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Pragmatics in Natural Logic

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Pragmatics in natural logic

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I would like to discuss two aspects of pragmatics that in recent years have been treated very differently: indexicals and conversational implicatures. Montague and Scott proposed to handle indexicals by adding to points of reference (sometimes called 'indices') extra coordinates for speaker, hearer, time and place of utterance. This proposal places indexicals among those phenomena to be dealt with by formal logic, and such systems have in recent years been articulated by Lewis and Kamp, among others. Implicatures on the other hand, were taken by Grice to be by nature informal inferences of a fundamentally different kind than logical inferences, and hence not to be dealt with by the apparatus of formal logic. In other papers I have dropped hints to the effect that indexicals and implicatures should be treated somewhat differently than they are in the Montague–Scott and Grice proposals. I would like to elaborate a bit on those hints.

The basic suggestion is this:

(I) If the goals of what I have called natural logic are adopted, then it should in time be possible to handle indexicals without any extra coordinates for speaker, hearer, and time and place of utterance, and it should also be possible to handle implicatures without any kinds of extralogical inference.

The basic ingredients of the suggestion are as follows:

(A) The so-called performative analysis for imperatives, questions, statements, promises, etc.
(B) The limitation of points of reference to assignment coordinates for variables and atomic predicates.
(C) The commitment of natural logic to the formal semantic characterization of *all* natural language concepts, including those having

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to do with social interaction, such as sincerity, politeness, formality, cooperation, etc.

(D) Global, transderivational, fuzzy correspondence grammars.

Let us start with what has been called the *performative analysis* – which is not a single proposal, but a family of various partial proposals made by grammarians like Sanctius, Lancelot, and Whitney, and more recently by Postal, Robin Lakoff, Ross, Sadock, J. McCawley, and myself, among others. The positions held by these people vary a great deal, and it is not my purpose to try to survey them here. What they have in common is that they would analyse imperative sentences like *Leave* as having logical structures containing a performative imperative predicate with arguments referring to speaker and hearer, essentially the same logical structure as that needed for the (surface) sentence *I order you to leave*, which contains a surface performative predicate (*order*) and surface arguments referring to speaker and hearer (*I* and *you*). In support of such an analysis, a large amount of syntactic evidence has been offered; it is my opinion that there is enough correct evidence of this sort strongly to support such a proposal for imperatives. Ross has, in addition, observed that syntactic evidence of the same sort in nearly the same amount is available to support a parallel performative analysis for declaratives. Thus, a declarative sentence like *There exist unicorns*, which contains a surface performative declarative predicate (*state*) and surface arguments referring to speaker and hearer (*I* and *you*). Whereas most of the evidence to date for these proposals has been syntactic in nature, I would like to provide some evidence in favour of them of a semantic-pragmatic nature.

Let us first consider two proposals for providing formal semantics for performative sentences, one made by David Lewis (1972) and one made by myself (1972a). Lewis adopts the Montague–Scott proposal for the use of *indices* (Montague's term) or *points of reference* (Scott's term) to account for indexicals in the framework of general intentional logic as outlined by Montague.

> We may take indices as n-tuples (finite sequences) of the various items other than meaning that may enter into determining extensions. We call these various items *coordinates* of the index, and we shall assume that the coordinates are given some arbitrary fixed order.
>
> First, we must have a *possible-world coordinate.* Contingent sentences depend for their truth value on facts about the world, and so are true at some possible worlds and false at others. A possible world corresponds to a possible totality of facts, determinate in all respects. Common nouns also have different

extensions at different possible worlds; and so do some names, at least if we adopt the position (defended in Lewis, 1968a) that things are related to their counterparts in other worlds by ties of strong similarity rather than identity.

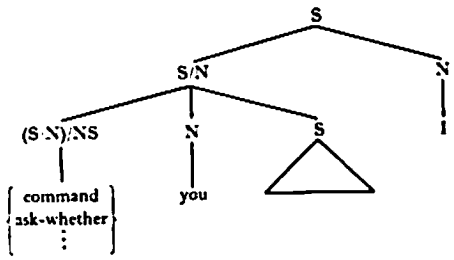
Second, we must have several *contextual coordinates* corresponding to familiar sorts of dependence on features of context. (The world coordinate itself might be regarded as a feature of context, since different possible utterances of a sentence are located in different possible worlds.) We must have a *time coordinate*, in view of tensed sentences and such sentences as 'Today is Tuesday'; a *place coordinate*, in view of such sentences as 'Here there are tigers'; a *speaker coordinate* in view of such sentences as 'I am Porky'; an *audience coordinate* in view of such sentences as 'You are Porky'; an *indicated-objects coordinate* in view of such sentences as 'That pig is Porky' or 'Those men are Communists'; and a *previous discourse coordinate* in view of such sentences as 'The afore-mentioned pig is Porky'.

Third, it is convenient to have an *assignment coordinate*: an infinite sequence of things, regarded as giving the values of any variables that may occur free in such expressions as 'x is tall' or 'son of y'. Each variable employed in the language will accordingly be a name having as its intension, for some number n, the *nth variable intension*: that function whose value, at any index i, is that thing which is the nth term of the assignment coordinate of i. That thing is the extension, or value, of the variable at i. (Note that because there is more than one possible thing, the variable intensions are distinct: nothing is both the n_1th and the n_2th variable intension for two different numbers n_1 and n_2.) The extensions of 'x is tall' of 'son of y' depend on the assignment and world coordinates of indices just as the extensions of 'I am tall' and 'son of mine' depend on the speaker and world coordinates. Yet the assignment coordinate cannot naturally be included among features of context. One might claim that variables do not appear in sentences of natural languages; but even if this is so, it may be useful to employ variables in a categorial base. In any case, I seek sufficient generality to accommodate languages that do employ variables.

...Thus an *index* is tentatively any octuple of which the first coordinate is a possible world, the second coordinate is a moment of time, the third coordinate is a place, the fourth coordinate is a person (or other creature capable of being a speaker), the fifth coordinate is a set of persons (or other creatures capable of being an audience), the sixth coordinate is a set (possibly empty) of concrete things capable of being pointed at, the seventh coordinate is a segment of discourse, and the eighth coordinate is an infinite sequence of things (Lewis (1972:175–6)).

Later, Lewis gives his account of the semantics of nondeclarative sentences, after rejecting a proposal by Stenius:

I prefer an alternative method of treating non-declaratives that requires no revision whatever in my system of categories, intensions, and meanings. Let us once again regard S as the category *sentence*, without discrimination of mood. But let us pay special attention to those sentential meanings that are represented by base structures of roughly the following form.



Such meanings can be represented by *performative sentences* such as these.

I command you to be late.
I ask you whether you are late.

(See Austin, 1962, for the standard account of performatives; but, as will be seen, I reject part of this account.) Such meanings might also be represented, after a more elaborate transformational derivation, by non-declaratives.

Be late !
Are you late?

I propose that these non-declaratives ought to be treated as paraphrases of the corresponding performatives, having the same base structure, meaning, intension, and truth-value at an index or on an occasion. And I propose that there is no difference in kind between the meanings of these performatives and non-declaratives and the meanings of the ordinary declarative sentences considered previously.

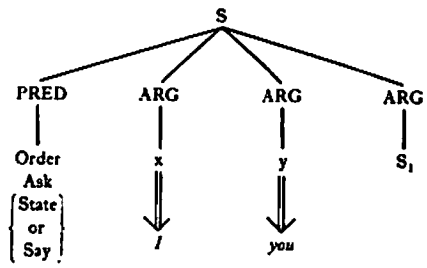
Lewis, however, refrains from going all the way with the performative analysis; in particular, he refuses to embrace a similar analysis for declaratives.

If someone says 'I declare that the Earth is flat' (sincerely, not play-acting, etc.) I claim that he has spoken truly: he does indeed so declare. I claim this not only for the sake of my theory but as a point of common sense. Yet one might be tempted to say that he has spoken falsely, because the sentence embedded in his performative – the content of his declaration, the belief he avows – is false. Hence I do not propose to take ordinary declaratives as paraphrased performatives (as proposed in Ross, 1970) because that would get their truth conditions wrong (Lewis (1972:210)).

The analysis Lewis adopts for non-declarative performatives resembles, in its essential parts, the proposal I made (1972a,b) for all performatives, including declaratives:

. . . it is claimed that the logical forms of imperatives, questions, and statements should be represented as in (A).

