

Reflections on negation¹⁾

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1 THE INADEQUACY OF CLASSICAL LOGICAL NEGATION

Around 300 BC the first professional linguists, professors at the newly created University of Alexandria, made the first attempts at describing the grammatical structures of Greek. They did so for the benefit of the large numbers of young people wanting instruction in Greek as a foreign language (since Alexander the Great's conquests had turned Greek into the language of prestige). Yet they had little to fall back on. Their only source of any consequence was Aristotle, deceased a few decades earlier, who had engaged in intensive linguistic analysis. Aristotle, however, had had logic and metaphysics in mind and not the teaching of Greek as a foreign language.

It is the business of logic to establish a formal procedure for the computation of necessary consequences (entailments): when a given set of sentences **A** is true then there is also a set of sentences **B** that are necessarily true in virtue of the meanings of the words and structures of **A**. We say that **A** entails **B**, or $A \vDash B$. Around 360 it had been discovered that some entailments are derivable on the basis of certain 'logical' elements in certain positions in sentences, regardless of the lexical meanings of the other words used. This discovery had led Aristotle to write down the first formal computational method for the derivation of entailments. For this he needed a structural and semantic analysis of sentences, besides a structural analysis of reality so that a correspondence relation of truth could be defined. Whether this type of sentence analysis could be of use in the teaching of Greek as a foreign language was a question that had no a priori answer, but the Alexandrian linguists felt that it would be unwise to reject the logical analyses out of hand. They took over what seemed usable, such as Aristotle's limited list of word classes or his notion of nominal and verbal flexion. Later generations of linguists did the same, whether for didactic or for more theoretical purposes. It was thus that some logical notions found their way into linguistics, negation being one of them, but not, for example, the Aristotelian quantifiers.

Our first question now is this: does natural language negation (NL-negation) correspond to the classical Aristotelian negation operator \neg ? This negation

1) This article is a reworked version of a Dutch article by the same author 'Overpeinzigen bij negatie', *Gramma/TTT, tijdschrift voor taalwetenschap* 2.2:145-163.

operates in a logical calculus that is subject to the strict bivalence condition, or the Principle of the Excluded Third (PET), requiring (a) that all sentences (propositions) always have a truth value, and (b) that there are precisely two truth values, 'true' and 'false'.

The logical properties of \neg are given in the truth table of fig.1:²⁾

A	$\neg A$
1	2
2	1

(NB: '1': 'true', '2': 'false')

Figure 1 The truth table of the classical Aristotelian negation operator \neg

This operator simply toggles from 1 to 2 and vice versa. Two consecutive negations, therefore, cancel out against each other, as the second negation will undo the effect of the first. Moreover, all entailments of A are lost under \neg , except the necessary truths, which are entailed by any sentence.

We have here a double test for NL negation. If it turns out either that consecutive negations do not cancel out against each other, or that not all contingent entailments of the negated sentence are lost under *not*, then there is something amiss with the standard analysis. Then the classical operator \neg cannot be simply the logical translation of NL-negation. Then either the truth-table is faulted, or the axiomatic Principle of the Excluded Third must be revised, or, most probably, both. If it were to turn out that PET should be revised then at least one further possibility must be assumed beyond simply true and simply false. That no longer excluded third would then be either the lack of a truth value or a third truth value. Let us see.

(a) Do consecutive negations cancel each other out?

Dave has been fined because he allegedly jumped the traffic lights. However, at the moment of the alleged offence he was abroad. He decides to let the matter go to court. In court the following dialogue takes place:

- (1) Judge: You are charged with not having stopped your car before a red traffic light on the crossing of High Street and Tumble Road on the 18th of June 1995 at 11.35 a.m.

2) I deviate from the tradition that goes back to George Boole to denote falsity with '0'. The reason will become clear presently, when a further truth-value is introduced.

Dave: The charge is incorrect. I am not guilty. I did not not stop.

Judge: So you did stop.

Dave: I'm afraid not. I did not stop and I did not not stop: I simply wasn't there! I was in Nepal on June 18th, 1995, as is shown by my passport.

Since the judge has no choice but to acquit Dave of the charge brought against him we must conclude that two consecutive negations do not cancel out against each other: it is possible for both *A* and *not-A* to be false, which means that there is a third possibility. We do notice, however, that Dave's sentence *I did not not stop* evokes a previously uttered sentence *I (you) did not stop*: the second negation causes a so-called 'echo-effect' (Baker 1970).

(b) Are all entailments of A lost under negation?

Here, too, we see that the standard analysis fails to do justice to the facts. One has to rummage a little in remote corners of the language to find them, but there definitely are cases where contingent entailments are indeed fully preserved under NL-negation:

- | | | | | |
|-----|----|---|---|-----------------|
| (2) | a. | Only Bob laughed | ⊢ | Bob laughed |
| | b. | Not only Bob laughed | ⊢ | Bob laughed |
| (3) | a. | It was Bob who laughed | ⊢ | Someone laughed |
| | b. | It wasn't Bob who laughed | ⊢ | Someone laughed |
| (4) | a. | That she was fined surprised Emily | ⊢ | Emily was fined |
| | b. | That she was fined did not surprise Emily | ⊢ | Emily was fined |

The entailments in question are obviously contingent. They cannot be logically necessary truths since they can easily be false. That they are indeed entailments results when one tries to imagine a situation where the entailment is false but the entailing sentence is true. For example, for (2b), imagine a situation where Bob did not laugh, yet it is true to say that not only Bob laughed. This is absurd: if it is true that not only Bob laughed, then by analytical necessity Bob laughed. And analogously for (3b) and (4b). The cases of (2a), (3a) and (4a) are clear and generally recognized.

The latter is not so for cases like (2b), (3b) or (4b). There is no mention of such cases at all in the literature, and when I bring them up in the presence of logicians there tends to be an embarrassed silence. One is, on the whole, unwilling to admit that these observations are correct, no matter how strong the evidence is. The reason for this unwillingness is clear, though amazing: logicians suddenly become stubborn when they suspect tinkering with the basic axioms of classical logic, especially when the suspected tinkerer does not go

through life as a professional logician. This attitude, incidentally, is not the privilege of logicians. It is somewhat depressing to see how academics in general, and often not only the minor figures, suddenly show signs of nervousness when they feel that their certainties are questioned. The otherwise great Bertrand Russell, for example, became quite nervous when he realized that the question of definite descriptions in natural language was a serious threat to the axioms of standard logic. In order to save classical logic from what would have to amount to a thorough revision he devised his famous Theory of Descriptions (Russell 1905), about which we shall say more in a moment. Later, after 1945, when the school of Ordinary Language Philosophy flourished at Oxford and the Oxford philosophers began to take delight in undermining the classical logical axioms, Russell found it necessary to express extremely bitter criticisms with regard to the Oxford school of philosophy (cp. for example Russell 1956,1957).³⁾ This is so generally in logic: revision of axioms is not appreciated. Logicians are, from this point of view, very conservative and inward looking. Yet something will have to be done if we are serious about understanding NL-negation.

