speaking of, we are unable to point to any one in particular." (Frege, 1884: par. 47.) In actual fact, the logical form of the sentence in question would be for Frege:  $(x) (\text{Whale } x \supset \text{Mammal } x)$ , where the word "Whale", in contrast to what the grammatical form would make one think, has a predicative function.

opinion is the essence of what Frege has to say: i) in formalized languages, every expression has a constant meaning in every sentence context, and there is a close correspondence between grammatical form and logical form; ii) natural languages *lack* this characteristic, and one has to appeal to principle (A) in order to be able to get at the logical form which might prove to be in contrast with the grammatical form. Only in this manner is it possible to avoid the arbitrariness of psychologizing considerations; for "It may be that mental pictures float before us all the while, but these need not correspond to the logical elements in the judgement. It is enough if the proposition taken as a whole has a sense; it is this that confers on its parts also their content". (Frege, 1884; par. 60).

4. In the light of what has been said, it might seem that one should link Frege's position to that of not a few logicians and philosophers of language according to whom there is *in principle* a difference between formalized and natural languages. But I do not think this is so. As I have already pointed out, it is significant that Frege several times speaks of the principle of functionality in the context of natural languages; in particular, what he is after in the article on "compound thoughts" is an analysis of the compositive structure of these languages, and it is precisely in this structure that he finds one of the most striking features pertaining to the logical aspect. But one could object that this still gives no explanation for the fact that principle (A) itself, if what was said above is correct, apparently establishes once and for all a disparity of treatment between these two families of languages. My answer is as follows: for Frege, the very fact of its having to fulfil a multiplicity of functions means that a natural language is endowed with characteristics that are not susceptible of a purely logical treatment, but this does not entail the impossibility of tracing a logical use within it, to which there corresponds a logical structure. In particular, in the case of sentences, what is relevant from this point of view are the *truth conditions*, but note that to determine the truth conditions of a sentence we must take into account its logical form. In other words, in a natural language (in contrast to what goes on, as we will see, in a "logically perfect" language) there is, it is claimed, no close correspondence between grammatical form (defined in purely syntactic terms) and logical form (which, as noted, is relevant for the determination of the truth conditions of sentences and therefore, as Frege would say, characterizes the sentences themselves from a *deductive* point of view). Several times Frege contrasts what he calls the "shadings" of "colourings" of a sentence to the thought (Gedanke)<sup>11</sup> that it expresses: whereas the former depend in some sense on language-specific idiosyncracies (and therefore on the mechanisms of constructions in the *observable* sentences of a given language), the latter is that

<sup>11</sup> A thought ("Gedanke": Church and Carnap propose that this term should be translated as "proposition") is that which is expressed by a sentence, (it is therefore the sense of a sentence, while its reference is a truth value: truth or falsity).

which can properly be said to be true or false, and which as such constitutes the basic object of the logical treatment: "We must not fail to recognize that the same sense, the same thought, may be variously expressed; thus the difference does not here concern the sense, but only the apprehension, shading, or colouring of the thought, and is irrelevant for logic. It is possible for one sentence to give no more and no less information than another; and, for all the multiplicity of languages, mankind has a common stock of thought. If all transformation of the expression were forbidden on the plea that this would alter the content as well, logic would simply be crippled; for the task of logic can hardly be performed without trying to recognize the thought in its manifold guises". (Frege, 1892 a: 46)<sup>12</sup>. It is interesting to note how it is exactly this type of consideration that drives Frege, as early as the *Begriffsschrift*, to a step of fundamental importance, namely the proposal to reduce the *linguistic* structure of subject and predicate to the *logical* structure of function and argument. And similarly, in later works as well, the analyses of subordinate sentences (eg. relatives), of the various functions of the verb "be" or of expressions such as "every", "all", "some", etc. have as objective the determination of a logical form underlying the grammatical form.

It should be clear by now why I believe that one cannot read into Frege an a priori differentiation between formalized and natural languages. For as we have seen, in the case of natural languages Frege distinguishes two separate levels; the first is characterized in logical terms and constitutes that fundamental framework which is common to all languages and which allows one to translate from one language to another (moreover, as we have just noted, it is the only one which is truly relevant to semantics in that it is concerned with *truth conditions* of sentences); the second level, on the other hand, is characterized in "grammatical" terms (in the sense of grammars which are specific to each individual language)<sup>13</sup>. Now, what is at the root of this second level? A transformational apparatus. And it is these transformations that we

<sup>12</sup> It is interesting to note that this is the level at which Frege carries out the analysis of the recursive structure of language. For example, in the case of sentences of the form "If *A*, then *B*", Frege writes: "My task here is to remove the adjuncts and thereby to pick out, as the logical kernel, a compound of two thoughts, which I have entitled 'hypothetical compound thought.' Insight into the structure of thoughts compounded of two thoughts must provide the foundation for consideration of multiply compounded thoughts." (Frege, 1923: 551).