(A)



In (A), S_1 represents the propositional content of the command, question, or statement. Note that in statements it is the propositional content, not the entire sentence, that will be true or false. For example, if I say to you 'I state that I am innocent', and you reply 'That's false', you are denying that I am innocent, not that I made the statement. That is, in sentences where there is an overt performative verb of saying or stating or asserting, the propositional content, which is true or false, is not given by the sentence as a whole, but rather by the object of that performative verb. In 'I state that I am innocent', the direct object contains the embedded sentence 'I am innocent', which is the propositional content. Thus, even in statements, it should not be surprising that the illocutionary force of the statement is to be represented in logical form by the presence of a performative verb.

In the analysis sketched in (A), the subject and indirect object of the performative verbs are represented in logical form by the indexical expressions *x* and *y*. Rules of grammar will mark the subject of the performative verb as being first person and the indirect object as being second person. Thus, logical forms need not contain any indication of first person or second person, as distinct from third person. If there are other instances of the indexical expressions *x* and *y* in S_1, they will be marked as being first and second person respectively by the grammatical rule of person-agreement, which makes a NP agree in person with its antecedent. Thus all occurrences of first or second person pronouns will be either the subject or indirect object of a performative verb or will arise through the rule of person-agreement. The analysis given in (A) and the corresponding account of first and second person pronouns makes certain predictions. Since the structure given in (A) is exactly the same structure that one finds in the case of non-performative verbs of ordering, asking, and saying, it is predicted that rules of grammar involving ordinary verbs of these classes, which occur overtly in English sentences, may generalize to the cases of performative verbs, even when those verbs are not overtly present in the surface form of the sentence, as in simple orders, questions, and statements (G. Lakoff (1972a: 560–1)).

The analysis of (A) not only permits the statement of grammatical generalizations, but it also permits one to simplify formal semantics. Consider, for example, the notion of an 'index' as given by Scott (1969). Scott assumed that indices would include among their coordinates specifications of the speaker, addressee, place, and time of the utterance, so that truth conditions could be stated for sentences such as 'Bring what *you now* have to *me* over *here*'. Under

an analysis such as (A), the speaker and addressee coordinates could be eliminated from Scott's indices. Moreover, if (A) were expanded, as it should be, to include indications of the place and time of the utterance, then the place and time coordinates could be eliminated from Scott's indices.[9] Truth conditions for such sentences could then be reduced to truth conditions for sentences with ordinary adverbs of place and time. Moreover, truth conditions for sentences such as 'I am innocent' and 'I state that I am innocent' could be generalized in terms of the notion 'propositional content', namely, S_1 in (A). Thus, (A) can be motivated from a logical as well as a grammatical point of view (F. Lakoff (1972a:569)).

I saw Lewis' paper after writing the above, but before receiving the proofs, and added footnote 9 at the last minute:

This becomes clearer if one considers Lewis' treatment in *General Semantics* rather than Scott's. Lewis distinguishes between 'contextual coordinates' and an 'assignment coordinate'. The contextual coordinates are for such things as speaker, audience, time of utterance, and place of utterance. The assignment coordinate gives 'the values of any variables that may occur free in such expressions as "*x* is tall" or "son of *y*" '.

The assignment coordinate will have to assign a value corresponding to the the speaker for person variables, since the speaker would presumably be in the worlds in question. The same for the audience. If times are assigned to time variables by the assignment coordinate, presumably the time of the utterance will be included. And if places are assigned to place variables, one would assume that the place of the utterance would be given by the assignment coordinate. Given this, and the analysis given in (A), the contextual coordinates become superfluous, since the job that they would do in Lewis' system would be done automatically by the assignment coordinate together with the analysis in (A). Since (A) involves no new types of structure – the same predicates occur in nonperformative uses and have to be given anyway – we have a considerable gain. What we have done is to largely, if not entirely eliminate pragmatics, reducing it to garden variety semantics. (G. Lakoff (1972a:655)).

The principal place where Lewis and I differ is on the analysis of declaratives. My feeling is that the reason he gives for rejecting the performative analysis for declaratives is a bad one. According to Lewis, if a speaker uttered (1)

(1) I state that the earth is flat

and someone replied

(2) a. That's true
or
b. That statement is true

then, Lewis claims, the speaker of (2a) or (2b) would not be committing

himself to the earth's being flat but only the first speaker's having said so. Lewis is simply wrong – natural language does not work that way. The speaker of (2a) or (2b) *is* committing himself to the earth's being flat.

Lewis' proposal is reminiscent of the classic story (probably fabricated) of the Pittsburgh judge who was caught taking bribes. When called before a grand jury, the judge took the stand under oath and said 'I swear that I have never taken a bribe'. The district attorney then brought the judge to trial for perjury, and produced witnesses to the effect that a bribe had taken place. The judge's defence was that he had not committed perjury at all, since all he said was 'I swear that I have never taken a bribe' and he had indeed sworn that he had never taken a bribe. The case was thereupon dismissed by the trial judge, who happened to be an old friend of the defendant judge. On Lewis' account, justice was served in this case. On my account, it was not.

Part of the confusion in Lewis' discussion arises because the English surface adjective *true* has certain conditions for appropriate use for just about all English speakers, with the exception of those logicians and philosophers who have made that surface adjective into a technical term. When Austin said that a performative sentence was neither 'true' nor 'false', and that such terms could only be applied to statements, he was using 'true' and 'false' in their ordinary senses. A statement is something stated or at least statable, that is, that can be the direct object of a predicate of stating. It should be added that the normal English surface adjectives *true* and *false* are also limited by an additional condition on their appropriate use, namely, that any statement that they are predicated of must have previously been asserted or at least entertained. Consider sentences like:

(3) a. It is true that it is raining outside
    b. It is false that it is raining outside

One could not just go up to someone out of the blue and appropriately say such sentences. The question has to have previously come up as to whether it is raining. Though (4a and b) will be true and false together in all situations in which they are both appropriate, they are appropriate in very different classes of situations.

(4) a. It is raining outside
    b. It is true that it is raining outside

Since logicians rarely if ever consider conditions for appropriate use, and since performatives were never discussed in classical logic, the surfaec

adjective *true* has come to be used as a technical term by many logicians. Within the tradition of formal semantics, *true* has been made into the relative term *true in a model (given a point of reference)*, which is equated with the technical term *satisfied in a model (given a point of reference)*. If I understand Lewis correctly, he is using the surface adjective *true* in this sense. Consider Lewis' claim (Lewis 1972: 210):

(5) 'I would wish to say that "I bet you sixpence it will rain tomorrow" is true on an occasion of an utterance if the utterer does bet his audience sixpence that it will rain on the following day; and, if the occasion is normal in certain respects, the utterer does so bet; therefore his utterance is true'

This statement does not make much sense if one takes the surface adjective *true* in its ordinary sense. Imagine the following discourses.

(6) a. I bet you sixpence it will rain tomorrow
  b. That's false, because you don't have a penny to your name. You didn't just make a bet
  b'. That's true – you did just bet me sixpence
(7) a. I hereby christen this battleship the *S.S. Borman*
  b. That's false, you have no authority to give a name to that ship
  b'. That's true – you did just give that name to that ship
(8) a. I hereby pronounce you husband and wife
  b. That's false, you have no authority to marry those people!
  b'. That's true, he did just marry them

The (b) and (b') sentences are all inappropriate responses; Austin was right that the surface adjectives *false* and *true* cannot be appropriately predicated of performatives. For this reason, Lewis' statement in (5) may not match the intuitions of most speakers of English, including many ordinary language philosophers and linguists. However, it makes perfectly good sense if *true* in (5) is taken to mean *satisfied in a model (given a point of reference)*. 'Truth conditions' in Lewis' sense are meant to be satisfaction conditions, not conditions under which one can appropriately use the surface adjective *true*.

This shows up pretty clearly in the proposal I made in 'Performative antinomies':

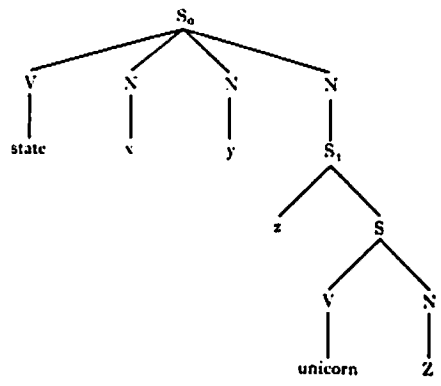
> What we need to do is to extend the assignment of truth values for non-performative sentences to the assignment of felicity values for performative sentences. Just as we have valuations like $V_w[P] = 1$ for 'P is true in world w'.

where P is nonperformative, we will let $V_w[P] = 1$ stand for 'P is felicitous in world w', where P is performative (G. Lakoff (1972b:570)).