The cases (2b), (3b) and (4b) are all presuppositional: the entailments in question are not 'classical' entailments (so called because they do not jeopardize classical logic) but presuppositional entailments (Seuren 1985,1988,1994). These are preserved under normal, unmarked negation, even though this runs counter to standard logic. The picture is further complicated by the fact that natural language not only has the normal, unmarked negation, which we shall call the *minimal negation*, but also a not so normal and strongly marked negation, which we shall call the *radical negation*, likewise expressed by the word *not*. In a way, therefore, we can say that *not* in English is ambiguous between a minimal and a radical interpretation. Radical *not* does indeed cancel all entailments, presuppositional entailments included, which has made some think that, after all, the classical operator \neg is indeed adequate for NL-negation, as it corresponds to what we call here the radical negation. But this is not so. First, consecutive radical negations do not cancel out at all against each other, and, moreover, the radical negation cannot occur in all positions in the English sentence where sentential negation is allowed. That is, there are cases of sentence negation where a radical interpretation is impossible. Those cases are crucial in that they prove that it does indeed happen that contingent entailments are preserved under negation. The examples (2b), (3b) and (4b) are cases in point: the *not* in these sentences is sentence

3) See, for example, the bitter attack on the Oxford philosophers in the essay 'The cult of "common usage"' in Russell (1956): 'What they believe in is the usage of persons who have their amount of education, neither more nor less. Less is illiteracy, more is pedantry — so we are given to understand. ... To discuss endlessly what silly people mean when they say silly things may be amusing but can hardly be important.'

negation, but it does not allow for a radical interpretation. But before we look at these matters more closely, let us go through the recent history of the question of presuppositions in language.

2 BIVALENT BUT WITHOUT PET?

In 1950 the Oxford philosopher Peter Strawson published an article in *Mind* entitled 'On referring' (a teasing reference to Russell's 'On denoting' of 1905, also in *Mind*). Here he raises the question of definite descriptions that have no reference object, as in Russell's old example:

(5) The present king of France is bald

The problem is that the noun phrase *the present king of France*, though grammatically well-formed and fit for reference, does not refer since France has no king. This complicates the normal criterion for truth and falsity, which says that a sentence (proposition) is true if and only if the reference object denoted by the subject term is an element in the set of things denoted by the predicate. For example, if I say *The Louvre is in Paris*, then that sentence is true just in case the object referred to by the NP *the Louvre*, i.e. the actual building, is an element of the set of things that are in Paris. If it is not, the sentence is false. In the case of (5), however, there is no reference object for the subject term *the present king of France*. As Russell puts it (1905:485):

By the law of the excluded middle, either "A is B" or "A is not B" must be true. Hence either "the present King of France is bald" or "the present King of France is not bald" must be true. Yet if we enumerated the things that are bald, and then the things that are not bald, we should not find the present King of France in either list. Hegelians, who love a synthesis, will probably reply that he wears a wig.

As Russell does not pursue the alleged Hegelian answer any further we must look for an answer elsewhere. One thing is clear: there is, in this world, a class of 'things' that are truly bald and does not contain any non-existing entities. This means that in any case sentence (5) cannot be true. PET now leaves no other possibility for (5) than falsity, and hence truth for its negation:

(6) The present king of France is not bald

But here the ordinary language user revolts, saying that (6) implies the existence of a king of France and says that that person has a hairy scalp. Since (5) likewise implies the existence of a king of France (but says the opposite about him), this would seem to be a case of preservation of an entailment under negation. So the question arises: who is right, the language user or logic?

If we are to believe Russell (1905), the language user cannot be right. (In later publications Russell is very explicit on this point. Ordinary language users cannot think, and therefore not speak, properly for lack of logical knowledge.

The world would be a better place if everyone observed the laws of logic but, unfortunately, mankind has not yet progressed to that state of perfection.) So logic is right? Yes, says Russell, but then it is better not to assign to (5) the logical analysis hitherto used. The traditional analysis in terms of subject ('the present king of France') and predicate ('is bald') must be replaced by a more sophisticated analysis involving quantification. The analysis he proposes is the following (though the notation did not yet exist):

$$(7) \quad \exists x[\text{now}[\text{KF}(x)] \wedge \text{Bald}(x) \wedge \forall y[\text{KF}(y) \rightarrow x=y]]$$

This is to be read as 'there is at least one x such that x is now king of France and is bald, and such that for all y , if y is king of France x is identical with y '. In simpler words: 'there is precisely one x that is now king of France, and x is bald'. The advantage of this analysis is that, since (7) is clearly false, the negation of (7) is now clearly true:

$$(8) \quad \neg \exists x[\text{now}[\text{KF}(x)] \wedge \text{Bald}(x) \wedge \forall y[\text{KF}(y) \rightarrow x=y]]$$

Now every suggestion that if (8) is true there should be a king of France (and one with a hairy scalp) has vanished. This proposal, according to which definite descriptions are analysed in terms of existential quantification and a uniqueness clause (' $\forall y[\text{KF}(y) \rightarrow x=y]$ '), is called the Theory of Descriptions.

Strawson (1950 and later publications) objected to Russell's Theory of Descriptions, mainly on the grounds that it fails to do justice to the facts of language. He introduces a new kind of entailment, the presuppositional entailment whose most typical property is that it is not lost under negation. NL-negation, therefore, preserves presuppositions. This means that PET is in jeopardy, because in classical logic it is possible for both A and $\neg A$ to entail B only if B is a necessary truth and cannot be false (falsity of B would entail both A and $\neg A$, which is impossible). Strawson therefore rejects PET, proposing that falsity of a presuppositional entailment B leads to the loss of a truth value for the entailing sentence A : 'The question as to its truth or falsity simply does not arise' is the phrase he uses time and again. (Ironically, the massive literature on the question of what truth value, if any, is to be assigned to sentences suffering from presupposition failure is living proof of the fact that the question arises very much!) What Strawson proposes has been called the theory of a *gapped bivalent logic*: sentences with presupposition failure fall into the so-called 'truth value gap'.

Strawson's approach is in fact identical to what was suggested on various occasions by Gottlob Frege, for example in Frege (1892). Frege, however, never elaborated the logical consequences. Strawson did make an attempt at doing so, but without much success. Not until many years later did it transpire what Strawson's proposal amounts to in a strictly logical sense.