<sup>13</sup> Frege speaks of the expressive exuberance of natural languages, which is determined by the multiple functions which these languages are called to fulfil, and which render them logically imprecise and inadequate (hence the need to construct an "ideography"). Now, the line of inquiry that I have been urging does recognize that though Frege may have started out from this premise, he also set himself the problem of determining the logical structure of these languages: such a structure is *not the only* element that characterizes them, but it is at least possible to delimit it if one leaves the rest aside. One hardly need add that for Frege this is one of the fundamental tasks of the philosophical analysis of language.

must take into account in order to get at the logical form of sentences, i. e. that with which the semantic analysis is concerned: "A sentence can be transformed by changing the verb from active to passive and making the object the subject at the same time. In the same way the dative may be changed into the nominative while 'give' is replaced by 'receive'. Naturally such transformations are not indifferent in every respect; but they do not touch the thought, they do not touch what is true or false. If the inadmissibility of such transformations were generally admitted then all deeper logical investigation would be hindered. It is just as important to neglect distinctions that do not touch the heart of the matter as to make distinctions which concern what is essential. But what is essential depends on one's purpose". (Frege, 1919:516).

5. We can sum up the above in the following terms: for Frege the difference that one finds between formalized languages and natural languages is not so much one of principle as of degree of precision; thus the workings of natural languages too are determined, at least at a deep level (which is not necessarily reflected in the surface form of the language) by a set of logical laws: in particular, it is to this level that we must turn if we wish to delimit an aspect of a natural language for which one can construct a rigorous semantics.

What I hope to demonstrate in this final section, albeit in a schematic and imprecise manner, is that a transformational approach could provide valuable linguistic support for the line of inquiry followed so far.

It is well known that Tarski (1936) established as a condition of material adequacy for the definition of the term "true", relative to the sentences of a given language, the possibility of obtaining as consequences of the definition itself all the equivalences of the form:

(T)  $x$  is true if and only if  $p$

where " $x$ " stands for the *name*, constructed in the metalanguage<sup>14</sup>, of any sentence of the object-language<sup>15</sup>, and " $p$ " for an expression that translates the sentence in question into the metalanguage, that is, an expression which has the same meaning as the sentence. One can also say that the metalinguistic equivalences of the form (T) (which are infinite in number when the sentences of the object-language are infinite in number), constitute "partial definitions" of truth for single sentences: in an adequate theory of truth one should be able to "explain" (deduce) every equivalence obtained from (T) by substituting for " $x$ " the name of any sentence and for " $p$ " its translation. Thus, taking up Tarski's example again, let us assume:

<sup>14</sup> By object-language I mean here the language *about* which one is speaking, and by metalanguage the one *in* which one is speaking.

<sup>15</sup> In actual fact Tarski (1936) requires that " $x$ " should not simply stand for a name, but for a *structural-descriptive* name: that is, such that it can describe "the words which compose the expression denoted by the name, as well as the signs of which each single word is composed and the order in which these signs and words follow one another" (pp. 156—157).

- i) that the object-language is the calculus of classes;
- ii) that to this language there belongs the sentence " $(x_1) (x_{11}) [(x_1 \subseteq x_{11}) \vee (x_1 \supseteq x_{11})]$ ";
- iii) that the metalinguistic name of the sentence quoted in (ii) above is " $\cap_1 \cap_2 (t_{1,2} + t_{2,1})$ ";
- iv) that the expression which translates the sentence quoted in (ii) above into the metalanguage is: "for any classes  $a$  and  $b$ ,  $a$  is included in  $b$  or  $b$  is included in  $a$ ".

Then, if it is materially adequate, a general definition of truth for the sentences of the calculus of classes will have as consequence:

(1)  $\cap_1 \cap_2 (t_{1,2} + t_{2,1})$  is true if and only if for all classes  $a$  and  $b$ ,  $a$  is included in  $b$  or  $b$  is included in  $a$ .

It is likewise well-known that Tarski rejected the notion that the method he had set up to construct an adequate definition of the concept of truth in the case of formalized languages might be applicable in natural languages as well. More generally, he denied that the semantics of a natural language can be constructed in a rigorous fashion. We will now try to see how this position can be interpreted and what its implications are for the problem under discussion in this paper.

