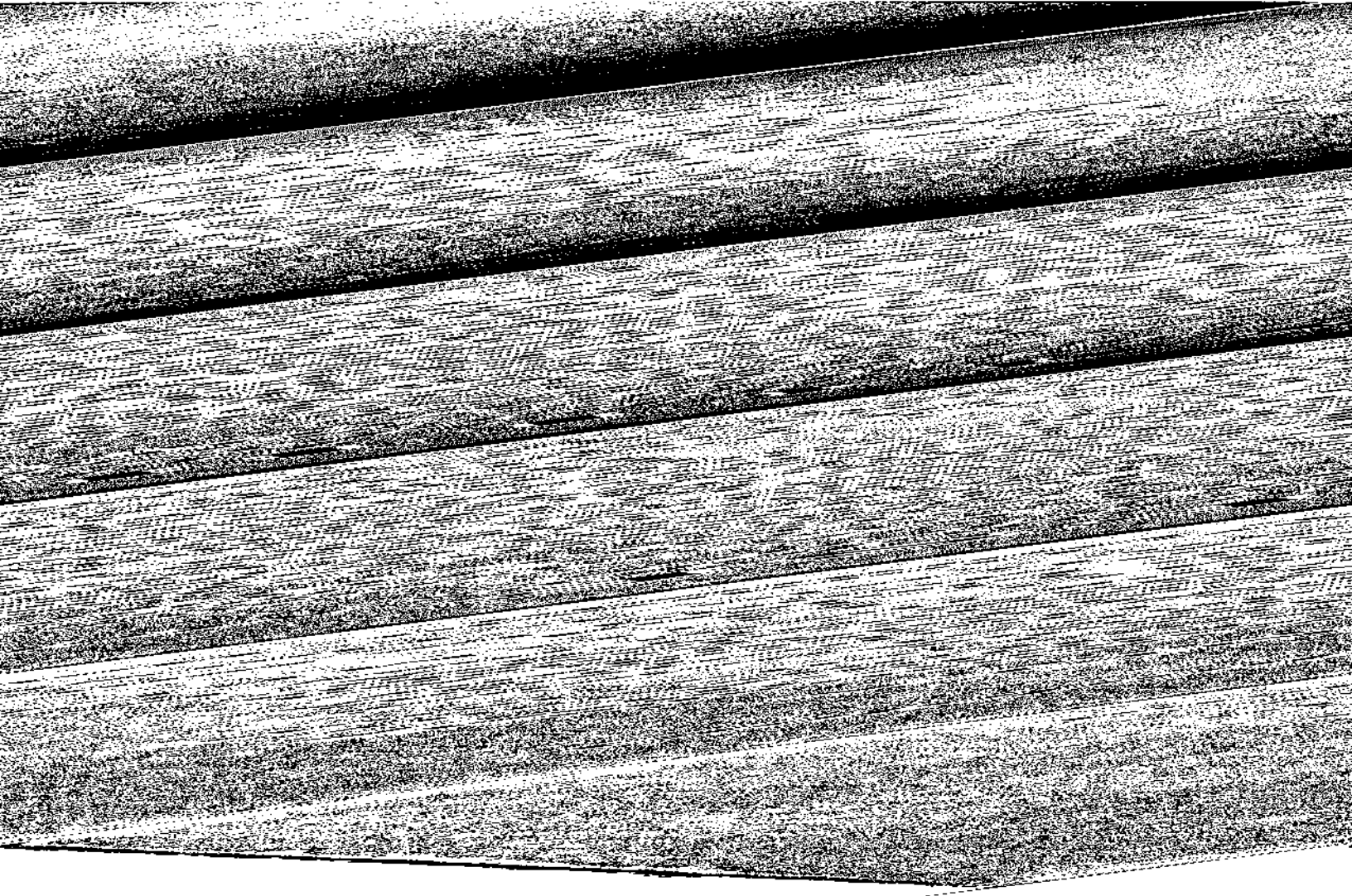
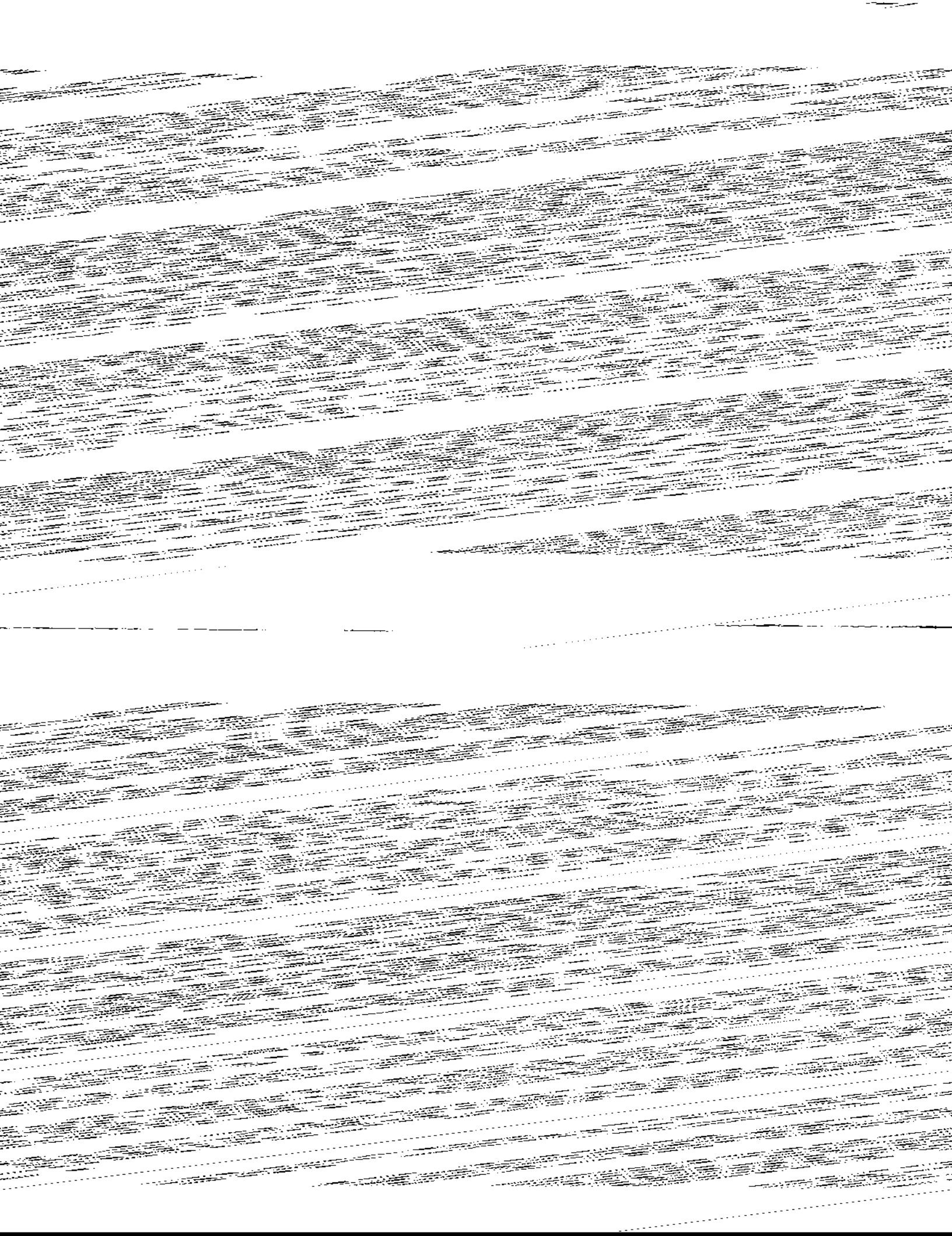




preposing is violated, the result can be an ungrammatical sentence.[1]

(4) a. I realize that Sam will leave town tomorrow.
b. *Tomorrow, I realize that Sam will leave town. (≠a)

(5) a. It is mistaken that Sam smoked pot last night.
b. *Last night, it is mistaken that Sam smoked pot. (≠a)

'Realize' and 'mistaken' do not permit adverb-preposing from a lower clause in my speech. In (4b) and (5b), violation of this constraint on adverb-preposing leads to ungrammatical sentences. Thus, the rule of adverb-preposing, constrained as indicated, must be a rule of grammar, since it plays a role in distinguishing grammatical from ungrammatical sentences. Now consider examples (6) and (6').