There I use the neutral '1' to indicate satisfaction, both in the case of performatives and nonperformatives. When I speak of felicity values, I do not mean to suggest, incidentally, that there is a new kind of value called a *felicity value*, but rather that there is only one kind of value, a satisfaction value, and that the surface adjectives *felicitous* and *true* are to be taken as indicating satisfaction in the case of performatives and nonperformatives respectively. This is also what I had in mind (1971:335–6) when I pointed out that the presuppositions of performative verbs in their nonperformative uses were identical to certain of the felicity conditions for those verbs in their performative uses.

An important point to bear in mind with respect to both Lewis' discussion and mine is that if so-called 'truth conditions' are satisfaction conditions in the model-theoretical sense, then in both Lewis' proposal and mine they are meant to apply to logical structures, *not to surface structures*. In both systems it is nonsense to think of a surface sentence being satisfied in a model at a point of reference, since satisfaction conditions are given only for logical structures, not for surface strings. Under the performative analysis for declaratives, all of the satisfaction conditions will come out to be correct, and the use of the surface adjective *true* in ordinary English will be accounted for (see appendix 1).

(9)



(10) a. I state to you that unicorns exist
b. Unicorns exist

Both the sentences in (10a and b) will have (9) as their approximate logical structures. The satisfaction conditions for the statement to be made will be those for S_0. The satisfaction conditions for the content of the statement to be true will be those for S_1. The surface adjective *true* will be predicated of

what is stated, i.e., the object of the verb of stating, namely, S_1. That is why someone who replies to (10a) by saying *That's true* or *That statement is true* will be committing himself to the truth of S_1 in (a).

Let us review the essential points of the two proposals:

(11) LEWIS' PROPOSAL	MY PROPOSAL
a. Satisfaction in a model is defined for all performatives except for the implicit declarative performative.	Satisfaction in a model is defined for all performatives including the implicit declarative performative.
b. Performative predicates have the same satisfaction conditions as nonperformative predicates.	Performative predicates have the same satisfaction conditions as nonperformative predicates.
c. Logical structures contain pronouns *I*, *you*, *here*, *now*, etc.	Pronouns *I*, *you*, *here*, *now*, etc. are not in logical structure, but are 'introduced' by rules of grammar as replacements for variables.
Transformational grammars are assumed.	Global transderivational correspondence grammars are assumed.
e. Logical structures are not universal (at least because they contain English pronouns *I*, *you*, etc.)	Logical structures are taken to be universal.
f. Index = $\{w,s,h,t,p,d,a\}$[1]	Index = {*a*, partial assignments to predicates}
g. Meaning is given completely by model-theoretical interpretations of logical structures.	Only literal meaning is given by model-theoretical interpretations of logical structures. Conveyed meaning is given by model-theoretical interpretations of logical structures conversationally entailed by logical structures of sentences in given contexts. Not all literal meanings are conveyed.

It should be noted that the adoption of the performative analysis for implicit declaratives allows one to avoid having pronouns like *I*, *you*, *here*, and *now* in logical structure, and hence allows one to get rid of pragmatic

[1] w = world coordinate; p = place coordinate; s = speaker coordinate; d = demonstrative coordinate; h = hearer coordinate; a = assignment coordinate; t = time coordinate

coordinates for speaker, hearer, time and place of utterance. But what is more important, defining satisfaction in a model for *all* performatives as I propose allows one to define entailment for all performative cases in the same way as entailment is defined for all nonperformative cases, namely:

(12) $X \cup \{P\}$ entails Q (where P and Q are logical structures and X is a finite set of logical structures) if and only if Q is satisfied in all models at all points of reference at which X and P are satisfied.

If one can give for performatives the same account of satisfaction and entailment as one gives for nonperformatives, the following possibilities open up:

(13) a. One may not need separate theories for speech acts and for descriptions of speech acts. For example, the satisfaction conditions for the predicate *promise* in *I promise to marry you* and *I promised to marry you* can be the same.

b. It is conceivable that conversational implicatures may turn out to be logical entailments of performative utterances in certain contexts.

c. It should be possible to give a uniform characterization of performative antinomies.

d. Indirectly conveyed meanings for embedded sentences can be treated in exactly the same way as indirectly conveyed meanings for performatives.

Let me begin with indirectly conveyed meanings. Gordon and I (1971)[1]

[1] I am also assuming that (i) is a meaning postulate

(i) *believe* (x,P and Q)$\supset$*believe* (x,P) *and believe* (x,Q)

Part of assuming rationality consists of assuming that the person involved does not have contradictory beliefs

(ii) *believe*(x,$P \supset \neg$*believe*(x,$\neg P$)

Given (14), (17), (i) and (ii), (17′) will yield a contradiction.

(iii) a. *sincere*(a, *state*(a,b,P and *believe*(a,$\neg P$))) [= (17′)]
b. *believe*(a,P *and believe*(a,$\neg P$)) [from (14)]
c. *believe*(a,P) *and believe*(a,*believe*(a,$\neg P$))
d. *believe*(a,*believe*(a,$\neg P$)) [simplification,c]
e. *believe*(a,$\neg P$) [from (17)]
f. *believe*(a,P) [simplification,c]
g. $\neg$*believe*(a,$\neg P$) [from (ii)]
h. *believe*(a,$\neg P$) *and* $\neg$ *believe*(a,$\neg P$) [e and g]

CONTRADICTION

Since (17′) yields a contradiction given an assumption of rationality, the only way to make (17′) noncontradictory would be to assume that Sam in (17′) held contradictory beliefs.

included the following in our proposal for what we called conversational postulates:

(14) *sincere*(x, *state*(s,y,P)$\supset$*believe*(x,P) ['if x is sincere in stating P to y, then x believes P']

At the time, we assumed that this and the other postulates we proposed were to be added specially to handle what Heringer has called 'indirect illocutionary force', that is, indirectly conveyed meanings in the case of performatives. I now think that we were wrong to segregate them off in that way. I would now consider (14) to be a normal part of natural logic, that is, a meaning postulate relating the meanings of *sincere*, *state*, and *believe*. (14) is one of the things that you know if you know the meanings of *sincere*, *state*, and *believe*. Logicians have sometimes worried about giving satisfaction conditions for *believe*, but to my knowledge, none has ever tried to give them for *state* and *sincere*. But if one were to accept the goals of natural logic, one would have to provide satisfaction conditions for all natural language concepts, including these. In an adequate natural logic, (14) would have to be satisfied in all models at all points of reference.

(15) a. Spiro was sincere in stating that Tricky Dick had betrayed him
b. Spiro believed that Tricky Dick had betrayed him

If (14) is taken to be a meaning postulate of natural logic, and if (12) is taken to define semantic entailment, then (15a) semantically entails (15b). Now consider (16).

(16) a. Sam was being sincere
b. Sam stated that Tricky Dick had betrayed him
c. Sam believed that Tricky Dick had betrayed him

Letting (16a) be X and (16b) be P in the definition of (12), then (16b), taken in a context where (16a) is assumed to be true, will semantically entail (16c), given (14) as a meaning postulate. Moreover, (17′) will be a contradiction, given (14) and (17) as meaning postulates and an assumption of rationality.

(17) *believe*(a, *believe*(a,S))$\supset$*believe*(a,S)

[Note that (17) will suffice here and that it is not necessary to assume its converse, which is probably false.[1]

(17′) Sam was sincere in stating that Tricky Dick had betrayed him but that he believed that Tricky Dick had not betrayed him

[1] See p. ooo, n. o.

If (14) is true at all points of reference in all models, then (17') cannot be true in any model at any point of reference. For the same reason, (18a) will entail (18b) in a natural logic.

(18) a. Sam stated that Tricky Dick had betrayed him but that he did not believe that Tricky Dick had betrayed him
b. Sam was not being sincere

Given the performative analysis for declaratives, the definition of entailment in (12), and the independently motivated meaning postulates of (14), (17), and (i) and (ii) in p. 000, n. 0, Moore's paradox can be accounted for automatically.

(19) a. Tricky Dick betrayed me, but I don't believe that Tricky Dick betrayed me
b. The speaker is not being sincere (assuming that he does not hold contradictory beliefs)

(19a) can never be said sincerely and rationally, and that is accounted for given (12), (14), (17), and (i) and (ii) in p. 000, n. 0, together with the performative analysis for declaratives. Moreover, if we adopt the postulates in (20) that Gordon and I proposed, we can give similar accounts of the oddness of the sentences in (21).