In order to simplify the exposition, we will make use of the following convention: in the construction of the equivalence of the form (T) for a given sentence, the metalinguistic name of the sentence will consist of the sentence itself preceded and followed by quotation marks (as is usual in the case of quotations), while its metalinguistic translation will be none other than the sentence itself just as it is in the object-language (this second point is linked to the fact that the metalanguage of which we make use to construct the semantics must necessarily be richer than the object-language, from the point of view of its expressiveness; it so happens that every expression of the latter must be translatable into the metalanguage, and this is guaranteed all the more effectively if the metalanguage contains the object-language as subpart, so that every expression of the latter belongs also to the former).

Given the sentence of English:

(2) Nixon did not go to China to win the election.

in accordance with (T) and the above convention, we should have:

(3) "Nixon did not go to China to win the election" is true if and only if Nixon did not go to China to win the election.

Brief reflection suffices to make one realize that, in contrast to (1), (3) is completely useless (and at worst misleading) for the purposes of determining the truth conditions of the sentence in question<sup>16</sup>. For while in (1) what follows the expression "if and only if" does actually constitute a *necessary and suffi-*

<sup>16</sup> The fact that (3) is constructed in a different way from (1), as a result of the adoption of the convention explained above, is completely irrelevant given that it is a question of a simplification made for expository purposes, with the principle remaining unchanged.

*cient condition* for the truth of the sentence in question, in (3) this is not the case at all. A simple remark clinches the matter: in order for (2) to be true, intuitively, it is sufficient that there should obtain *one* of the two following conditions, which I will formulate discursively and imprecisely as follows for the sake of simplicity of exposition:

- (4) a) Nixon did not go to China, and this in order to win the election.  
 b) Nixon went to China, and this not in order to win the election.

It is therefore clear that we are faced with the impossibility of constructing a reasonable equivalence of the form (T), whether we place after "if and only if" the sentence (2) itself (as stipulated in the convention that has been adopted and as we did in order to obtain (3)), or instead a translation of (2), of the same meaning (meanings, in this case) and thus leaving the problem untouched. In other words, there are *two* sufficient conditions (instead of one necessary and sufficient one, as in the case of (1)) so that instead of an equivalence of the form (T) there are intuitively two conditionals:

- (5) a) "Nixon did not go to China in order to win the election" is true if Nixon did not go to China, and this in order to win the election.  
 b) "Nixon did not go to China in order to win the election" is true if Nixon went to China, and this not in order to win the election.

I would imagine that it must have been cases of this kind which induced Frege to claim that (in general) the grammatical (or surface) form of a sentence is not relevant for the determination of the truth conditions of the sentence itself, and that it is necessary to look at its logical form. Now, what I want to emphasize is that a transformational grammar is precisely the device which allows one to restate Frege's position in a more precise fashion. (Here I must assume some acquaintance with a few of the basic concepts expounded by Chomsky in *Aspects*, in particular the concepts of base component, transformation and deep structure<sup>17</sup>). The point is that one of the ways to construct an equivalence for sentence (2) could be approximately the following: (i) At the origin of the two "transformational histories" of the sentence there are two distinct deep structures from which the sentence may be

<sup>17</sup> As is well known, the notion of deep structure and in general the Chomskian way of defining the base component have been criticized by the upholders of so-called generative semantics. Now, my arguments have been put forward on such a general (or generic) level that no theoretical position is required in this matter: for it seems to me that my hypothesis is not tied to either alternative. (Since the central problem here is the problem of truth conditions, an important concept is the notion of interpretation, in the normal logical use of the term. But it is not quite clear what happens to the notion of interpretation in some of the positions that have emerged within generative semantics, according to which there is identity between deep syntactic representations and semantic representations. Obviously the fact that one can and/or must take into account considerations of a semantic order (as for instance those relevant to truth conditions) when dealing with syntactic problems does not mean that there should be identity between syntactic structures and semantic structures.)

derived. (ii) Assuming that the base component has been conceived so as to satisfy the requirement of "logical perfection", then for each one of the two deep structures generated by the base component it is possible to construct an equivalence of the form (T) in which "x" is substituted by the metalinguistic name of the deep structure and "p" by its metalinguistic translation, which we will term a *partial non-ambiguous translation* of (2), and which for the sake of simplicity we will assume to be of the forms respectively (4 a) and (4 b). (iii) If we now wish to construct an equivalence for (2) itself, instead of for its deep structures, it seems natural to get round the problem by constructing it in such a manner that "if and only if" is followed by the disjunction of all the partial non-ambiguous translations of (2). Thus we have:

(6) "Nixon did not go to China to win the election" is true if and only if Nixon did not go to China, and this in order to win the election or Nixon went to China, and this not in order to win the election.