(6) a. I mentioned that Sam smoked pot last night.
b. Last night, I mentioned that Sam smoked pot. (≠a)

(6') a. I mentioned that Sam will smoke pot tomorrow.
b. *Tomorrow, I mentioned that Sam will smoke pot. (≠a)

(6'b) shows that 'mention' is also a verb that does not permit adverb-preposing from a lower sentence. In (6b) on the other hand, we have a grammatical sentence which looks just like the sentence that would be formed by preposing the adverb 'last night' to the front of (6a). However, (6b) does not have the meaning of (6a). In (6b) 'last night' does not modify 'smoked', but rather 'mentioned'. The reason is obvious. 'Last night' in (6b) originates in the same clause as 'mentioned' and moves to the front of its own clause by adverb-preposing. On the other hand, 'tomorrow' in (6'b) cannot originate in the same clause as 'mentioned', since 'tomorrow' requires a future tense and 'mentioned' is in the past tense. Although 'tomorrow' can originate as a modifier of 'will smoke', it cannot move to the front of the higher clause, since adverb-preposing from a lower clause is blocked by 'mention'. The fact that 'mention' blocks adverb-preposing from a lower clause also accounts for the fact that (6b) cannot be understood as a paraphrase of (6a). Note however, that the same rule with the same constraint in the case of (6'b) yields an ungrammatical sentence, while in the case of (6b) it blocks a certain interpretation of a grammatical sentence. Here we have a case where the violation of a rule of grammar does not guarantee that the sentence generated will be ungrammatical. The violation only guarantees that the sentence will be

ungrammatical relative to a given reading. A sentence will be fully ungrammatical only if it is ungrammatical relative to all readings. This suggests that the role of rules of grammar is not simply to separate out the grammatical from the ungrammatical sentences of English, but also to pair surface forms of sentences with their corresponding meanings, or logical forms. Thus, rules like adverb-preposing appear to have two functions: to generate the grammatical sentences, filtering out the ungrammatical sentences, while at the same time relating the surface forms of sentences to their corresponding logical forms, while blocking any incorrect assignments of logical form to surface form.

This can be seen somewhat more clearly in the case of *if*-clauses. It is often assumed that sentences of the form

$$\text{If } S_1, \quad \text{then} \quad S_2,$$

are to be translated into a logical form like

$$S_1 \supset S_2$$

or something of that sort, perhaps with a different connective. This view is mistaken. As Jerry Morgan has observed, *if*-clauses behave just like other adverbial clauses (e.g., *when*-clauses, *because*-clauses, etc.) with respect to low level syntax. In particular, *if*-clauses undergo the rule of adverb-preposing. Adverb-preposing derives (7b) from (7a).

(7) a. Sam will smoke pot, if he can get it cheap.
b. If he can get it cheap, *then* Sam will smoke pot. (=a)

Morgan (1970) has proposed that the 'then' of 'if-then' is inserted by transformation after the *if*-clause has been preposed. This view is substantiated by examples like (8) and (9).

(8) a. I think Sam will smoke pot, if he can get it cheap.
b. If he can get it cheap, *then* I think Sam will smoke pot. (=a)

(9) a. It is possible that Sam will smoke pot, if he can get it cheap.
b. If he can get it cheap, *then* it is possible that Sam will smoke pot. (=a)

In (8) and (9) adverb-preposing has moved the *if*-clause to the front of a higher clause. The *if*-clause in (8b) originates inside the object comple-

ment of 'think', as in (8a). Thus (8b) can be synonymous to (8a). Similarly, the *if*-clause in (9b) originates inside the sentential complement of 'possible' and so (9b) can be synonymous to (9a). Note, however, where the 'then' appears. In (8b) and (9b) 'then' appears in front of the higher clause. This corroborates Morgan's claim that 'then' is inserted after adverb-preposing.[2]

As we saw above, certain verbs and adjectives block the application of adverb-preposing from below. The examples we gave were 'realize', 'mistaken', and 'mention'. Examples (10) and (11) show that adverb-preposing blocks in the same cases with *if*-clauses.

(10) a. I realize that Sam will smoke pot, if he can get it cheap.
b. *If he can get it cheap, *then* I realize that Sam will smoke pot. ($\neq$a)

(11) a. It is mistaken that Max smokes pot if he can get it cheap.
b. *If he can get it cheap, *then* it is mistaken that Max smokes pot. ($\neq$a)

In (12) we have a case parallel to (6) above.

(12) a. Max mentioned that Sam will resign if Sue is telling the truth.
b. If Sue is telling the truth, *then* Max mentioned that Sam will resign.

The *if*-clause in (12b) is understood only as modifying 'mention' and not as modifying 'resign'.

It should be clear from these examples that sentences of the form

$$\text{If } S_1, \text{ then } S_2.$$

are not necessarily to be translated as

$$S_1 \supset S_2.$$

If one permitted such a translation from surface form to logical form, then a sentence such as (9b), which has a logical form something like (13), would be given a logical form like (14).

(13) $\Diamond(p \supset q)$
(14) $p \supset (\Diamond q)$.

Classical logical fallacies are often results of such mistaken translations.

It should be clear from these remarks that the rule of adverb-preposing, which we have seen is a rule of grammar, plays a crucial role in relating surface forms to their logical forms. It follows that the rules determining which sentences are grammatical and which, ungrammatical are not distinct from the rules relating logical forms and surface forms. The rule of adverb-preposing is a rule which does both jobs.

Adverb-preposing is interesting in other respect as well. For example, it can be used to show that there are cases where material which is understood but does not appear overtly in the sentence, and which can only be determined from context, must appear in underlying grammatical structure and must be deleted by a rule of grammar. Consider the following case.

(15) a. I'll slug him, if he makes one more crack like that.
b. If he makes one more crack like that, I'll slug him.
c. One more crack like that, and I'll slug him.

(15c) is understood in the same way as (15a) and (15b), that is, it is understood as an if-then construction. In (15c) 'he makes' is understood, though it does not appear overtly in the sentence. The question is whether 'he makes' in (15c) is to be deleted by a rule of grammar or to be supplied by a rule mapping surface form into logical form, which is not a rule of grammar. Further examples show that the missing material in such constructions is determinable only from context, that is, only from what is presupposed by the speaker. Consider, for example, (16).

(16) a. One more beer, and I'll leave.
b. If I drink one more beer then I'll leave.
c. If you drink one more beer then I'll leave.
d. If you pour one more beer down my back, then I'll leave.

and so on.

Sentence (16a) can be understood, depending upon the context, as any of (16b, c, d, etc.). Yet it can be shown that noun phrases such as 'one more beer' as in (16a) must be derived by deletion from full clauses. Consider examples (17), (18), (19) and (20).

(17) a. It's possible that I'll slug him if he makes one more crack like that.

b. If he makes one more crack like that, then it's possible that I'll slug him.
c. One more crack like that, and it's possible that I'll slug him.