(20) a. $sincere(x, promise(X,y,P)) \supset intend(x,P)$
b. $sincere(x, request(x,y,P)) \supset want(x,P)$
c. $sincere(x, request(x,y, tell(y,x,P))) \supset want(x, tell(x,P))$

(21) a. I promise to marry you, but I don't intend to
b. Please close the window, but I don't want you to
c. Who left, but don't tell me

None of these can ever be used sincerely and rationally.

What is interesting about such cases is that supposedly pragmatic paradoxes can be accounted for with just the apparatus of formal semantics, provided we adopt the performative analysis for all cases and the given meaning postulates, which are required independently for an adequate account of truth conditions in nonperformative cases.

There is another class of supposedly pragmatic paradoxes that can be handled by purely semantic means provided that we adopt a uniform performative analysis with definitions of satisfaction and entailment that hold for both performative and nonperformative predicates. These are what I have called the 'performative antinomies', cases like:

(22) a. Don't obey this order
b. I promise not to keep this promise
c. I advise you not to follow this advice
etc.

An account of these was given in G. Lakoff (1972b), where the principles in (23) were proposed.

(23) a. An order is felicitous only if it is (logically) possible for it to be obeyed.
b. A promise is felicitous only if it is (logically) possible for it to be kept.
c. A piece of advice is felicitous only if it is (logically) possible for it to be followed.

It is assumed that an order is felicitous if and only if the logical structure representing it has a satisfaction value of 1.

Given (23) and the usual satisfaction conditions for '$\Diamond P$', namely (24), we can account for the performative antinomies of (22).

(24) $V_w[\Diamond P] = 1$ iff $(\exists w')\,(Rww' \;\&\; V_{w'}[P] = 1)$
where w and w' are possible situations.

Take (22a). The order in (22a) can be obeyed if and only if it is not obeyed. If P = *you do not obey this order*, then there will be no possible situation in which P is true, since in every possible situation in which P is true it is also false. Hence, here is no situation in which the value of '$\Diamond P$' can equal 1. Consequently, (22) can never be a felicitous order.

What we have done in the case of (22a) is to account for what appears to be a pragmatic paradox by using only the devices of formal semantics, taken together with the performative analysis for imperatives and the principles of (23). Similar accounts can be given for (22b) and (22c).

Although declarative antinomies were not discussed in G. Lakoff (1972b), it turns out that they exist and can be handled in the same way. The declarative antinomy can be given by any of the following sentences:

(25) a. You do not believe this statement
b. I state that you do not believe this statement
c. You believe that this statement is false
d. I state that you believe that this statement is false

Each of the sentences of (25) has the following property: It is true if and

only if you believe it is false, and it is false if and only if you believe it is true. Hence you cannot have a correct belief about it.

Given the performative analysis for declaratives, we can account for all the declarative antimonies in exactly the same way as we accounted for the nondeclarative antinomies, provided we add the principle:

(23) d. A statement is felicitous only if it is (logically) possible for it to be believed.

As before there will be no possible situation in which '$\Diamond$*believe*(y,P)' will be satisfied, since y can believe P if and only if y does not believe P. Thus, '$\Diamond$*believe*(y,P)' will always be false and so each of the statements in (25) will always be infelicitous.

Note, incidentally, that the principles of (23) are needed independently to account for natural logic entailments in nonperformative cases:

(26) a. Sam ordered Olga not to obey the order he was then giving
b. Sam did not give a felicitous order

(27) a. Sam stated to Olga that she did not believe the statement he was then making
b. Sam did not make a felicitous statement

The principles in (23) are needed to account for the inferences from the (a) to the (b) sentences above.

What we have shown so far is that, in the case of performative antinomies as in the case of the Moore paradoxes, the principles needed to account for natural language entailments in nonperformative cases will, given a uniform performative analysis, automatically give an account of what goes wrong in performative antinomies. This is no mean accomplishment. For what appeared to be paradoxes of a pragmatic nature can be accounted for by the use of independently needed formal semantic apparatus, given a uniform syntactic performative analysis for declaratives as well as for imperatives, promises, etc. Even if there were no purely syntactic evidence for a performative analysis, these results suggest that we would want to have one anyway – just so that the Moore paradoxes and performative antinomies could be accounted for by independently needed apparatus in formal semantics. It is especially interesting that purely syntactic evidence buttresses this result from the area of model-theoretical semantics. And it is striking that the same types of arguments obtain in both cases.

(28) THE FORM OF SYNTACTIC ARGUMENTS FOR PERFORMATIVE ANALYSES
  (i) We need certain rules to account for given syntactic phenomena in nonperformative sentences.
  (ii) Given the performative analysis, the same rules will automatically account for the corresponding syntactic phenomena in performative sentences for which additional and different rules would be needed if we do not adopt a performative analysis.

(29) THE FORM OF SEMANTIC-PRAGMATIC ARGUMENTS FOR THE PERFORMATIVE ANALYSIS
  (i) We need certain apparatus in natural logic to account for certain semantic facts in nonperformative sentences. (The apparatus includes definitions of satisfaction for certain classes of predicates, meaning postulates, and a definition of entailment.)
  (ii) Given the performative analysis, the same apparatus will automatically account for the corresponding 'pragmatic' facts in the case of performative sentences; while additional and different apparatus would be needed if we do not adopt a performative analysis.

The convergence of the syntactic evidence for the performative analysis with the semantic-pragmatic evidence seems to me to strongly confirm the need for some version of the performative analysis (though not necessarily any of the particular ones proposed by Sanctius, Lancelot, Whitney, Postal, R. Lakoff, Ross, or Sadock).

I suggested above that the performative analysis should enable us to frame the theory of speech acts within formal semantics. Actually, the idea for doing this is implicit in the approach to the theory of speech acts given in chapter 3 of Searle (1969), where Searle gives truth conditions for third-person descriptions of speech acts and lets them *be* the felicity conditions for those acts. Similarly, in a natural logic, satisfaction conditions would be given for each atomic predicate, including all of the performative predicates; the satisfaction conditions are at once both truth conditions and felicity conditions. The sincerity conditions given in (14) and (20) are examples of meaning postulates that function as conditions on satisfaction. Searle's *essential conditions* might take the form of meaning postulates like that in (30).

(30) $Request(x,y,P) \supset attempt(x, cause(x,P))$

(30) expresses Searle's essential condition for requests, which is that a request counts as an attempt on the part of the speaker to get the hearer to do the action requested. The need for (30) as a meaning postulate independently of performative asentences can be seen in (31).

(31) a. Henry requested of Jill that she take her clothes off
b. Henry attempted to get Jill to take her clothes off

It should follow from the meaning of *request* that if (31a) is true then (31b) is true. Thus the meaning postulate in (30) is needed to account for entailments in nonperformative sentences.

Searle's preparatory conditions are especially interesting, since at least some of them are presuppositional in nature. For example, consider the condition on orders that says that the speaker has authority over the hearer. An inspection of nonperformative sentences show that this is a presupposition, not merely an entailment.

(32) a. Sam ordered Harry to get out of the bar
b. Sam didn't order Harry to get out of the bar
c. Sam may order Harry to get out of the bar

Each of the sentences in (32) entails that Sam has authority over Harry.

Given a uniform performative analysis, there are only two ingredients required for a theory of speech acts: (i) an account of satisfaction conditions for all performative predicates; and (i) an account of culture-specific assumptions about social interaction, at least in so far as they pertain to conversational interaction. We have discussed (i) at length; it is needed independently to account for nonperformative uses of performative predicates and requires only the apparatus of formal semantics. What about (ii) – the culture-specific assumptions? What Searle had in mind for these were such assumptions as (33):

(33) In normal conversations, you assume that the person you are talking to is being sincere, unless you have a good reason for not assuming it.

Thus, in an example like (16) above, (16a) ('Sam was being sincere') would be taken to be part of the culture-specific assumptions of speaker and hearer in a normal conversation. There is some doubt in my mind as to whether (33) is really a *culture-specific* assumption, rather than a truth which follows from the meaning of the concepts 'normal' and 'conversation'. That latter seems to me more likely, in which case (33) would just be

a theorem of natural logic. (33) just does not seem to me to be the sort of thing that would vary a great deal from culture to culture.