In gapped bivalent logic the truth tables for negation (with ' \sim ' for the new negation, and ' u ' for 'no value'), conjunction and disjunction are as follows:

A	$\sim A$
1	2
2	1
u	u

		B		
	A	2	2	u
	1	1	2	u
	2	2	2	u
	u	u	u	u

		B		
	A	2	2	u
	1	1	1	u
	2	1	2	u
	u	u	u	u

Figure 2 The truth tables of negation, conjunction and disjunction in gapped bivalent logic

As one sees, the absence of a truth value (u) is 'infectious': wherever u is (part of) the input the output value is u. This is a natural consequence of the fact that the operators in question are truth-functional: 'no value' means no input, and hence no output. Other than the infectious band of 'no value' outputs, the tables are as in standard propositional calculus. Logic, therefore, is applicable only when the presuppositions of the sentences (propositions) that play a part in it are fulfilled. Failing that, the sentence in question and all its logical compositions are not valued and branded as u. Assuming a 'universe' set U of all possible situations for each application of the logical system, classical logic keeps U constant for the whole duration of the application. But in gapped bivalent logic one can say that U changes as circumstances change. The applicability of such a logic is, therefore, dependent on contingent circumstances.

From a certain point of view the prospects of such a logic are now extremely dim. The developments in logic since George Boole had been directed at eliminating the main defect of Aristotelian Predicate Calculus, which was that it is not applicable in cases where any of the sets quantified over is empty. That defect was considered serious precisely because logic aims at defining entailment relations merely on the basis of analytical semantic properties and regardless of contingent factors. Logic should be applicable always and everywhere, and not be restricted by what happens to be the case in the real world. From this point of view, therefore, gapped bivalent logic is a retrograde development, as it makes propositional calculus dependent on contingent factors.

Here we are faced with a conflict of interests. If one takes a non-applied, purely mathematical view of logic, this objection is no doubt justified. But one can also wonder if the imposition of contingency restrictions on the logical machinery may not make this machinery more appropriate as a description of how humans use their logical powers in thinking and speaking. It seems realistic to posit that in each situation where speech is used or thinking takes place one deals with a set of possible situations that is a great deal less

enormous and more manageable than the unimaginably large and unwieldy universe U of standard logical systems. The universes within which we move when speaking or thinking are not only heavily restricted by, precisely, contingent factors but they also change in the course of the speaking or thinking process. From this perspective it makes perfect sense to let the logic be restricted by whatever bounds are imposed on the variable, flexible universe of discourse and reserve a limbo, denoted for example by 'u', for whatever falls outside the system. Therefore, if we object to bivalent gapped logic as a description of the logic of language it is on empirical grounds and not because of the abstract criticisms advanced by the mathematical logicians.

A first empirical objection came from Wilson (1975) and Boër and Lycan (1976). These authors pointed out that natural language allows for a use of the negation operator where indeed all contingent entailments, including the presuppositional ones, are cancelled:

- (9) a. Carl did NOT lose his watch. He never had one!
 b. The king of France is NOT bald. France doesn't have a king!
 c. It did NOT surprise Emily that she got fined. She didn't get fined!
 d. Victor did NOT stop smoking. He never did smoke!

Wilson and Boër and Lycan concluded from this that, apparently, NL-negation does, after all, correspond to the classical operator \neg , since the word *not* can be used in such a way that all contingent entailments of the negated sentence are cancelled. From a strictly logical point of view, therefore, presuppositional entailments are just ordinary entailments. What makes them presuppositional has nothing to do with logic, maybe with pragmatics. This analysis goes by the name of *entailment analysis*, as it treats presuppositions as just entailments. This was good news for the logicians, since no tinkering is needed with the good old principles of logic. Whatever is unclear has to be cleared up by something called 'pragmatics'.

Yet things are not that easy. First it has to be observed that the appeal to pragmatics has so far remained unanswered. Not by a long shot has pragmatics succeeded in explaining what is presuppositional about presuppositional entailments, despite rather longwinded attempts by Wilson to get pragmatics to deliver the answer. But apart from this, there are straightforward empirical grounds that force us to reject the entailment analysis. The authors in question were right in making observations like those in (9), but they forgot to look at cases like those given in (1)-(4). So let us see where the entailment analysis flounders.

Consider again the cases (9a-d). These are all cases of the radical (use of) negation, mentioned above, which we have opposed to the minimal (use of) negation. Wilson and Boër and Lycan knew that the negation, when used radically, requires a strongly marked accent. But they did not realize that the radical negation is restricted to certain syntactic positions and to certain

constructions. When discussing (2)-(4) we already pointed this out. We can now be more specific and say that when sentence negation occurs in fronted position, preceding a quantifier (*not all children laughed*) or a contrasted element (*not BOB but JACK laughed*) or operators like *only* (*not only Bob laughed*), the negation has to be minimal and must, therefore, preserve presuppositions. Likewise with so-called ‘cleft’ and ‘pseudocleft’ constructions, and with contrastive accent cases, as in:

- (10) a. It wasn’t Jack who started the row (cleft)
 b. Who started the row wasn’t Jack (pseudocleft)
 c. JACK didn’t start the row, LEO did (contrastive accent)

These presuppose that someone started the row. When one tries to eliminate the presupposition by using the negation radically one will find out that this is not possible. The same applies again to sentences with a verb inducing a factive presupposition and a preposed *that*-clause, as in (4) above. In all these cases the radical negation cannot be used, which means that there at least the presuppositional entailments are preserved under negation.

Furthermore, it is generally known, nowadays, that the negation required with Negative Polarity Items (NPIs) has to be the minimal, presupposition-preserving negation. The radical negation is not possible there (the NPIs are in italics):

- (11) a. I didn’t *bat an eyelid*
 b. He hasn’t *lifted a finger*
 c. The man won’t *give a damn*

A further argument against the entailment analysis is the fact that morphologically incorporated negations are always minimal. This is not only so with cases of morphologically opposed adjective pairs, such as *polite* and *impolite* (both induce the presupposition that the subject term refers to a living being capable of good manners), but also for sentence negation in languages that have a morphological negation. Turkish is a case in point, as it incorporates sentence negation as a morphological element in the verb form:

- (12) Ben anla - ma - d - im
 I understand-not PERF - 1sg (‘I didn’t understand’)

This sentence presupposes that there was something to understand. Suppose someone is asked in Turkish whether he or she has understood while there was nothing to understand, the addressee cannot use (12) to say the equivalent of *I did NOT understand. There was nothing to understand!* The reaction one gets in such a case is a repeated, rhetorical shrugging of the shoulders and an ironical repetition of the original question. For Turkish, therefore, the entailment analysis stands no chance at all.

Then there is the important fact that the radical negation always evokes the so-called ‘echo’-effect, noticed above in connection with Dave’s court case. The radical negations in (9a-d) show this very clearly: in all cases there is the

strong suggestion that someone else has just uttered the non-negated sentence, and the speaker makes it clear, by his use of the radical negation, that the non-negated sentence, uttered just before, must be considered unacceptable in the present discourse since it has a presupposition which must be removed from the discourse. The speaker then proceeds to do precisely that, remove a presupposition from the discourse.