(18) a. I think that I'll slug him if he makes one more crack like that.
b. If he makes one more crack like that, then I think I'll slug him.
c. One more crack like that and I think I'll slug him.

(19) a. I realize that I'll slug him if he makes one more crack like that.
b. *If he makes one more crack like that, then I realize that I'll slug him.
c. *One more crack like that and I realize that I'll slug him.

(20) a. It's mistaken that I'll slug him if he makes one more crack like that.
b. *If he makes one more crack like that, then it's mistaken that I'll slug him.
c. *One more crack like that and it's mistaken that I'll slug him.

(21) a. I mentioned that I would slug him if he made one more crack like that.
b. *If he made one more crack like that, then I mentioned that I would slug him.
c. *One more crack like that and I mentioned that I would slug him.

It should be clear from such examples that constructions like (15c) are derived from preposed *if*-clauses, since they are paraphrases and obey the same grammatical constraints. It follows that noun phrases like 'one more crack' in (15c) are derived from full underlying clauses and that the 'and' in this construction is not an underlying 'and' but rather an underlying 'if-then'. (16a) is an instance of exactly the same construction. Moreover, it shows exactly the same constraints. Consider the examples of (22).

(22) a. One more beer and I'll leave.
b. One more beer and I think I'll leave.

c. One more beer and it's possible that I'll leave.
d. *One more beer and I'll realize that I'll leave.
e. *One more beer and it's mistaken that I'll leave.
f. *One more beer and I mentioned that I would leave.

These cases provide strong evidence that constructions such as (16a) must be derived from if-then clauses and that noun phrases such as 'one more beer' be derived from the full underlying *if*-clause. If there were no *if*-clause present in the syntactic derivation of sentences like (16a), then the facts of (22) would be inexplicable. Consequently, it follows that the understood matter in such sentences is recoverable only from context; it must be present in order to form a full clause at the time of adverb-preposing, and hence must be deleted by a rule of grammar. Thus rules of deletion in grammar must be sensitive to context, that is, to what is presupposed by the speaker. Let us now return to the facts of (1)–(14).

From a consideration of these facts we have reached conclusion 1.

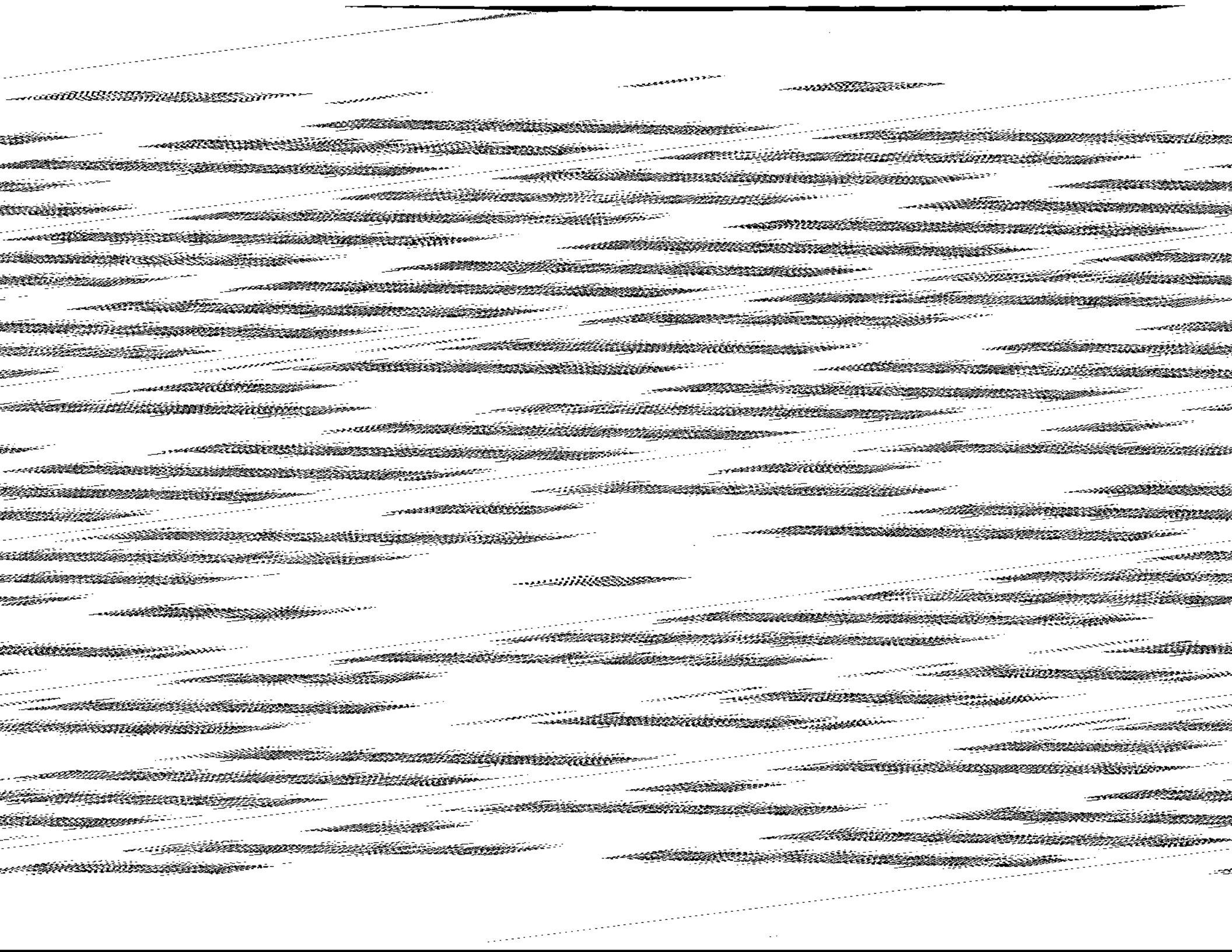
CONCLUSION 1: The rules of grammar, which generate the grammatical sentences of English, filtering out the ungrammatical sentences, are not distinct from the rules relating the surface forms of English sentences to their corresponding logical forms.

The reason for this is that adverb-preposing must do both jobs at once. The only way conclusion 1 could be avoided would be to assume that there were two rules which did the same job as adverb-preposing and had exactly the same constraints and that one was a rule of grammar and the other a rule relating surface forms to logical forms. This would necessarily involve stating the same rule twice, and thus missing a significant generalization.

CONCLUSION 2: Conclusion 1 provides support for the theory of generative semantics, which claims that the rules of grammar are identical to the rules relating surface forms to their corresponding logical forms.

At present, the theory of generative semantics is the only theory of grammar that has been proposed that is consistent with conclusion 1.

It should be noted that both of the above conclusions depend upon a form of argumentation upon which just about all of the linguistics of the past decade and a half depends, namely, that if a given theory necessarily requires that the same rule be stated twice, then that theory is wrong. Not just inelegant, but empirically incorrect. It was on the basis of just



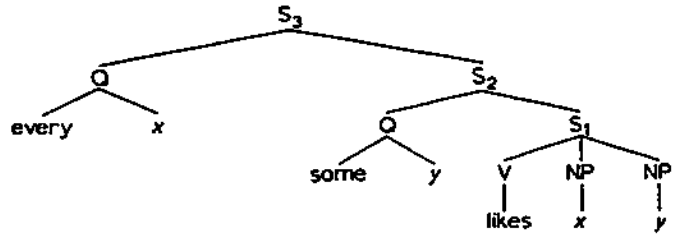
(7) may have the readings of (8a, b, and c), but not (d). I have no idea of how the group reading is to be represented formally. But whatever its formal representation is to be, the possibility of scope ambiguities, as is the norm with quantifiers, must be excluded.