Be that as it may, there are real examples of culture-specific assumptions that have to be characterized in order to understand various aspects of speech acts in a given culture. But this does not mean that we need to go beyond the resources of formal semantics to provide an account of speech acts. In particular, we do not need any new notion of pragmatic or non-logical inference. Ordinary semantic entailment will suffice, just as it sufficed in the case of (16) above. Cultural assumptions play the same role in semantic entailment as any other assumptions.

This brings us to conversational implicature. I would like to suggest (modestly) that implicatures are not 'loose' or informal inferences. Given the performative analysis, implicatures should turn out to be a species of semantic entailment, providing one had an adequate natural logic and an adequate analysis of the relevant culture-specific principles of social interaction. Grice's theory of conversational implicature is based on the 'cooperative principle', the idea that certain 'maxims' are to be followed in conversational situations in which the participants are cooperating. Grice's maxims can be restated as principles like the following:

(34) a. If *x* is cooperating with *y*, then *x* will do only what is relevant to the enterprise at hand, unless his actions make no difference to the enterprise [MAXIM OF RELEVANCE]
b. If *x* is cooperating with *y*, then *x* will not do less than is necessary to make the enterprise successful
c. If *x* is cooperating with *y*, then *x* will not greatly exceed his needed contribution [MAXIMS OF QUANTITY]
etc.

It seems to me that principles like those in (34) should follow from the meaning of *cooperate*, rather than being special culture-specific principles of social interaction. Since natural logic is committed to the study of all natural language concepts, including *cooperation*, principles like those in (34) should fall within the purview of formal semantics within natural logic, and no separate set of pragmatic principles should be necessary for handling them. So far, unfortunately, neither linguists nor logicians have done any serious formal study of the logic of cooperation. Until such studies are done, we cannot say for sure whether implicatures can be handled using normal semantic entailment or whether a new, informal mode of inference needs to be characterized. What we can do now is (i) provide some evidence in favour of the proposal, (ii) show that apparent counter-

examples are not real, and (iii) show that similar cases in the realm of indirectly conveyed meaning show promise of eventually being dealt with within formal semantics.

Some evidence in favour of the proposal comes from work on the presuppositions of complex sentences by Lakoff and Railton (1971) and by Karttunen (1973). They observed that in sentences, S, of the form *If A, then B*, where B presupposes C, S presupposes C with respect to context X, unless $X \cup A \Vdash C$. This principle is meant to handle cases like the following:

(35) a. If Jack has children, then all of Jack's children are bald
b. If Nixon invites Angela Davis to the White House, then he will regret having invited a black militant to his residence

Assuming these sentences are of the form *If A, then B*, then in (35a), B presupposes that *Jack has children* ($=C$). Therefore $A = C$, and so $X \cup A \Vdash C$, for any X at all. In (35b), B presupposes that *Nixon will have invited a black militant to his residence* ($=C$). Therefore in any context X in which it is assumed that *Angela Davis is a black militant* and that *the White House is Nixon's residence*, the condition $X \cup A \Vdash C$ will be met, and so C will not be a presupposition of (35b) with respect to those contexts X.

If implicatures are really entailments in context, then we would expect the above principle, which is stated in terms of entailment in context to work in the case of implicatures. That is, suppose we have a sentence of the form *If A, then B*, where B presupposes C and where in a context X, A implicates C. If implicature is really entailment in context, we would expect the entire sentence *If A, then B* not to presuppose C with respect to X. This prediction is borne out, as the following example shows:

(36) If Sam askes Professor Snurd to write him a recommendation to graduate school, and Professor Snurd writes the recommendation, saying only that Sam has nice handwriting, then Sam will regret that Professor Snurd wrote him a bad recommendation

In (36), B presupposes that *Professor Snurd will have written Sam a bad recommendation* ($=C$). Consider every situation X in which it is assumed that if, in recommending someone for graduate school, a professor writes only that the student has a nice handwriting, then the professor is writing a bad recommendation. It will be the case that $X \cup A \Vdash C$. Thus, it is predicted that (36) as a whole does not presuppose C with respect to such contexts X, which is the case. But the inference from saying only that a student has nice handwriting to giving a bad recommendation is a classic case of a

Gricean implicature. (36) indicates that implicatures work like entailments in context with respect to the phenomenon of presupposition cancelling. Other implicatures seem to work the same way. Since implicatures can be treated as entailments in context, (36) gives us reason to believe that they should be treated as such, since then the presuppositional facts of (36) will be accounted for by the same principle that accounts for the presuppositional facts of (35).

In addition to providing evidence for our conjecture, we can show that apparent counter-examples are not real and that similar cases in the realm of indirectly conveyed meaning show promise of being dealt with within formal semantics. Probably the main objection to trying to treat implicatures via formal semantics is that implicatures are cancellable, while entailments are not. Consider the following examples.

(37) a. John has three children
b. John has three children – and he may even have six
(38) a. John caused Harry to leave
b. John caused Harry to leave – but Harry may not have left

On Grice's account (37a) invites the interference by means of conversational implicature that John has only three children, but does not entail it. The implicature can be cancelled, as in (37b). (37a) differs from (38a) in that (38a) has an entailment – Harry left – not an implicature. Any attempt to cancel the entailment, as in (38b) leads to a contradiction. Clearly there is a difference between (37a) and (38a), but this does not mean that the formal semantic mechanism of entailment cannot be used to handle both cases. Let me explain. The definition of entailment given above in (12) was context-dependent entailment; this is the usual model-theoretical notion. One special case of that is context-independent entailment, as defined in (39).

(39) CONTEXT-INDEPENDENT ENTAILMENT
P entails *Q* if and only if *Q* is satisfied in all models at all points of reference at which *P* is satisfied.

(38a) is a case of context-independent entailment; (37a) is not. I would like to suggest, however, that (37a) is a case of context-dependent entailment. If so, then (37a) will entail that John has only three children in some contexts, but not in others. The function of the cancellation phrase in (37b) will then be to limit the contexts appropriate for the use of the sentence to those in which the entailment does not hold.

To provide support for this claim we need to show that cancellation of implicatures is context-dependent. That turns out to be fairly easy to do.

(40) a. We've got a job for a welfare recipient who has at least three children – and the more the better. Do you definitely know someone who fills the bill?
b. We've got a job for a junior executive with children, but no more than three. Do you definitely know someone who fills the bill?

(41) Exactly how many children does John have?

Consider the sentences of (37) as being replies to (40) and (41). If (37a) is a reply to (40a), the implicature is cancellable, as shown by the fact that (37b) is a relevant and appropriate response. However, if (37a) is taken as a reply to (40b) or (41), the implicature is not cancellable, as shown by the fact that (37b) is not an acceptable response in these cases. The reason is fairly clear. The implicature is based on principle (34b). (34b) will be part of X in '$X \cup \{P\}$ entails Q' in (12). Whether or not implicature arise due to (34b) will depend on what else is assumed in context, namely, what else X contains that is relevant to the 'success of the conversational enterprise'. In this case, the relevant issue is whether it matters that John has more than three children. In (40a) it does not. In (40b) and (41), it does. My claim is that if examples like the above could be suitably formalized, the presence or absence of implicatures could be handled using context-dependent entailment, as defined in (12).

Although no significant work has yet been done on the problem of formalizing Gricean implicatures, there has been considerable investigation of other types of indirectly conveyed meanings, or in Heringer's terminology, 'indirect illocutionary force'. At present, these studies suggest that indirectly conveyed meanings might be handled using the apparatus of context-dependent semantic entailment, together with global and transderivational rules of grammar.

The basic idea is this: Grammars are taken as generating quadruples of the form (42).

(42) (S,L,C,CM), where S is a sentence (more strictly its phonetic representation), L is a model-theoretically interpreted logical structure (representing the literal meaning of the sentence), C is a consistent set of logical structures (the models in which they are satisfied represent the contexts in which the sentence has the literal meaning of L), and CM is a sequence of logical structures

(representing the conveyed meanings of the sentence relative to context C – the last member of the sequence is the 'ultimately conveyed meaning')

More specifically, pairs of the form (S,L) are characterized by derivations, that is, sequences of trees linking S and L. Each derivation D uniquely characterizes a pair (S,L). Thus one could alternatively say that a grammar generates triples of the form (D,C,CM), where D determines a pair (S,L). Derivations are not well- or ill-formed in and of themselves, but only with respect to contexts C and conveyed meanings CM. Derivations are characterized by local and global correspondence rules. Transderivational rules are constraints that specify which derivations are well-formed with respect to which contexts and which conveyed meanings.

The need for distinguishing literal from conveyed meaning is fairly obvious, as cases of sarcasm show. Take a sentence like (43).