This echo-effect was first observed in Baker (1970). He showed that it occurs typically when the negation is placed over a Positive Polarity Item (PPI). All languages have a set of expressions, the Positive Polarity Items, which do not allow for the normal, unmarked minimal negation but require a radical, presupposition-cancelling negation or a metalinguistic negation (Horn 1985) which denies the appropriateness of a word or expression used by the previous speaker. Examples of PPI are *still*, *extremely*, *relatively*, *bristle with*, and many others. When these are placed directly under negation an echo-effect arises (PPIs are in italics):

- (13) a. She is NOT *relatively* ignorant of her husband's wrong-doings. She isn't even married!
 b. I am NOT *still* writing. I haven't even started!
 c. The place did NOT *bristle with* policemen. There wasn't a policeman in sight!

As presented here, with strong accent and a presupposition denial following, the negations are radical. It is, however, also possible to unstress the negation and place accent on a word or expression of the sentence. In that case there is metalinguistic negation, in the sense that the speaker criticises a particular lexical selection, a kind of negation Horn (1985) calls attention to. The sentence can thus be followed by the correct expression, not by a presupposition denial:

- (13) a'. She is not 'relatively ignorant' of her husband's wrong-doings. She is totally ga-ga.
 b'. I am not 'still writing'. I have finished.
 c'. The place did not 'bristle with policemen'. There were only a few of them.

We shall come back later to metalinguistic negation. What is relevant here is that both the entailment analysis and the attendant pragmatics fail to offer an explanation for this echo-effect.

So we are back at Strawson's position. Strawson, and with him the vast majority of logicians and philosophers of language who looked at these problems, failed to see the distinction between the natural, unmarked use of the negation and its highly marked radical use. He therefore failed to see the possibility of a radical interpretation of (6) in terms of (9b). Yet, as we have just shown, there are still a fair number of cases where indeed the negation preserves the presuppositional entailments in full. And this is sufficient for the rejection of the entailment analysis.

It is interesting, in this connection, to point out that the Greek philosopher Eubulides, contemporary of Aristotle and owner of a small philosophy school at Megara, a short distance West of Athens, had also spotted the problem of presuppositional entailments. He had spotted other problems as well with regard to Aristotelian logic, in particular Aristotle's Principle of the Excluded Third (Bivalence), and he sent these to Aristotle in the form of his 'paradoxes', thereby enraging the Athenian master and causing him considerable embarrassment (especially because Aristotle failed to answer most of Eubulides' objections). Eubulides cast some of his paradoxes in the mould of an earthy joke, no doubt in order to tease Aristotle who did not like earthy jokes at all. The example of the presupposition 'paradox' illustrates this:

- (14) a. What you haven't lost you still have.
 b. You have not lost your horns.
 c. So you are still wearing horns!

If this argument were correct then anyone 'who has not lost his horns' would be a cuckold. So what is wrong with the argument? We do not know what Aristotle's answer was, if any. But he could have answered in the spirit of the entailment analysis, saying that premiss (14a) is incorrect as it does not follow generally that if you have not lost something you still have it: you may never have had it in the first place — and he would have been right, but at the cost of interpreting the negation radically throughout. We now know that the solution, and the explanation, of this paradox lies in the fact that the negation is used minimally in (14a) but radically in (14b). (14a) is valid only with minimal negation. Therefore, the conclusion (14c) does not follow.

All this lands us back at the bivalent gapped logic analysis proposed by Strawson. The intermezzo caused by the entailment analysis has held us up, but we have also learned from it. So we now ask again if the gap-analysis is tenable, and the observations we have made meanwhile provide an immediate answer: the gap-analysis is not tenable. For what kind of operator would the radical negation be if it took as input something which has no truth value? It would take an empty input and turn that into a true sentence! Moreover, it would have to distinguish between empty inputs of different kinds, as it must clearly not turn gibberish like *alaMinD gr hi rtswqzxc* into a true sentence, even though this sequence of symbols also lacks a truth value. The fault of the gap-analysis is, in general, that it fails to take into account all phenomena to do with the radical negation. We shall, therefore, now consider a second alternative.

3 BIVALENT BUT WITH TWO NEGATIONS?

Horn (1985) puts forward a different proposal. He distinguishes between the unmarked 'descriptive' and the metalinguistic negation. The former he equates with the classical operator \neg (this just goes to show how strong the attachment

is to classical logic!). The latter is not considered to be truth-functional, as it does not take a truth value as input to deliver a truth value as output. And it does not say anything about the negated proposition as such. But it does say something about a sentence or word or expression just used in the discourse. From this perspective this negation is 'metalinguistic'.

What then does the metalinguistic negation say about the sentence, word or expression it is meant to be a comment on? Unfortunately, Horn does not tell us. Many pages of elegant prose are dedicated to what is, in his words, the 'metaphorical' function of the metalinguistic negation, yet no analysis of the metaphor is provided. We do understand that the hearer resorts to the intended 'metaphorical' interpretation when a literal interpretation would lead to inconsistency or be otherwise incoherent. The point where he comes closest to an explicit statement on this issue is (1985:136), where he proposes that the metalinguistic negation 'can be glossed "I object to *u*", where *u* is crucially a linguistic utterance rather than an abstract proposition.' But this is too wide, as is shown by the case of a man, whom we shall call A, ringing the praises of some politician who, in the eyes of his interlocutor B, is a crook. Having listened to A's laudations with regard to the politician in question, B wistfully says: *And Brutus is an honourable man*, quoting Shakespeare and thereby making it very clear what he thinks about the man. Clearly, A will object to B's last linguistic utterance, but he can hardly express his objection by saying *Brutus is NOT an honourable man*, though he does have other means of telling B what he thinks of B's utterance, such as, to take a mild phrasing, *To hell with your Brutus!* This does not mean that we wish to deny the existence of a negation use that implies a metalinguistic comment on a previously made utterance. But we do feel that a better definition is in order.

Horn distinguishes three categories of metalinguistic negation:

(A) Cancellation of scalar implicatures:

- (15) a. He did not insult SOME Muslims, he insulted them ALL!
 b. He isn't SOMEWHAT corrupt, he is corrupt THROUGHOUT!

(B) Lexical, phonetic or stylistic correction

- (16) a. Not LIZZY, you little brat, but HER MAJESTY is viewing the trooping of the colour!
 b. Miss Debenham is not a WOMAN, she is a LADY!⁴⁾

(C) Correction of false presupposition:

- (17) a. Carl did NOT lose his watch. He never had one! (=9a)
 b. The king of France is NOT bald. France doesn't have a king! (=9b))

4) From Agatha Christie's *Murder on the Orient Express*, when the Continental train conductor has just shown Miss Debenham to her cabin saying *Women this way please*. Her companion objects to this by uttering (16b).