Now let us consider some implications of the above facts. Let us begin with sentences like (9) and (10).

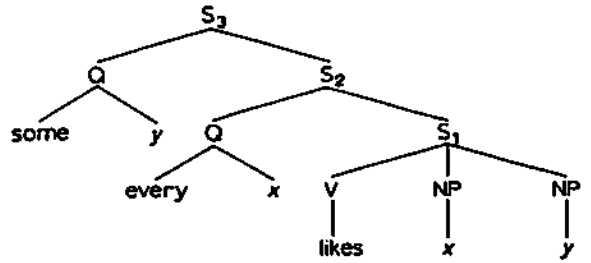
(9) Everyone likes someone.
(10) Someone is liked by everyone.

In my speech, though not in that of all speakers of English, (9) and (10) have different meanings.[1] (9) would have a logical form something like that of (11), while (10) would have to have a logical form something like that of (12).[2]

(11)



(12)



To relate the logical forms of the sentences and their corresponding surface forms, there would have to be a rule of quantifier-lowering, which in (11) would lower 'some' onto the NP with the index *y* and the 'every' onto the NP with the index *x*. The same rule would apply in (12). In my speech, though not in that of many other speakers, there is a constraint on possible pairs of logical forms and surface forms which says that when two quantifiers appear in the same surface clause, the leftmost quantifier must be the higher one in the logical form of the sentence. That constraint

accounts for the difference in meaning between (9) and (10) in my speech.

Any account of the relationship between the logical form and the surface form of sentences like (9) and (10) must include a rule essentially like quantifier-lowering (or, if one prefers, its inverse, which I will call 'quantifier-raising'). Quantifier-lowering (or quantifier-raising, if one prefers) will be a movement rule. That is, it will move a quantifier over a stretch of tree. Movement rules have been studied in great detail by John R. Ross (Ross, 1967). Ross discovered that movement rules (in particular, chopping rules, of which quantifier-lowering would be one) obeyed certain very general constraints. One of these constraints, known as the coördinate structure constraint, states that no movement rule may move an element into or out of one conjunct of a coördinate structure. For example, consider examples (13) through (15).

(13) a. John and Bill are similar.
b. John is similar to Bill.
(14) a. *Who is John and similar?
b. Who is John similar to?
(15) a. *Bill, John and are similar.
b. Bill, John is similar to.

In (13a) the subject is the coördinate NP 'John and Bill'. In (13b) there is no coördinate NP. Consider the NP in the position of 'Bill' in these examples. Suppose we try to question that NP. This is possible in (14b), where 'Bill' would not be part of a coördinate structure, but it is impossible in (14a), where one would be questioning an element of a coördinate structure. Or consider topicalization, as in (15). In (15b) 'Bill' can be moved to the front of the sentence, since it is not part of a coördinate structure, but in (15a), where 'Bill' would be part of a coördinate structure, it cannot be moved to the front of the sentence. Now let us return to the rule of quantifier-lowering and to the distinction between the group-reading and the quantifier-reading of 'nine' and 'all'. In cases of true quantification, where scope of quantification is involved, the rule of quantifier-lowering would apply, moving the quantifier down to the NP containing the appropriate variable. Thus, 'some' in (11) would move down to the NP containing the variable *y*. One would predict that, in such cases, Ross's coördinate structure constraint would apply. That is,

if the variable were contained in a coördinate NP, the rule of quantifier-lowering would be blocked. This, however, would only be the case for true quantifiers, and not for quantifiers with a group-reading, since the group-reading involves no scope of quantification, and hence no rule of quantifier-lowering. As one would guess, this is exactly what happens, as (16) and (17) show.

(16) a. John and nine boys are similar. (UNAMB)
b. John and all the girls are similar. (UNAMB)
c. *John and every linguist are similar.
d. *Few philosophers and John are similar.

(17) a. John is similar to nine boys. (AMB)
b. John is similar to all the boys. (AMB)
c. John is similar to every linguist. (UNAMB)
d. Few philosophers are similar to John. (UNAMB)

Compare (17a) with (16a). (17a) is ambiguous. It can mean either that nine boys share a single property with John or that there are nine boys who share some property or other with John. (16a) however only has the former reading. In (16a) the shared property must be the same, as in the group-reading of (17a). (16a) cannot have the reading that John shares different properties with each of the nine boys. The same is true of (16b) and (17b). This is predictable, since the true quantifier reading of (16a and b) is ruled out by the application of the coördinate structure constraint to the rule of quantifier-lowering, leaving only the group-reading for (16a and b). Since the quantifiers 'every' and 'few' do not have group-readings, but only quantifier readings, sentences (16c) and (16d) are ungrammatical, because in order to derive such sentences, the rule of quantifier-lowering would have to violate the coördinate structure constraint. Compare these with (17c and d) where there is no coördinate structure and where, correspondingly, the sentences are grammatical. The rule of quantifier-lowering not only obeys Ross's coördinate structure constraint, but also Ross's other constraints on movement transformations, as would be expected. For details, see G. Lakoff (1970).

Now let us consider what these facts show. First, they reveal the existence of a group-reading for quantifiers of certain sorts, the logical form of which is unknown. All we know about it is that it does not involve

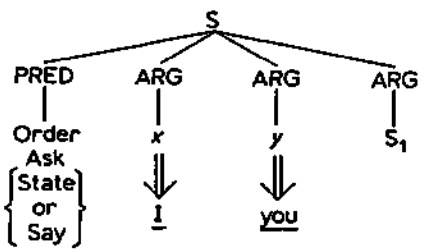
scope of quantification. Secondly, we have seen that the rules relating sentences with true quantifiers to their corresponding logical forms must obey Ross's constraints on movement transformations. These are constraints on grammatical rules, such as question-formation and topicalization (see (14) and (15)). Thus, the rules relating the surface forms of sentences containing true quantifiers to their logical forms obey the same constraints as ordinary grammatical rules. This should not be surprising, since violations of the rule of quantifier-lowering lead to ungrammatical sentences, as in (16c) and (16d). Thus, quantifier-lowering seems to do double duty. It not only accounts for the difference between grammatical and ungrammatical sentences (compare (16c and d) with (17c and d)). but it also serves to relate the logical form of sentences to the corresponding surface forms. Note also that the same rule constrained in the same way will block the generation of the sentences in (16c) and (16d), but only block the corresponding readings for the sentences of (16a and b), it will not yield an ungrammaticality in the case of (16a and b), but only restrict the possibilities for what those sentences can mean. Here we have another case that shows that the rules of grammar, which separate grammatical from ungrammatical sentences, are not distinct from the rules which relate logical forms and surface forms. Consequently, we reach the same conclusions from these facts as we did from the facts considered in the previous section.