(43) Harry is a real genius

Depending on context, (43) can be understood as being either literal or sarcastic. In contexts where it is to be taken sarcastically, the literal meaning is not conveyed at all – instead its polar opposite, namely, *Harry is an idiot*, is conveyed. Although in most of normal cases that linguists and logicians and philosophers of language have talked about, the literal meaning of the sentence is conveyed and perhaps other meanings as well, in sarcasm, the literal meaning is not conveyed at all. Interestingly enough, there are linguistic rules that correlate with sarcasm. R. Lakoff has observed that American English (at least many dialects) has a rule of sarcastic nasalization, whereby the sentence as a whole or the portion one is being sarcastic about is nasalized. Thus, if (43) or the sarcastic portion of it – *real genius* – is nasalized, the sentence can only have a sarcastic reading. This nasalization rule therefore seems to have a transderivational condition on it limiting the conveyed meaning of the sentence to the polar opposite of the literal meaning.

The reason that conveyed meanings are given as a sequence is that sentences often convey more than one meaning at once – the literal meaning plus one or more others. Take the following cases.

(44) Can you pass the salt?
(45) I want a beer
(46) Why don't you ask Harriet for a date?
(47) Your mother would like it if you asked Harriet for a date

Each of these sentences has a literal reading, and in certain situations the literal meaning can be conveyed. For example, (44) is literally a question about the addressee's abilities, and can be used as such, say, by a doctor trying to determine how well his patient's injured arm was healing. Of course, (44) is more frequently used to convey a request. (45) is literally a statement about the speaker's desires, and might be used as such, say, by a starving captive in reply to his sadistic captor's question 'What do you cant most?'. More typically, it would be used to convey a request. (46) and (47) have very different literal meanings, but could both be used as suggestions to the effect that the addressee ask Harriet for a date.

But where these sentences convey requests or suggestions, their literal meanings are also conveyed, and in fact the nonliteral meanings arise only by virtue of the literal meanings being conveyed. Thus, (44) in the right context can be both a question about one's abilities and by virtue of that, a request. Gordon and I proposed that the appropriate way to account for the relation between literal and conveyed meanings was by using context-dependent entailment together with the performative analysis. We suggested that there existed what we called 'conversational postulates' on which such relations were based, and that the literal meanings taken together with the postulates would, given the performative analysis and context-dependent entailment, entail the conveyed meanings. (48) is an example of one our our proposed postulates (slightly revised).

(48) *assume*(x, *not relevant*(*want*(x,Q))) & *say*(x,y,*want*(x,Q))$\supset$*request* (x,y,Q)
[If x assumes that it is not relevant that he wants Q and he says to y that he wants Q, then he is requesting that y do Q']

Thus, (48) would account for the fact that (45) is a request in exactly those contexts where the mere question of my *desire* for a beer was irrelevant. Given the performative analysis for (45) and context-dependent entailment, (48) will do the job.

It ought to be pointed out that there is independent motivation for (48) from nonperformative cases.

(49) a. Sam assumed that the pure question of his desires was irrelevant
b. Sam said to Mary that he wanted a beer
c. Sam requested that Mary get him a beer

(49a) and (49b) together entail (49c).

Gordon and I, in setting up postulates like (48) and calling them 'conversational postulates' were assuming that they were culture-specific prin-

ciples of social interaction. I now have some doubt about that, and think that they may simply be meaning postulates or theorems of natural logic that happen to contain performative predicates.

In summary, let me state what I hope to have convinced you of:

(50) a. There is strong semantic-pragmatic evidence supporting a uniform performative analysis.
b. Given a uniform performative analysis, the treatment of indexicals in natural language does not require that additional coordinates for speaker, hearer, and time and place of utterance be added to points of reference.
c. No additional pragmatic theory is necessary for an account of speech acts and conversational implicatures, provided that one accepts the goals of natural logic and the need for global transderivational grammars.

APPENDIX 1

An important point to bear in mind with respect to both Lewis' discussion and mine is that if so-called 'truth conditions' are taken to be satisfaction conditions in the model-theoretical sense, then in both Lewis' system and mine they are meant to apply to logical structures, *not directly to surface structures*. In both systems it makes no sense to think of a surface sentence being directly satisfied in a model at a point of reference, since satisfaction conditions are given for logical structures and not for surface strings. Because of this, a certain confusion can arise when one does not distinguish between the normal English surface adjective *true* and the technical term *true in a model*, taken to mean *satisfied in a model*. One can speak in English of a surface sentence as being *true* or *false* in the non-technical senses of those terms. Superficially it might appear that the normal English surface adjective *true* could be predicated of a surface sentence, while the technical *true* meaning *satisfied in a model* cannot.

We can see more easily what is going on here if we consider such classic examples as the following (from Postal (1969), and Borkin (1971)).

(1) a. IBM went up six points
b. IBM stock went up six points
(2) a. Proust is impossible to read
b. Proust's works are impossible to read
(3) a. This page is illegible
b. The writing on this page is illegible
(4) a. This page is impossible to understand
b. What is expressed by the writing on this page is impossible to understand

In each case the (a) sentence is understood in the same way as the (b) sentence.

Proust in (2a) is understood as referring to *Proust's works*, while *Proust* in (5a) refers to the remains of Proust's body, while *Proust* in (5b) refers to the person himself.

(5) a. Proust is buried in France
b. Proust wrote a lot

Similarly, *this page* in (3a) refers to the writing on the page and in (3b) refers to the content of what is written (or printed) on that page, while in (6) it refers to the physical page itself.

(6) This page weighs 1/50th of a gram

There are various ways in which one might try to deal with such sentences as (1a)–(4a). Postal has suggested that the (a) sentences in those cases be derived from the structures underlying the (b) sentences via a deletion rule (or rules), and the constraints on such sentences cited by Borkin and Lawler have given plausibility to such a suggestion. On the other hand, if one dislikes the deletion solution, one might propose instead a semantic solution whereby, for instance, the logical structure of (2a) would have the surface name *Proust* corresponding to the same logical structure element(s) as the surface name *Proust* in (5b), but would have different references in the two sentences. So far as I have been able to tell, such a suggestion would be difficult to implement adequately in terms of formal semantics for the following reason: Somehow the surface NP *Proust* in (2a) does not simply refer to Proust's works. In a sense, it also refers to Proust himself, and if it refers to Proust's works, it does so by means of its reference to the writer himself. This is exactly what happens under Postal's proposal. If the logical structure of (2a) is the same as that of (2b) and if *Proust* in (2a) is derived via a deletion rule from the structure underlying *Proust's work*, then in the logical structure of (2a) *Proust* refers to the man himself, and *Proust's works* refers to the man's works. Under Postal's proposal, the ordinary reference assignments used in formal semantics will suffice; while under the alternative proposal, we would have to control the reference of a description or a proper name in a different way. An obvious suggestion would be a 'pragmatic' solution, adding to points of reference a new coordinate for each proper name and each description in the language, i.e., an infinite number of new coordinates, and one would somehow have to mark each description and proper name in a logical structure to tell whether it was to have its ordinary reference or whether it was to refer to what was specified in its 'pragmatic' coordinate. Such a solution would not only have to have an additional infinite sequence of pragmatic coordinates, as well as having special markings in logical structure for ordinary vs. 'pragmatic' reference, but it would also have all the complication that would go along with Postal's proposal in addition. The reason is that there are empirical constraints on what a surface NP can ordinarily be understood as referring to. For example, *Proust* in (2a) cannot be understood as referring to the works that Proust did *not* write, nor as referring to Shakespeare's works, nor as referring to the works that my cousin Herbie believes that Proust wrote, nor as referring to this paper (which I have not given the title *Proust*). The principal unsolved problem with Postal's proposal is how to constrain his proposed deletion rule so as to get the right sur-

face NPs from the right underlying NPs. Exactly the same problem would remain in the pragmatic proposal. It is for this reason that I prefer Postal's deletion proposal. It requires less apparatus. Both proposals require the same constraints, but Postal's proposal uses the ordinary formal semantic apparatus to account for reference, and does not require extra pragmatic coordinates, that is, extra indicators of nonordinary reference.

Let us now return to the surface adjective *true*.
Note that (7a) is nderstood to mean the same as (7b).

(7) 1. That sentence is true
b. The proposition that the logical structure of that sentence expresses is true

That sentence in (7a) has the same reference as *the proposition that the logical structure of that sentence expresses* in (7b), while in (8) it refers to the sentence itself.