To this we say, firstly, that there seems to be no reason why the categories A and B should be distinguished, as A can be interpreted as a criticism of a lexical selection made by a previous speaker. Secondly, category C seems to form very much a category of its own, not to be brought under one umbrella with A and B. This is shown by the fact that the negation occurring in cases of the categories A and B may occupy those syntactic positions that are reserved for the minimal negation and from which the radical negation is excluded. Some examples are (18a-c), where the metalinguistic negation occurs sentence-initially (a,c), with an NPI (b), and with a contrastively accented constituent (a,c):

- (18) a. Not SOME but ALL children laughed
 b. The Clarks don't have a CLEANING LADY *any more*; they now have a DOMESTIC ASSISTANT
 c. Not LIZZY, you little brat, but HER MAJESTY is viewing the trooping of the colour! (=16a))

The conclusion must be that the negation in these cases is both metalinguistic and minimal, whereas the negation in (17a,b) is radical. We shall see in a moment that it is also metalinguistic.

Moreover, the C-cases do not lead at all to an inconsistent or otherwise incoherent interpretation if the negation operator is equated with the classical operator \neg . For this operator cancels all contingent entailments, so that the language user would have no need at all to resort to a non-literal, metaphorical interpretation.⁵⁾

We cannot but conclude that the C-cases, the cases of radical negation, form a separate category, even though we can agree with Horn that all cases in the categories A, B and C are instances of metalinguistic negation. We must also conclude that the negations in the A and B categories are instances of minimal negation, besides being metalinguistic. In other words, the distinction between descriptive and metalinguistic, as well as that between minimal and radical negation are both valid. They form the following matrix:

	descriptive	metalinguistic
minimal	+	+(A,B)
radical	-	+(C)

Figure 3 Matrix of four kinds of negation

5) Horn has clearly slipped up here, due, I suspect, to the fact that in his heart of hearts he does not really believe that NL-negation corresponds to \neg . In actual fact he works with a presupposition-preserving negation, and, therefore, with a non-classical logic. We shall come back to this point presently.

The only combination that does not occur is descriptive-radical: the descriptive negation can only be minimal, and the radical negation can only be metalinguistic. We thus have two implicational relations for NL-negation:

- (a) if the negation is descriptive it is minimal (but not vice versa)
- (b) if the negation radical it is metalinguistic (but not vice versa)

The negation which is both minimal and metalinguistic is the one we find in Horn's categories A and B (now united into one category). The negation which is both radical and metalinguistic is the one we find in Horn's category C. But we shall see in a moment that the minimal-metalinguistic negation is not a category of its own, as that negation is just minimal but the negated clause is metalinguistic.

Meanwhile we have still not solved the question of how metalinguistic negation works. On the contrary, it has become more complex, since we now have two kinds of metalinguistic negation, the minimal and the radical one. As regards the minimal metalinguistic negation we simply state that if a sentence implies a comment on a previous utterance or a previously uttered expression this must be expressed in the semantic analysis of this sentence. A sentence like (16b) is not the expression of a proposition about Miss Debenham's womanhood, which is not at issue. But it is the expression of a proposition about the correctness or incorrectness of the word *woman* as a predicate to be applied to Miss Debenham. If this is so, the literal interpretation of (16b) is rendered semantically as something like (19):

- (19) not [the correct expression X in ['Miss'-'Debenham'-'is'-'a'-X] is 'woman'], the correct expression X in ['Miss'-'Debenham'-'is'-'a'-X] is 'lady'

In a way, this answer is problematic because we do not know what rules of grammar will convert (19) into (16a) and vice versa. We do know that there is an enormous mass of metalinguistic material in the sentences we use everyday, witness such perfectly normal cases as *He is, how shall I put it, a bit strange, or perhaps rather funny.*⁶⁾ But it is still a mystery what rules and principles will make explicitly metalinguistic material disappear in surface structure and mix with object language elements. The 'grammar of quotes' still remains to be written.

It should be observed, in this connection, that metalinguistic correction also occurs without negation. The following episode will illustrate that. Not too long ago my plane made a stopover in Vienna and the passengers were transported by bus from the plane to the transit lounge. Each passenger had to be issued with a plastic token of a particular colour, so that no confusion with passengers from other planes would occur. Unfortunately, the ground-

6) The meaning 'moderately' of the word *rather*, whose original meaning is 'with preference', finds its origin in bleaching of an original metalinguistic use.

stewardess in charge had distributed tokens of the wrong colour to some of the passengers. In order to correct the situation she asked, nervously, all the passengers on the bus to check the colour of their token, using the words *Could you prove that please?*, obviously confusing the German *prüfen* with the English *prove*. I happened to be sitting close to where she was standing, and whispered, so that the other passengers wouldn't hear: *Could you CHECK that please* (without question intonation!), whereupon she repeated her request saying *Could you check that please?*

In any case, assuming that one day we will have at our disposal an adequate 'grammar of quotes', we can say now that *not* in (19) is the normal, minimal and presupposition-preserving negation. But the presuppositions in question are not those of either of the sentences *Miss Debenham is a woman*, or *Miss Debenham is a lady*, but of the sentence whose attempted semantic analysis is given in (19) and which contains a judgement about expressions and their correct use. Therefore, *the metalinguistic aspect of the negation in the cases of categories A and B does not reside in the negation, which is the normal, unmarked minimal-descriptive negation, but in the argument proposition, which is metalinguistic*. The matrix of fig.3 is thus reduced to two negations, the minimal-descriptive negation, which can take either an object-language or a metalanguage proposition as its argument term, and the radical-metalinguistic negation, which can only take a metalinguistic proposition as its argument. There is no need for a separate minimal-metalinguistic negation.

Having cleared the ground a bit, we are still left with the question of what to do with the radical-metalinguistic negation. This question, too, has become more complex. For on the one hand we have seen that this negation has different logical properties from the minimal negation, which makes us wonder what logic is operating here. And, on the other hand, the metalinguistic echo-effect and the presupposition correction need to be explained. In the next section we shall investigate the logical properties of the two negations, while in section 5 we shall look at the echo-effect and the presupposition correction.

4 WHAT LOGIC?

It is often said that the difference between the minimal and the radical use of negation can be accounted for with the help of the classical operator \neg , which is assigned different structural positions in the logical analysis of the sentences concerned. In this connection one usually speaks of an 'internal' versus an 'external' position, as in (20a,b), for *The doctor is not/NOT Russian*:

- (20) a. $\exists x[\text{Doctor}(x) \wedge \neg \text{Russian}(x)]$
 b. $\neg \exists x[\text{Doctor}(x) \wedge \text{Russian}(x)]$

In this essentially Russellian analysis, the external negation in (20b) would account for the radical, presupposition-cancelling use of *not*. However, (20a)

does not mean ‘The doctor is not Russian’ but ‘There is a non-Russian doctor’, whereas (20b) does not mean ‘The doctor is NOT Russian’ but ‘There is no Russian doctor’, which is quite different. In general, such analyses lead to too much logical structure and too little semantic agreement. We have also seen that the gap-analysis is inadequate. Little else remains, therefore, but to consider a three-valued logic.