IV. PERFORMATIVE VERBS

In Sections II and III we saw that the rules of adverb-preposing and quantifier-lowering do double duty in that they serve both to distinguish the grammatical from the ungrammatical sentences of English and to relate the surface forms of sentences to their corresponding logical forms. They thus serve to confirm what has come to be called the theory of generative semantics.[1] Generative semantics claims that the underlying grammatical structure of a sentence *is* the logical form of that sentence, and consequently that the rules relating logical form to surface form are exactly the rules of grammar. If the theory of generative semantics is correct, then it follows that the study of the logical form of English sentences is indistinguishable from the study of grammar. This would mean that empirical linguistic considerations could affect decisions concerning how

the logical form of a sentence is to be represented. It would also mean that, on linguistic grounds, the logical forms of sentences are to be represented in terms of phrase structure trees. In this section, we will consider the question of how linguistic considerations can bear on the question of how the illocutionary force of a sentence is to be represented in logical form. In particular, we will consider some of the linguistic evidence which indicates that the illocutionary force of a sentence is to be represented in logical form by the presence of a performative verb, which may or may not appear overtly in the surface form of the sentence. This should not be too surprising in the case of imperatives or questions. It is clear that sentences like 'I order you to go home', in which there is an overt performative verb, namely 'order', enters into the same logical relations as a sentence like 'Go home' in which there is no overt performative verb in the surface form. Linguistic arguments in favor of such an analysis of imperatives can be found in R. Lakoff (1968). It should also not be too surprising that the logical form of questions should be represented in a similar way. On the other hand, it might be assumed that statements should be distinguished in their logical form from imperatives, questions, etc. by the absence of any such performative verb (or modal operator). However, there is considerable evidence to show that even statements should be represented in logical form by the presence of some performative verb with a meaning like 'say' or 'state'. Thus, it is claimed that the logical forms of imperatives, questions, and statements should be represented as in (A).[2]

(A)



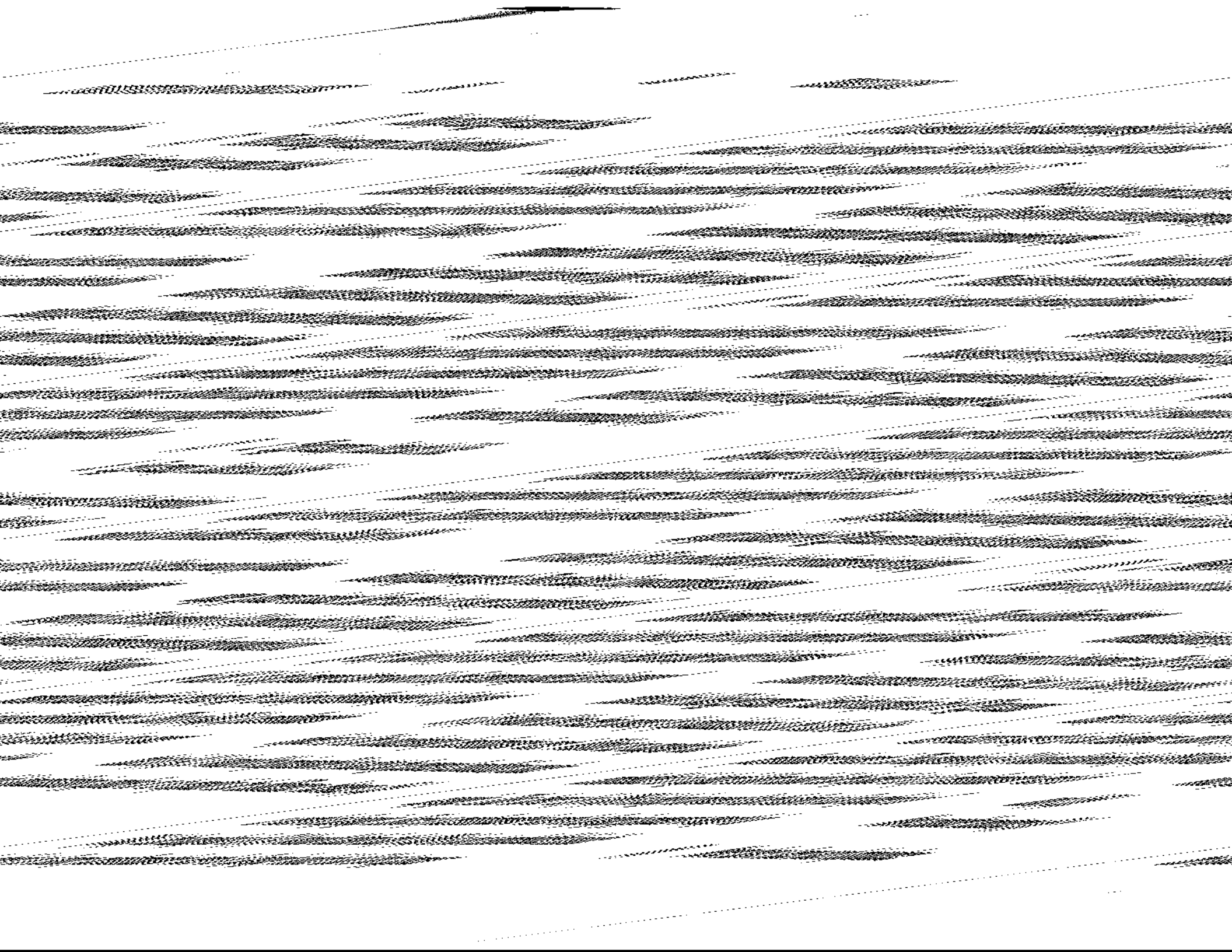
In (A), S_1 represents the propositional content of the command, question, or statement. Note that in statements it is the propositional content, not the entire sentence, that will be true or false. For example, if I say to you 'I state that I am innocent', and you reply 'That's false', you are

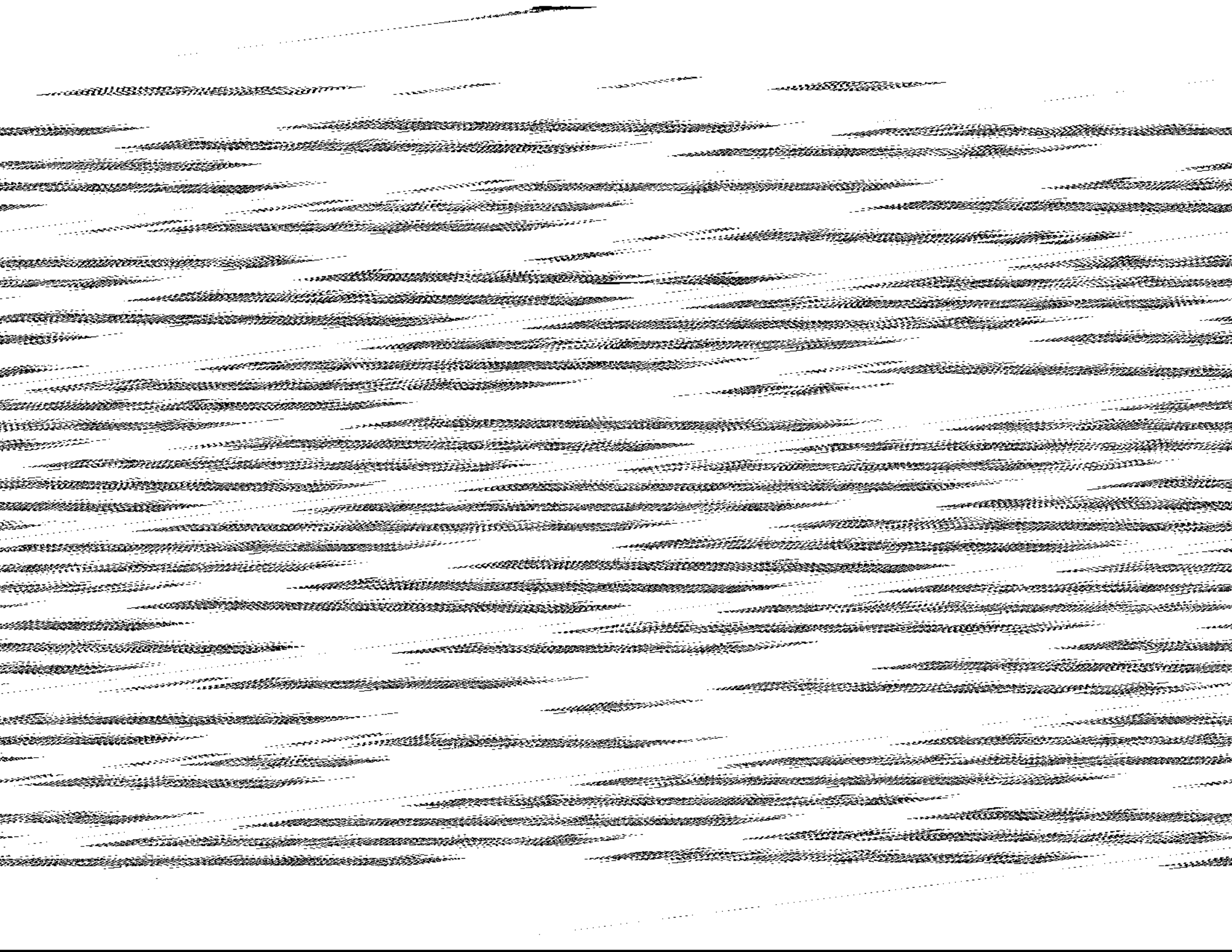
denying that I am innocent, not that I made the statement. That is, in sentences where there is an overt performative verb of saying or stating or asserting, the propositional content, which is true or false, is not given by the sentence as a whole, but rather by the object of that performative verb. 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. Since the analysis of simple statements is likely to be the most controversial, let us begin by considering some of the grammatical evidence indicating that simple statements must contain a performative verb of saying in their logical forms. Consider sentences like (1)[3].