In general, the paradigm of partial definitions of truth for sentences of a natural language could be something like:

(N) x is true if and only if  $p_1$  or  $p_2$  or . . .  $p_n$

where "x" stands for the metalinguistic name of any sentence and " $p_1$  or  $p_2$  or . . .  $p_n$ " ( $n \geq 1$ ) is the disjunctive finite sequence of all and only the possible partial non-ambiguous translations of the sentence<sup>18</sup>.

At this point we can observe that, from the point of view of semantics, the inclusion in our grammar of a transformational apparatus has precisely the consequence of enabling us in principle to construct the infinite equivalences of the form (N), which constitute as many partial definitions of truth for sentences. If this is so, it amounts to saying that besides rendering the grammar empirically more adequate and *syntactically* more exhaustive and simpler, the adoption of the transformational apparatus would have the effect, on the *semantic* level, of furnishing every sentence with a precise enough structure for it to be feasible to assign it truth conditions. But it is clear that a linguistic procedure would thus lead to the very thing that logic is aiming at with a view to determining the logical form of the sentence. I will now try to explain this idea in greater detail.

Kaplan (1969:282—283) proposes to consider Russell's contextual definitions as rules of translation which bridge the gap between the grammatical form and the logical form of a sentence. I will not deal here with the problem with which Kaplan is concerned in the discussion of contextual definitions (the problem of descriptions), but will content myself with mentioning a general aspect of the problem that Kaplan brings up: namely, the possibility of considering rules of this type as rules of translation from a language that is

<sup>18</sup> As already mentioned, the set of partial non-ambiguous translations of a sentence is the set of expressions each of which translates a deep structure of the sentence into the metalanguage. The obvious prerequisite is that *all* the deep structures of the sentence should be available. Naturally, in the case of non-ambiguous sentences, one has  $n = 1$ .

not logically perfect to one that is indeed "logically perfect". What is meant by this expression? In simplified terms, this: a language will have a grammar associated with it in the normal fashion, that is, a set of formation rules (so that the grammatical form of every expression is determined by these rules); and secondly it will have a set of evaluation rules associated with it specifying how to construct the semantic value of an expression on the basis of its components, (and here the logical form<sup>19</sup> is to be taken as the structure determined by these rules, in other words as an interpreted structure). Now, the prerequisite that a language must satisfy in order to be logically perfect is that "the logical form of an expression must always mirror the grammatical form. Therefore, for logical perfection we require that the logically simple expressions coincide with the grammatically simple (but well-formed) expressions, and that to every formation rule there corresponds a unique evaluation rule, such that any compound formed by applying the formation rule to given components is evaluated by applying the corresponding evaluation rule to the values of the components. This has the desired result that the semantical evaluation of an expression exactly recapitulates its grammatical construction". (Kaplan, 1969: 283—284).

In sum, the idea implicit in our observations on the relation between surface form and truth conditions (in Frege's sense) is that of considering the possibility of viewing the inverses of transformations as rules of translation from a logically imperfect language to a logically perfect one; in other words, if this point of view is plausible, the transformational component will permit us to arrive at the logical forms behind the set of "surface" sentences. And, assuming that one accepts this point of view, it is natural to establish the following condition of adequacy for the base component, namely, that it should generate all and only the sequences of symbols to which truth conditions can be assigned<sup>20</sup>. In this manner the principles informing the con-

<sup>19</sup> As we have seen, by "logical form" Kaplan means the interpreted structure that "mirrors" the grammatical form (in a logically perfect language). In this paper, which is in part dedicated to the problem of transformations, by "grammatical form" I mean the "observable" syntactic structure of the sentence, while the term "logical form" is used mostly to indicate the "deep" syntactic structure which would be "mirrored" by the logical form in Kaplan's sense. For the problems raised by the usefulness or otherwise of the concept of deep structure, see note 17 above.

<sup>20</sup> It should be clear that in this paper, which is concerned with a few of the problems inherent in the Fregean concept of logical form and truth conditions, I have followed Frege in restricting the scope of the discussion to declarative sentences. But it is obvious that unless one adopts *ad hoc* solutions (which in actual fact have on occasion been adopted, but which seem to me intuitively unsatisfactory), the introduction of non-declarative sentences would entail a revision or at least an elaboration of the arguments put forward in this paper: one would have to take into account such concepts as felicity conditions, appropriateness conditions, etc. But these considerations would take us too far from the problems being dealt with here.

struction of a Fregean semantics (principles which intuitively are to be matched up with Frege's claim, — taken up and elaborated by Carnap, 1947 — that understanding a sentence is equivalent to grasping its truth conditions) are seen to be capable of playing a significant role in the determination of the task of a transformational grammar.

(Engl. tr. by Rachel Costa)

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