4.1 Kleene’s trivalent logic

But which logic? Most proponents of a trivalent approach to account for presuppositional phenomena, such as Blau (1978), fall back on the logic found in Kleene (1938) and going back to work done by Ajdukiewicz, although this logic was devised for purely mathematical reasons, without any linguistic motivation. With * for the third value, the tables for the propositional calculus of this logic look as follows:

A	~A		A	∧	B		A	∨	B		
					1	*	2		1	*	2
1	2		1	1	*	2		1	1	1	1
*	*	A	*	*	*	2		*	1	*	*
2	1		2	2	2	2		2	1	*	2

Figure 4 Kleene’s trivalent logic

The negation (~) is minimal (presupposition-preserving). $A \wedge B$ is true just in case both are true, false if at least one of the two is false, and otherwise *. $A \vee B$ is true just in case at least one of the two is true, false if both are false, and otherwise *. The logical definition of the presupposition relation in this system is as follows (where ‘ $v(X)$ ’ stands for the truth value of X):

Def-1: $A \gg B =_{\text{Def}} A \vDash B$ and $\sim A \vDash B$ and thus: if $v(B) \neq 1$, then $v(A) = *$.

This logic has the special property of being equivalent to classical logic: all theorems expressed by standard logic in terms of $\{\neg, \wedge, \vee\}$ are preserved in this logic in terms of $\{\sim, \wedge, \vee\}$. It is, moreover, independent of the number of truth values: the equivalence is maintained no matter how many truth values are introduced. Classical calculus is, therefore, the bivalent borderline case of an n -valued calculus ($n > 1$). Yet there are drawbacks as well.

- (a) This calculus has only one negation, and is thus unable to account for radical negation. If a second negation is added it is either classical negation \neg but defined for three values, or a new radical negation \simeq that leaves the value 2 unchanged:

A	$\sim A$	$\neg A$
1	2	2
*	*	1
2	1	1

or:

A	$\sim A$	$\simeq A$
1	2	2
*	*	1
2	1	2

Figure 5 classical negation
in Kleene's trivalent system

Figure 6 radical negation in Kleene's
trivalent system

The option of fig.5 does not make much sense. For Kleene's calculus with $\{\neg, \wedge, \vee\}$ is logically equivalent to that with $\{\sim, \wedge, \vee\}$: when in a Kleene-logical expression \sim is replaced with \neg , truth is preserved, and likewise if \neg is replaced with \sim . The option of fig.6, on the contrary, adds a new operator that assigns truth only when a presupposition of the argument proposition is unsatisfied (false), and simple falsity in all other cases. Let us assume, therefore, that a radical negation as defined in fig.6 can be added, so that this objection can be met.

- (b) The calculus does not fit into a discourse-semantic presupposition theory. Disjunction and conjunction yield odd and confusing results (cp. Seuren 1988, 1990a). E.g.:

(i) $A_Q \vee B_R \gg (Q \wedge R) \vee (A \vee B)$ (NB: ' X_Z ' stands for 'X with presupposition Z')

(ii) $A_Q \wedge B_R \gg (Q \wedge R) \vee (\sim A \vee \sim B)$

Disjunctions with contradictory presuppositions presuppose themselves, as they can only be true or *. Hence, when they are not true they are *:

(iii) $A_Q \vee B_{\sim Q} \gg A_Q \vee B_{\sim Q} \gg A_Q \vee B_{\sim Q}$, etc.

Likewise for $A_Q \vee \sim B_{\sim Q}$. For example, a sentence like

(21) Brian has finished working or he hasn't started yet

i.e. of the form $A_Q \vee \sim B_{\sim Q}$, would, if Kleene's calculus is applied to presuppositions, presuppose itself. In a discourse-semantic theory, where presuppositions are interpreted as sentences that have to precede their bearers in order to produce a coherent discourse, this cannot be correct.

- (c) A further empirical objection consists in the fact that, under Def-1, every necessary truth is presupposed by every sentence, as it is entailed by every sentence. Therefore, under this logical definition, all empirical and descriptive relevance of the notion of presupposition is taken away. It must be added immediately that this objection necessarily holds for every purely logical definition of presupposition.

(d) The gravest objection is that, in this interpretation, some entailments are wrong. E.g.:

$$(i) \quad A_{Q_x} \wedge B_{\sim Q_x} \gg Q_R \vee \sim Q_R \gg R$$

$$(ii) \quad A_{Q_x} \wedge B_{\sim Q_x} \gg Q_R \vee \sim Q_R \gg R$$

For example, in a presuppositional analysis based on Kleene's logic, the sentence:

(22) Brian has finished working and he hasn't started yet
presupposes that Brian exists. Note that (22) is of the form $A_{Q_x} \wedge B_{\sim Q_x}$,
where:

A = Brian has finished working Q = Brian has worked before

B = Brian has started working R = Brian exists

To see this consider that (22) can never be true, but it is false, in Kleene's calculus applied to presuppositions, when $v(Q) = 1$ or $v(Q) = 2$, and it is * when $v(Q) = *$. Hence, according to Def-1, (22) presupposes 'Brian has worked before or he hasn't', which presupposes that Brian exists. This is intuitively odd and factually incorrect if presuppositions are taken to be sentences that have to precede their bearers in order to produce a coherent discourse: (22) can never be added to a discourse and keep it coherent. There are, therefore, no conditions under which (22) is a coherent addition to a discourse. (22) does have a presupposition, viz.

$Q \wedge \sim Q$, which is necessarily false; hence, (22) is necessarily radically false.

On the whole, Kleene's calculus does not fit presuppositional phenomena at all well. It makes for a much better and much more natural fit if applied to vague predicates with gradual transitions between full truth and full falsity. If the value * is considered to be an aggregate value for all infinitely many transitional values between truth and falsity we have the model for an adequate fuzzy logic.

4.2 Trivalent presuppositional calculus

An alternative consists in the trivalent presuppositional calculus (TPC) devised by Seuren (1985,1988) and elaborated in Weijters (1985). Here the truth tables are (with '3' for the third value).⁷⁾

7) For a set-theoretic foundation for TPC in terms of valuation spaces (sets of possible situations in which a proposition is true) see Seuren (1988). There it is shown how the truth tables of TPC follow directly from a set-theoretic account of valuation spaces. Note, however, that the criticism advanced there (p.207) with regard to the Kleene calculus (as used in Blau 1978) is incorrect and must be taken back. I apologise for that lapse.