(1) Egg creams, I like.

In (1), the object NP 'egg creams' has been moved to the front of the sentence by a rule of topicalization. Let us consider the general conditions under which this rule can apply. Consider (2) through (4).





where John bought *Das Kapital*. Exactly the same ambiguity occurs in (31).

(31) Bill asked me who knew where John bought which books.

31) allows one to see somewhat more clearly what is going on here. It appears that verbs like 'ask' and 'know', which take indirect questions, act like operators binding the items which they question.[7] The reason for the ambiguity in (31) is that three items are being questioned, while there are only two verbs doing the binding. The third item may be bound by either of the verbs. Thus in (31), 'ask' binds 'who' and 'know' binds 'where'. 'Which books' may be bound either by 'ask' or by 'know'. Hence the ambiguity.[8]

(31) shows that verbs taking indirect questions bind the items that they question. But what of direct questions? (30) exhibits the same ambiguity as (31). Under analysis (A), this is not surprising, since under analysis (A), (30) would be embedded inside the object of a performative verb of asking. The performative verb would then act as a binder, binding 'who' on one reading and on the other reading binding both 'who' and 'which books'. Without an analysis like (A), there could be no non-ad hoc uniform analysis of binding in questions. In addition, both direct and indirect questions exhibit the movement of an interrogative pronoun to the front of some clause.

(32) Who did Sam say that Bill ordered Max to hit?
(33) Max asked Sue who Sam said Bill ordered Max to hit.

In (32), the pronoun is moved to the front of the sentence as a whole. In (33), the pronoun is moved only to the front of the clause which is the direct object of the verb of asking. Without an analysis like (A), one would have to state two distinct conditions for the application of that rule. With analysis (A), we can state only one condition, namely, that the interrogative pronoun is moved to the front of the clause which is the direct object of that verb of asking which binds that interrogative pronoun. Again, analysis (A) allows one to state a generalization that would otherwise be missed.

In this section we have provided a number of arguments, on linguistic grounds, that the underlying grammatical structure of imperatives, questions, and statements must be represented as in (A). All of these

arguments involved linguistic generalizations which could be stated if (A) was accepted, but which could not be stated otherwise. Under the generative semantics hypothesis, for which we provided arguments in Sections II and III, the underlying grammatical structure of each sentence would be identical with its logical form. Therefore the logical forms of imperatives, questions, and statements would have to look like (A) if all of these grammatical arguments are accepted.

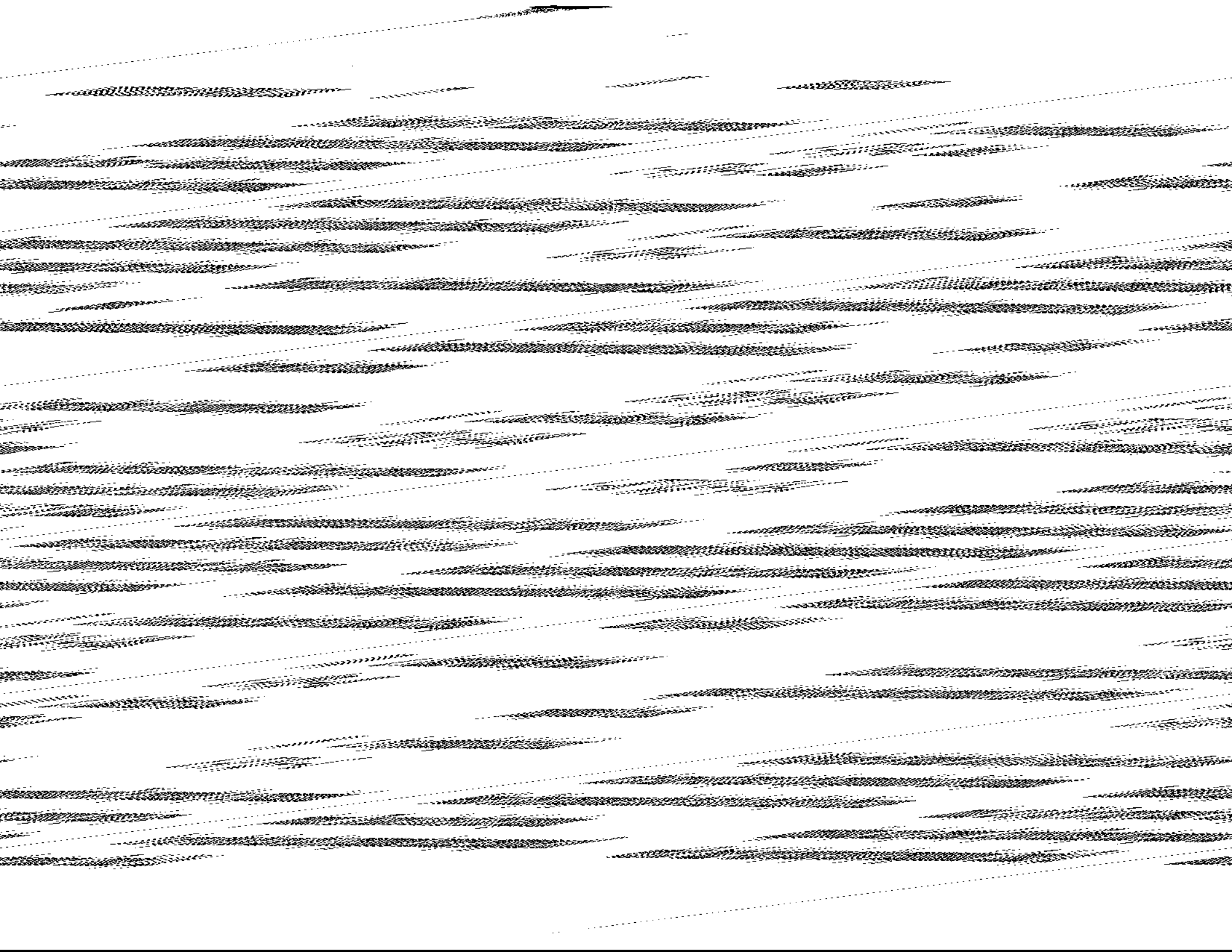
The analysis of (A) not only permits the statement of grammatical generalizations, but it also permits one to simplify formal semantics. Consider, for example, the notion of an 'index' as given by Scott (1969). Scott assumed that indices would include among their coordinates specifications of the speaker, 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_t in (A). Thus, (A) can be motivated from a logical as well as a grammatical point of view.