(8) That sentence contains five words

The problem is exactly that encountered in (1)–(4) above, and I would again suggest Postal's proposed solution: derive (7a) from the structure underlying (7b) by a deletion rule. Under this proposal, the English adjective *true* would not be predicated of surface sentences themselves, but only of propositions expressed by the logical structures of those sentences. And in both Lewis' proposal and mine, propositions are expressed not by surface sentences directly, but by the logical structures associated with those surface sentences. Thus, according to both our proposals, truth is predicated not of a surface sentence, but of the proposition expressed by the logical structure associated with the surface sentence.

In other words, in order to give satisfaction conditions for a given surface structure S, we must first pick out a logical structure S related to it by the grammar of the language. The question is: can one always find a unique logical structure S associated with any given surface structure S? It should be observed that the problem of determining satisfaction conditions for a surface S overlaps in part with the problem of assigning reference to surface structure nominals. Given a surface structure N, we must pick out a logical structure N associated with it, and then find out what that logical structure N refers to at a given point of reference. The question here is whether one can always find a unique logical structure N associated with an arbitrary surface structure N. Under Postal's beheading proposal, the answer to this question in general is no. For example, in (2a),

(2) a. Proust is impossible to read

the surface *N Proust* would have associated with it *two* logical structure *N*s, one of which would refer to Proust and the other, to Proust's works. Thus the question 'What does the surface *N Proust* refer to in surface sentence (2a)?' makes no sense, since surface *N*s can be said to refer only by virtue of there being an associated logical structure N that refers. If the question is rephrased, as it should be, to 'What does the logical structure N associated with the surface

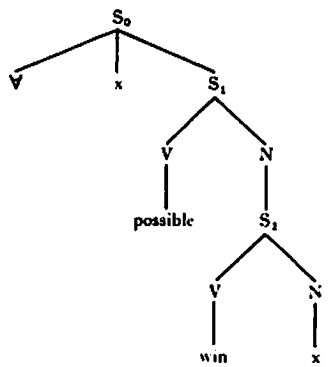
structure *N Proust* in (2a) refer to?', it becomes clear that the question makes no sense since the presupposition is false. It should also be noted that the fact that such a question does not have a sensible answer in no way creates a problem for the assignment of reference so far as the logical structure of (2a) is concerned.

The situation is the same with surface structure *S*s. Surface structure *S*s will not in general be associated with unique logical structure *S*s and therefore, it may make no sense to ask for the satisfaction conditions for a surface structure *S*. Consider (8a) for example.

(8) a. It is possible for anyone to win

In (8a), *for anyone to win* is a surface *S* (at least on one reading). Assuming for the sake of discussion that the logical structure of (8a) is (8b) [we have left out the declarative performative, since it is irrelevant for the moment], we might ask what are the satisfaction conditions for the surface structure *S for anyone to win*'?

(8) b.



For this to be a sensible question, there would have to be a unique logical structure *S* in (8b) that *for anyone to win* in (8a) is associated with. But there is no such *S*. The reason is that there are certain necessary conditions given in (9) that must be met in order for an *S*-node in a surface structure tree to be 'associated with' an *S*-node in a logical structure tree in discussions about the 'truth' of a surface structure sentence or clause.

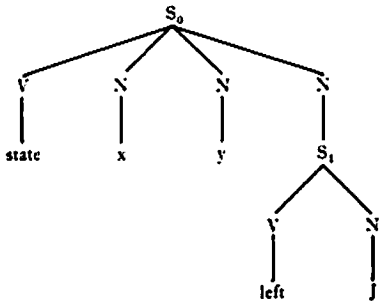
(9) Let S_i be a surface structure *S*-node and S_j be a logical structure *S*-node.
   a. The logical structure elements that correspond to the surface structure elements dominated by S_i are all dominated by S_j.
   b. The surface structure elements that correspond to the logical structure elements dominated by S_j are all dominated by S_i.

S_2 is not a candidate, since the logical structure element corresponding to *anyone* is not dominated by S_2. And S_0 is not a candidate since it dominates *possible*, which does not correspond to any element in the surface *S* 'for anyone to win'. Thus in general it does not make sense to ask for satisfaction conditions for a random surface structure *S*.

Suppose, for the sake of discussion, that the grammar of English pairs the logical structure (11) with the surface sentence (10).

(10) John left

(11)



Suppose we were to ask what the satisfaction conditions were for the surface *S* ***John left*** (= 10). In order for there to be an answer to that question, there would have to be a unique logical structure *S* associated with the surface *S* of (10). But if (11) is the logical structure of (10), then there would be two logical structure *S*s, not one, associated with the surface *S*, ***John left***. For this reason, it would make no sense in this case to ask for the satisfaction conditions for the surface *S*, ***John left***, though it would make perfect sense to ask for the satisfaction conditions of either S_0 or S_1 in (11). Note however that since words like 'true' and 'felicitous' can give clues as to which logical structure *S* is meant, it would make sense to ask whether the sentence in (10) is true (in the ordinary sense of the term, rather than in Lewis' extended sense) on a given occasion, just as it would make sense to ask whether it was felicitously used on a given occasion. To ask whether (10) is true is to ask whether S_1 in (11) is satisfied, and to ask whether it is felicitously asserted is to ask whether it is felicitously asserted is to ask whether S_0 is satisfied.

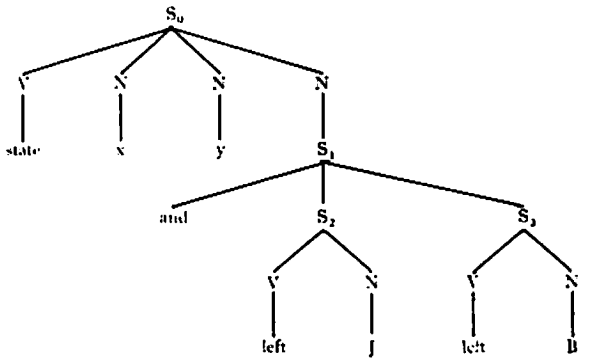
As we have seen, it makes sense to talk about satisfaction in a model ***directly*** only for logical structure *S*s; and it makes sense to talk about satisfaction in a model indirectly for a surface structure *S* only if there is a unique logical structure *S* which is associated by the grammar with that surface *S* and in terms of which satisfaction can be directly defined. We are in the same position with respect to entailment, which after all is defined in terms of satisfaction. Strictly speaking, entailment is a relation between logical structures, not surface sentences. We can define entailment indirectly for surface sentences just in case we can associate a unique logical structure *S* with each of the surface sentences. consider the following examples.

(12) a. John and Bill left
b. John left

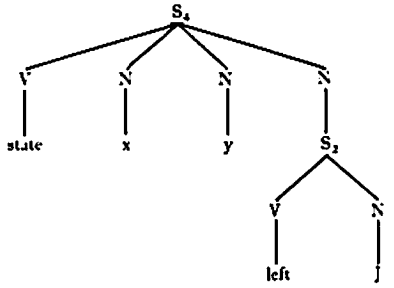
(13) a. I state that John and Bill left
b. I state that John left

Under the performative analysis for declaratives, the (a) and (b) sentences in (12) and (13) will be associated with the logical structures in (14a) and (14b)

(14) a.



b.



respectively. With respect to (14) we can say the following about entailment.

(15) a. S_1 entails S_2
b. S_0 does not entail S_4

Since entailment is a relation directly defined between logical structures and only indirectly between sentences depending on which logical structure *S*'s they are associated with, we can only talk about entailment relations in (12) and (13) if we know which logical structure *S*s we are talking about. Consider for example the sentences in (13). If we can find a locution to make it clear that we are associating (13a) with S_1 and (13b) with S_2, then we can speak of an entailment relation of the appropriate sort holding.

(16) That (13a) is a true statement on occasion *t* entails that (13b) is a true statement on occasion *t*.

By using the locution about true statements, we make it clear that we are associating (13a) with S_1 and (13b) with S_2, since:

(17) a. (13a) is a true statement on occasion *t* if and only if S_1 in (14a) is satisfied on occasion *t*.
b. (13b) is a true statement on occasion *t* if and only if S_2 in (14b) is satisfied on occasion *t*.

The point again is that when we speak of true statements, we are speaking of direct objects of statement predicates, not whole sentences or the logical structures corresponding to them.

Now consider (18).

(18) Sentence (13a) entails sentence (13b)

(18) would be understood as meaning (19).

(19) The truth of the proposition expressed by the logical structure *S* associated with sentence (13a) entails the truth of the proposition expressed by the logical structure *S* associated with sentence (13b).