A	$\sim A$	$\simeq A$
1	2	2
2	1	2
3	3	1

		B		
\wedge		1	2	3
1	1	2	3	
A 2	2	2	3	
3	3	3	3	

		B		
\vee		1	2	3
1	1	1	1	1
A 2	1	2	2	2
3	1	2	3	3

Figure 7 Trivalent presuppositional calculus

In this logic the concept ‘falsity’ is split up into two different kinds of falsity, minimal (‘2’) and radical (‘3’) falsity. Taken together they form classical falsity. Each of the two forms of falsity corresponds to a *specific negation* that yields truth for precisely one form of falsity: \sim yields truth for the value 2, and \simeq yields truth for the value ‘3’. Moreover, conjunction always selects the highest value, and disjunction always selects the lowest value.

This logic, too, is a trivalent extrapolation of classical bivalent logic, though in a different dimension. Given the operators $\{\neg, \wedge, \vee\}$ the number of truth values makes no difference. All values $n > 1$ are now specific forms of falsity, brought about by the non-fulfilment of specific categories of truth conditions. In this system minimal falsity arises when the presuppositional truth conditions are all fulfilled but at least one standard truth condition (leading to a standard entailment) is not. Radical falsity arises when at least one presuppositional truth condition is not fulfilled. If the presupposition is defined in terms of TPC the definition is:

Def-2: $A \gg B =_{\text{Def}} A \not\models B$ and $\sim A \not\models B$ and thus: if $v(B) \neq 1$, then $v(A) = 3$.

Objection (c) formulated for the Kleene logic stands unaltered for TPC. As has been said, this is a necessary corollary of any definition of presupposition in purely logical terms, and we shall do something about it below. As regards objection (b), a similar fact presents itself for TPC, in that:

$$B \wedge A_B \gg B$$

That is, a sentence like *Sue has passed her exam and she is happy about it* would presuppose that Sue has passed her exam, despite the fact that it already asserts it. In a discourse-semantic interpretation of presupposition this does not fit at all, and we shall, therefore, have to do something about it if we adopt TPC as the logic for presuppositional phenomena. No other disasters have been spotted, which makes TPC a better candidate for presuppositional analysis than Kleene’s calculus, which, as has been said, seems more adequate for the handling of vagueness phenomena.

Even so, however, TPC remains stuck with a few empirically undesirable consequences, and, generally, all logical definitions of presupposition suffer from empirical drawbacks. Not only is there objection (c) to the Kleene calculus, which is valid for all logical definitions, but there is also the fact that logic, in no matter what variety, is unable to account for the echo-effect of the radical negation. It thus seems as if a radically new perspective is called for. This we shall now develop.

5 A DISCOURSE-SEMANTIC ANALYSIS

In a number of publications (a.o. Seuren 1972, 1975, 1985, 1988) I have argued that presuppositions are not primarily a logical but a discourse-semantic phenomenon. Semantics, in this view, is not applied logic (which is what model-theoretic semantics takes it to be), but a branch of cognitive science. The comprehension of uttered sentences, which is the subject matter of semantics, takes place against the background of a context and a situation which are represented in a specifically linguistic working memory called Discourse Domain (DD). A DD is neither short term nor long term memory but somewhere in between. It has considerable stability over the kind of time span that is involved when humans attend to a topic. There is, moreover, a qualitative difference between the most recent end of a DD, where it keeps being incremented by new utterances, and its more remote parts. The latter have abstracted from specific modes of presentation and keep only the purely propositional content. As the DD-elements recede into the past they get integrated more and more into a unified complex representation of a total situation and/or chain of events. How precisely this takes place is simply unknown at the present date: we have no idea of the overarching structures that individual propositions are integrated into as time goes by. Yet any preliminary analysis of human memory will show that some such process must be assumed. This problem will, however, not concern us here, as we shall consider only the front end of a DD-structure, where it meets with direct linguistic input.

A DD is taken to have open access lines with the entire available knowledge base. Yet it is an autonomous unit that operates according to its own specific laws and principles. Each new utterance is added ('incremented') to the existing DD in the sense that the information contained in the utterance is stored in the DD in specific ways. As a DD develops further and further the situation represented by it gets more and more detailed. A new increment is *informative* only if it makes the possible situation represented by the DD more specific, or, in other words, if it restricts further the set of possible situations for which the DD is true.

Ideally, a speaker who presents a text has in mind a certain situation which he wishes to represent piecemeal in the form of a DD in such a way that his

hearers can reconstruct the DD through the speaker's successive utterances, and thus form a picture of the situation the speaker intends to describe. In building up a DD for his hearers, the speaker may have a variety of ulterior motives. In some cases he will try to present a picture of a really existing situation that is as truthful and relevant as he can make it. But he may also wish simply to present a story, a joke, a hypothesis, a future prospect, or even a lie. In philosophy there exists a widespread, yet absurd, prejudice that a speaker will, normally speaking, strive for truth and that this is a factor that contributes to the proper comprehension of uttered sentences. A stark case in point is Fodor (1983:45): 'what underwrites the correlation between token utterances and distal layouts [i.e. the "world", PS] is (roughly) a convention of truth-telling. ... Because that convention holds, it is possible to infer from what one hears said to the way the world is.' Fortunately, we are, in our daily lives, less naive than this philosopher is in his philosophy. We would soon come to grief if we were to infer, by convention and without further guarantee, from what we hear said to what the actual world is like. In any case, it is important to realize that our belief as to the truth or falsity of what is being said to us makes not a whit of difference for our understanding of what is being said. Having said this we can now return to discourse semantics.

The theory of discourse domains is in its first infancy,⁸⁾ and we only have a very imperfect idea of what its elements will have to be and in what way it will account for the semantic phenomena we wish to entrust it with. One thing is commonly accepted now: every DD will have to contain some representation system for individuals and sets of individuals. It will also have to contain subdomains to store the information about what someone in the main domain believes, hopes, says, etc., or about what is possible, necessary, desirable, etc. These subdomains, in other words, will represent intensional objects and intensional information. But what we wish to concentrate on here is the fact that DDs will also have to contain *instructions* regarding their further development. A prime example is the instruction that comes with ordinary minimal negation: *the information contained in the negated clause must not be incremented to the current DD*. Since the set of possible situations for which the DD in question is true is further restricted by such an instruction, negative sentences are as informative as non-negated ones.

But now how about the metalinguistic radical negation? This is of a totally different character. Its increment value is not an instruction or prohibition, as with the minimal negation. On the contrary, it is a full predicate assigning a property to an object. The object is the radically negated sentence as such, i.e.

8) It wouldn't be if the admonitions had been heeded of George Stout (1896), who proposed that the semantics of natural language should be based on the notion of discourse, extended with the information brought in by each new utterance.

a linguistic object. This may sound strange to anyone with a grounding in logic, as it is one of the first principles of modern logic that object language and metalanguage must not be mixed. But we have already seen that natural language does not observe this principle at all. In natural language there is widespread mixing of object and metalanguage (without, for that matter, there arising any paradox or confusion, as language has its own means of preventing that kind of logical disaster), and this is what we see happening here. In (6), for example, read with the radical negation, the sentence itself, *The present king of France is bald*, is the object of which it is said that *for presuppositional reasons it does not fit into the present discourse*. This calls for some explanation, which takes us back to the notion of presupposition.