V. PRESUPPOSITIONS

Natural language is used for communication in a context, and every time a speaker uses a sentence of his language to perform a speech act – whether an assertion, question, promise, etc. – he is making certain assumptions about that context.[1] For example, suppose a speaker utters the sentence of (1a).

(1) a. Sam realizes that Irv is a Martian.
b. $+R^{+}(S) \rightarrow +S$.

(1a) presuppose that Irv is a Martian. In general, the verb 'realize' presupposes the truth of its object complement. We will represent this as in (1b). In (1b) we let S stand for the object complement of 'realize', namely



(12) a. Few men have stopped beating their wives.
b. Some men have stopped beating their wives.
c. Some men have beaten their wives.

(12a) presupposes (12b) and (12b), in turn, presupposes (12c). As it turns out, (12a) also presupposes (12c). Thus it would appear, at least in this case, that the presupposition relation is transitive. If S_1 presupposes S_2, and S_2 presupposes S_3, then S_1 presupposes S_3. We will refer to (12b) as a 'first order presupposition' of (12a), and to (12c) as a 'second order presupposition' of (12a). As it turns out, first order presuppositions must be distinguished from second and higher presuppositions. The evidence for this comes from a set of odd constructions in English which I will refer to as 'qualifications'. Consider (13).

(13) Few men have stopped beating their wives, if any at all have.

(13) consists of (12a), with the qualifying phrase 'if any at all have' tacked on. Though (12a) presupposes (12b), (13) does not presuppose (12b). In fact, the job of the qualifying phrase is to cancel the presupposition of (12b). Similarly, the sentence, 'Sam has stopped beating his wife' presupposes 'Sam has beaten his wife'. Yet in (14), the qualifying phrase has cancelled out this presupposition.

(14) Sam has stopped beating his wife, if he has ever beaten her at all.

What is particularly interesting about qualifying phrases is that they can cancel out only first-order presuppositions, not second-order or higher-order presuppositions. Thus, given the sentence of (12a) we cannot tack on a qualifying phrase cancelling out a second-order presupposition (12c).

(15) *?Few men have stopped beating their wives, if any have ever beaten them at all.

(15) is decidedly strange, if intelligible at all, while (13) and (14) are perfectly normal. Compare (15) to (16), where a first order presupposition is cancelled by the same qualifying phrase as in (15).

(16) Few men have beaten their wives, if any have ever beaten them at all.

Some further examples of qualifying phrases are given in (17).

(17) a. Few girls are coming, or maybe none at all are.
b. If the FBI were tapping my phone, I'd be paranoid, but then { I am anyway. / *they are anyway. }
c. If Irv weren't a Martian, I'd still be running away.
d. If Irv still were a Martian, I'd be running away.

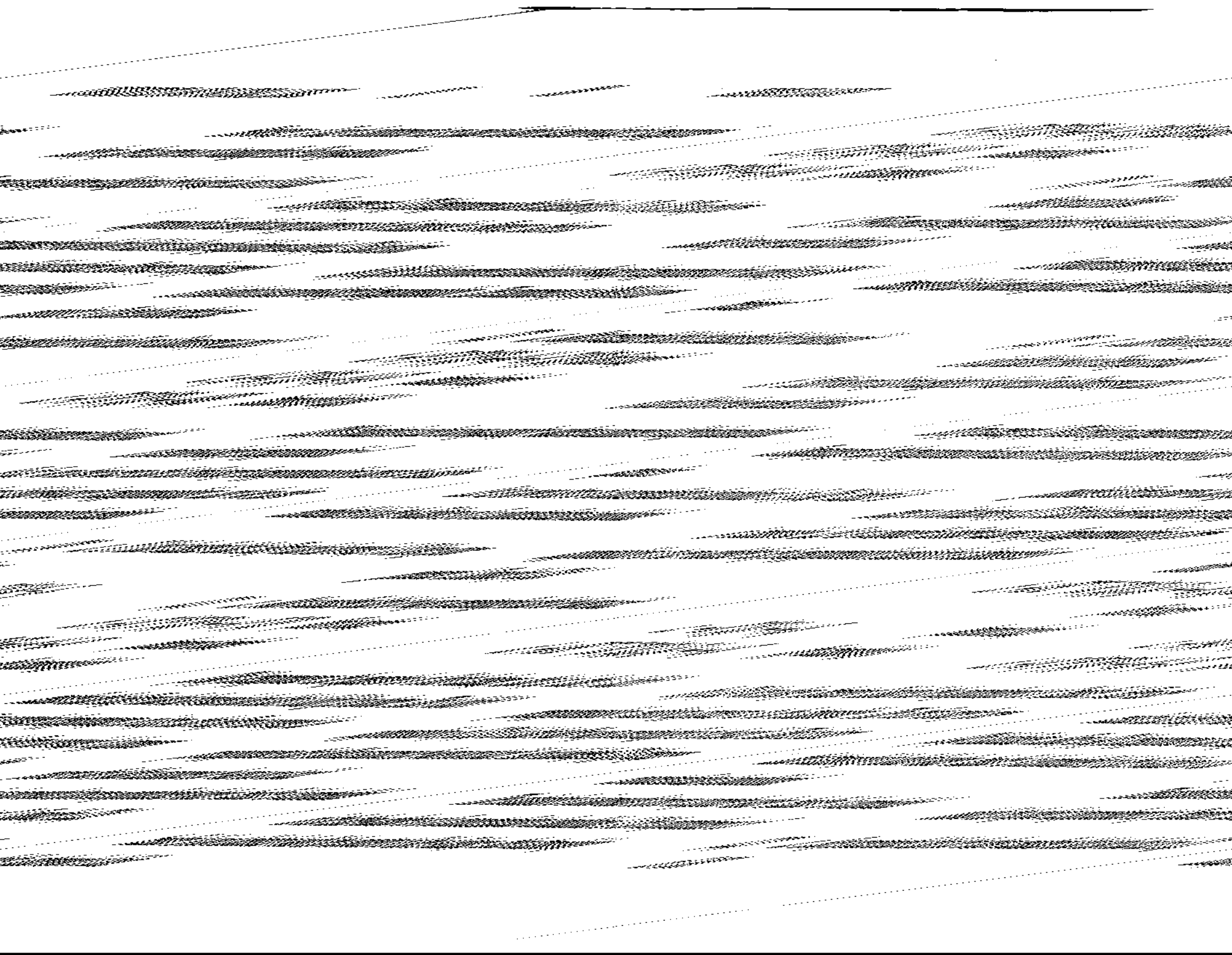
Note that in (17b) the negative presupposition associated with the second clause of a counterfactual condition can be cancelled by a qualifying phrase, but the presupposition corresponding to the first clause may not. In (17c) the word 'still' acts as a qualifying phrase for the second clause of the counterfactual conditional. Compare (17c) with (8a). In (8a), the simple counterfactual conditional, the negative of the second clause is presupposed. But in (17c) the positive of the second clause is presupposed, though the negative of the first clause is still presupposed. Note that 'still' used as a qualifying phrase cannot be inserted into the first clause of a counterfactual conditional, as (17d) shows. Though (17d) is grammatical, 'still' can be understood there only in its ordinary sense, and not as a qualifying phrase.[2a]