Without any special locutions about true statements, the constraints of (19) would be in force for the entire surface sentences (rather than just for the surface *S* marking the direct object of a predicate of stating, as in the case above). By (9a), (13a) and (13b) could not be associated with S_1 and S_2 respectively, but rather with S_0 and S_4 respectively. Since S_0 and S_4 describe speech acts it is inappropriate to speak of their 'truth'; moreover, there is no entailment relation between S_0 and S_4. Thus, there are two reasons why (19) does not hold.

Let us now consider (12). If we use the 'true statement' locution, we get the same results as in (16).

(16′) That (12a) is a true statement on occasion *t* entails that (12b) is a true statement on occasion *t*.

(17′) a. (12a) is a true statement on occasion *t* if and only if S_1 in (14a) is satisfied on occasion *t*.

b. (12b) is a true statement on occasion *t* if and only if S_2 in (14b) is satisfied on occasion *t*.

But because (12) contains no overt performative verb, (12) displays a difference with respect to (13) when one looks at statements parallel to (18) such as (18′).

(18′) Sentence (12a) entails sentence (12b).

(18′) is understood as (19′).

(19′) The truth of the proposition expressed by the logical structure *S* associated with sentence (12a) entails the truth of the proposition expressed by the logical structure *S* associated with sentence (12b).

(18′) is unlike (18) in that principle (19) permits both S_0 and S_1 to be 'associated with' the surface *S* dominating sentence (12); and (19) also permits both S_4 and S_2 to be 'associated with' the surface *S* dominating sentence (12b). But since one can only speak of S_1 and S_2 as being 'true', while it is inappropriate to speak strictly of the 'truth' of S_0 and S_4, the surface nominals *sentence (12a)* and *sentence (12b)* in (18′) wind up being associated with S_1 and S_2 respectively. Since there is an entailment relation between S_1 and S_2, (18′) not only makes sense, but is true.

The point here is that the grammar of English may assign sentence (12a) the logical structure (14a), while the surface nominal *sentence (12a)* in the *sentence* (18′) may be taken as referring to the content of only a subtree of (14a), namely

S_1. The reason why I have taken the trouble to discuss this matter at such length is that a failure to make such distinctions can lead one into making a fallacious argument against the performative analysis for declaratives. (20) contains the gist of such an argument.

(20) (i) (14a) is the logical structure of sentence (12a) and (14b) is the logical structure of sentence (12b).
(ii) Sentence (12a) entails sentence (12b).
(iii) But (14a) [= S_0] does not entail (14b) [= S_4].
(iv) Therefore, assuming that entailment is based on logical structure, (i) cannot be correct.

The argument is fallacious. In order to make the argument correct, we would have to assume in addition:

(21) *Sentence (12a) entails sentence (12b)* is true if and only if the logical structure of sentence (12a) entails the logical structure of sentence (12b).

But this need not be a correct assumption, as we saw above. The truth of (20 ii) [= (18')] depends upon what the surface nominals *sentence (12a)* and *sentence (12b)* refer to in that sentence. As we have seen, these surface nominals may be understood as referring to the proposition expressed by a subtree of the logical structure of the surface sentence. This is not particularly strange, considering the general complexities that we have seen to be involved in the assignment of reference to surface nominals, and the general constraints in (9) above.

APPENDIX 2

Given transformational grammar of the Aspects vintage, it made sense to ask 'Do transformations preserve meaning?' Within generative semantics, this question does not make sense, for various reasons. First and most obviously, there are no transformations. In their place there are correspondence rules which may have global and/or transderivational constraints associated with them. Secondly, the role of correspondence rules is correctly to relate surface structures and logical structures, given various constraints involving context, conveyed meanings, etc. The rules will have correctly to account for all aspects of meaning; but the term 'preserving meaning' will be itself meaningless in such a theory. Since there is more to meaning than just the model-theoretical interpretations of logical structures – in particular, those features of meaning associated with context and conveyed meanings – one would not expect all aspects of the meaning of a sentence to be given by the model-theoretical interpretation of the logical structure of the sentence. The rule of performative deletion, as discussed by R. Lakoff (1973), is a case in point. As Lakoff observes, overt performatives are used under different contextual conditions than nonovert performatives. Thus, sentences with overt performatives would differ in their contextual meaning from sentences with nonovert performatives. This would be accounted for in the grammar of English by placing transderivational conditions concerning context on the rule of performative deletion.

If one had a theory like the Aspects theory, with transformations and a notion of deep structure, and if one stated performative deletion in such a theory as a transformation, then performative deletion would, as expected, not be a meaning-preserving transformation in such a theory, since the contextual constraints on sentences in the derivation of which the rule has applied would differ from those in which the rule had not applied. But this issue does not arise in generative semantics, since the notion of 'preserving meaning' does not make sense in such a theory. In generative semantics, meanings are assigned to sentences by rules of grammar. One may ask whether they are assigned correctly or incorrectly, but not whether they are 'preserved'.

APPENDIX 3

Ross and Sadock, in their versions of the performative analysis, assume that the logical structure of every sentence has a performative predicate expressing the literal content of that speech act which is performed when the speaker utters the given sentence in an appropriate situation. I am not making such an assumption, but rather two weaker assumptions:

(I) Every sentence when used in a given situation to perform a speech act has associated with it in that situation a logical structure which contains a performative predicate which expresses the literal content of the speech act.

(II) Every sentence which contains in its surface structure a deictic (or 'indexical') element, i.e., an element which has meaning only with reference to a speech act, has in its logical structure a performative predicate which expresses the literal content of that speech act. (I) and (II) leave open the possibility that there are sentences of natural languages which do not have any deictic elements and which can be considered in the abstract apart from any implicit or explicit speech act. Such sentences do seem to occur in English, though they constitute a very tiny proportion of sentences of the language. They include certain sentences about mathematics and the physical sciences, as well as definitions. Compare the following two groups of sentences.

(1) a. Two plus two equals four
    b. Force equals mass times acceleration
    c. Whales are mammals
(2) a. My uncle came here yesterday
    b. Whales are becoming extinct
    c. The earth has one satellite
    d. That is a wombat

Though the sentences in (1) have surface structure present tense elements, those tense elements have no relation to the time that such sentences were uttered (written, etc.). They are true (or false) independent of who utters them, or when or where or under what circumstances they are uttered, and independently of whether they are uttered at all. Thus the tenses in (1) are not deictic elements. The tenses in (2) are, however, deictic elements. The truth of each sentence in (2) depends on when it is uttered. Moreover, the truth or falsity of (2a) depends

on who utters it and where the utterance takes place. (2d) depends for a truth value on what the speakers refers to by *that*.

A tiny proportion of natural language sentences have no deictic elements in them at all, and if we ignore instances where such sentences, including those in (1), are considered in the abstract rather than being asserted by a speaker, then my proposals in (I) and (II) become identical with the Ross–Sadock proposal. The disparity between our positions, though miniscule so far as natural language phenomena on the whole are concerned, is important with respect to the history of the study of formal semantics. Formal semantics grew out of the study of formal logic, which in turn concerned itself primarily if not wholly with non-deictic sentences abstracted away from speech situations, since it was concerned with mathematics (and science in general). Mathematics can be formalized without taking speech acts into account. However, when formal semantics is extended from its traditional domain to natural languages as wholes, the study of nondeictic sentences abstracted from speech situations pales into insignificance. Not that such cases should not be accounted for; (I) and (II) are set up to account for them. According to (I) and (II), sentences like those in (1) would be associated with two logical structures; one for cases in which the sentence is uttered in the performance of a speech act – typically an assertion, and another in which the sentence is considered in the abstract, as logicians usually consider them. In the former (speech act) case, the logical structure of the sentence would contain a performative predicate expressing the literal content of the speech act; in the latter case, since the sentence can be totally abstracted from any speech act situation, there would be no performative predicate in logical structure.

The Ross–Sadock proposal requires that all logical structures contain performatives in the appropriate place; my proposal requires no such constraint. (I) and (II), rather than being constraints placed on grammars, would simply fall out automatically once the principles governing the occurrence of deictic elements were stated correctly. Each surface structure deictic element would correspond to some argument in logical structure that would be a clause-mate of some performative predicate. Thus, the presence of a deictic element would require the presence of a performative predicate in logical structure; correspondingly, if a sentence contained no deictic element, no performative predicate would be required – one might be there or not. If a performative predicate were there, then in order for the logical structure to be satisfied in a model, some speech act would have to occur. With no performative predicate, there would be no corresponding speech act, and we would get the consideration-in-the-abstract case.

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