We define a presupposition as follows: *A presupposition of a sentence B is a condition that must be fulfilled in the current DD for B to be interpretable*. More precisely, a sentence B_A (B presupposing A) requires that A be incremented first before B can be incremented. In practice, a sentence B_A is often incremented without A having been incremented first, but in that case the hearer quickly slips in A post hoc, a process known as *post hoc suppletion* or *accommodation*. The hearer can do this because presuppositions are structurally derivable from their carrier sentences. The functional rationale of post hoc suppletion is obvious. It means a drastic reduction of time and energy: the speaker need not say everything he has to say because what is presupposed by his sentences can be slipped in post hoc, a rapid and automatic process.

Now suppose speaker X utters sentence B_A and thereby adds (increments) it to the current DD. If A had not been incremented before it is now, by post hoc suppletion. However, speaker Y is aiming at the representation of a situation where A does not fit (is treated as being false), which would make B_A uninterpretable. Speaker Y now wants to correct the DD that is building up between himself and speaker X. In order to do that he has to remove not only B_A but, first of all, A from the DD at hand. This is where the radical negation comes in. Speaker Y can now use the radical negation as a predicate to be assigned to the linguistic object ' B_A '. This predicate says, in ordinary words: *The sentence B_A , which has just been uttered, must be considered unfit for the current DD because at least one of its presuppositions must be removed from DD*. Having said that, speaker Y must then, of course, also specify which presupposition of sentence B must be removed from DD, which is why cases of radical negation are always followed by a specification of the presupposition that is to be removed.

It is now clear why the radical negation should have a metalinguistic character. It does not primarily deny truth to a sentence, but declares it unfit, as a linguistic object, to serve in the current DD. A logical analysis, whether trivalent or other, cannot render this meaning, which is why a logical definition of either presupposition or the radical negation misses the point: these are

primarily discourse-semantic phenomena, and a logical description only touches on certain, relatively marginal, aspects. Thus, taking up Eubulides' paradox of the horns again, we now say that the logical analysis (23b) of the second sentence of the paradox (here repeated as (23a)) fails to do justice to the discourse-correcting and metalinguistic character of that sentence, though it probably gives a good enough rendering of its truth-conditional properties. The proper semantic analysis is given in (23c):

- (23) a. You have not lost your horns
 b. \sim [you have lost your horns]
 c. the sentence "you have lost your horns" fails-to-fit-the-context-for-presuppositional-reasons

What then, one may ask, is the role of logic in the study of linguistic meaning? The answer to this very serious question is twofold. First, logic helps to specify entailments, and getting the entailments right is a necessary, though not a sufficient, condition for an adequate natural language semantics. We may act on the presumption that natural language processing as it takes place in our daily lives is sufficiently precise to be taken as logically sound. On the other hand, it is difficult to see how logic could provide the basis for an explanatory account of what goes on in natural language comprehension and production, unless one assumes the presence of an actual logical machinery in the human mind, which is highly implausible. The fundamental reason why logic does not provide a semantic theory, not even in a model-theoretic sense, lies in the fact that logic aims at an exact mapping between sentence structures on the one hand and possible situations on the other, without the mediating intervention of cognition. That this is what logic does is a consequence of its history: ever since Aristotle defined truth as a correspondence between what is *said* and what is the case, logic has seen it as her task to make that correspondence explicit. But it seems more adequate to say that truth consists in the correspondence between what is *thought* and what is the case, and under that definition logic should seek to establish a structural correspondence relation between *thoughts* and situations. Any empirically adequate model theory for natural language sentences must define a truth calculus not for surface sentences, but for the underlying thoughts, with respect to possible situations. And now that we are beginning to develop more precise ideas about the structure of thoughts, we might well envisage a program for logic as, indeed, a truth calculus not for sentences but for thoughts, or rather, thought complexes. Discourse domains might provide a good starting point. But the reader will understand that we must, at this moment, leave such a program to future research.

BIBLIOGRAPHY

- Baker, C.L. (1970). 'Double negatives'. *Linguistic Inquiry* 1.2:169-186.
- Blau, U. (1978). *Die dreiwertige Logik der Sprache. Ihre Syntax, Semantik und Anwendung in der Sprachanalyse*. Berlin, De Gruyter.
- Boër, S., W. Lycan (1976). 'The myth of semantic presupposition'. Indiana University Linguistics Club.
- Fodor, J.A. (1983). *The Modularity of Mind*. Cambridge, Mass., MIT Press.
- Frege, G. (1892). 'Ueber Sinn und Bedeutung'. *Zeitschrift für Philosophie und philosophische Kritik* 100:25-50.
- Horn, L.R. (1985). 'Metalinguistic negation and pragmatic ambiguity'. *Language* 61.1:121-174.
- Kleene, S. (1938). 'On notation for ordinal numbers'. *Journal of Symbolic Logic* 3:150-155.
- Russell, B. (1905). 'On denoting'. *Mind* 14:479-493.
- Russell, B. (1956). *Portraits from Memory and Other Essays*. London, Allen & Unwin.
- Russell, B. (1957). 'Mr Strawson on referring'. *Mind* 66:385-389.
- Seuren, P.A.M. (1972). 'Taaluniversalialia in de transformationele grammatika'. *Leuvense Bijdragen* 61:311-370.
- Seuren, P.A.M. (1975). *Tussen taal en denken. Een bijdrage tot de empirische funderingen van de semantiek*. Utrecht, Oosthoek, Scheltema & Holkema.
- Seuren, P.A.M. (1985). *Discourse Semantics*. Oxford, Blackwell.
- Seuren, P.A.M. (1988). 'Presupposition and negation'. *Journal of Semantics* 6:175-226.
- Seuren, P.A.M. (1990a). Review of N. Burton-Roberts, *The Limits to Debate*, Cambridge University Press, 1989. *Linguistics* 28:503-516.
- Seuren, P.A.M. (1990b). 'Burton-Roberts on presupposition and negation'. *Journal of Linguistics* 26:425-453.
- Seuren, P.A.M. (1994). 'Sign'. In: R. Asher & S. Simpson (eds.), *The Encyclopedia of Language and Linguistics*, Oxford, Pergamon.
- Stout, G.F. (1909³ (1896¹)). *Analytical Psychology*. 2 Vols. London, Sonnenschein/ New York, Macmillan.
- Strawson, P.F. (1950). 'On referring'. *Mind* 59:320-344.
- Weijters, A. (1985). 'Presuppositional propositional calculi'. Appendix to Seuren 1985:483-525.
- Wilson, D. (1975). *Presuppositions and Non-Truth-Conditional Semantics*. London-New York-San Francisco, Academic Press.