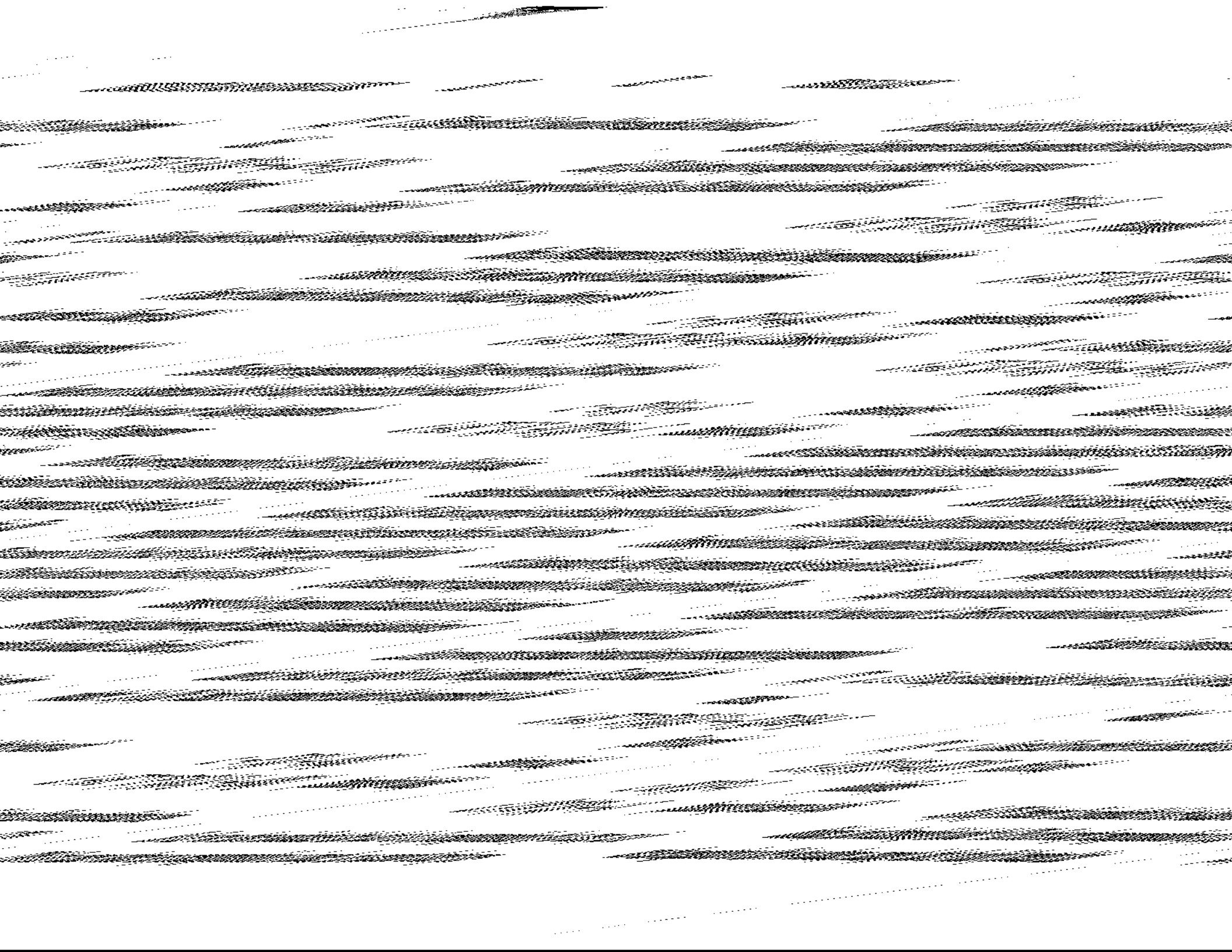
We can define first-order presuppositions in terms of the concept 'immediately presupposes'. Thus, we will say that 'S_1 immediately presupposes S_2, if and only if S_1 presupposes S_2 and there is no S_3 such that S_1 presupposes S_3 and S_3 presupposes S_2'. This of course does not solve the deeper problem of how qualifying phrases are to be represented in logical form without contradictions arising. It only provides a way of restricting what the content of a qualifying clause can be.

In addition to qualifications, there is another construction discovered by Paul Neubauer and myself which differentiates first-order from second- and higher-order presuppositions. Consider (18).

(18) a. Sam stopped beating his wife, and it is odd that he stopped beating his wife.
b. Sam stopped beating his wife, and it is odd that he ever beat her at all.

In the second clauses of (18a and b), the speaker is making a comment about the first clause. In (18a) it is a comment about the entire first clause, while in (18b) it is a comment about the presupposition of the first clause.





supposition is defined, at least as we have defined the presupposition relation. Thus (29c) is undefined. However, (29a) makes a positive presupposition, namely, that Sam was sick. Thus, given the way we have defined the lack of a presupposition, transitivity seems to fail for (29a). Suppose, however, that we redefine what is meant by the lack of a presupposition as meaning that either a positive or a negative presupposition is permitted, as in (30b).

(30) a. I asked Sam whether he realized that he was sick.
b. $A^{+V-}(R^{+}(S)) \rightarrow R^{+}(S) \vee -R^{+}(S)$ (first order)
c. $+R^{+}(S) \rightarrow +S$ (second order)
d. $-R^{+}(S) \rightarrow +S$ (second order)
e. $A^{+V-}(R^{+}(S)) \rightarrow +S \vee +S(\equiv +S)$ (by distribution and transitivity).

If, in addition, we add an axiom of distribution saying that the presupposition of a disjunction entails the disjunction of the presuppositions, then transitivity holds for (30a).

(31) Distribution
$(S_1 \rightarrow (S_2 \vee S_3)) \supset ((S_1 \rightarrow S_2) \vee (S_1 \rightarrow S_3))$.

(30a) presupposes that either Sam realized that he was sick or that he didn't realize that he was sick. But both of those sentences presuppose that Sam was sick. Therefore, by distribution and transitivity, it follows that (30a) should presuppose that Sam was sick, which it does.

Distribution and transitivity also work in the case where 'pretend' is embedded inside 'ask whether'.[6]

(32) a. I asked Sam whether he was pretending that he was sick.
b. $AW^{+V-}(P^{-}(S)) \rightarrow +P^{-}(S) \vee -P^{-}(S)$ (first order)
c. $+P^{-}(S) \rightarrow A(-S)$ (second order)
d. $-P^{-}(S) \rightarrow (A(+S) \vee A(-S))$ (second order)
e. $AW^{+V-}(P^{-}(S)) \rightarrow (A(+S) \vee A(-S))$ (by distribution and transitivity).

(32a) presupposes that either Sam pretended that he was sick or Sam didn't pretend that he was sick, as shown in (32b). 'Sam pretended that he was sick' presupposes that Sam assumed he was not sick, as given in (32c), but 'Sam didn't pretend that he was sick' presupposes that he either assumed he was sick or assumed he wasn't sick, as shown in (32d). Therefore by distribution and transitivity, no particular presupposition is made.

Just as we saw above that there are cases where transitivity fails, so there are cases involving distribution where transitivity fails. Consider (33a), in Dialect A, which is the interesting dialect.

(33) I asked Sam to pretend that he was sick.
b. $AT^{+V-}(P^{-}(S)) \rightarrow (+P^{-}(S) \vee -P^{-}(S))$ (first order)
c. $+P^{-}(S) \rightarrow A(-S)$ (second order)
d. $-P^{-}(S) \rightarrow (A(+S) \vee A(-S))$ (second order)
e. $AT^{+V-}(P^{-}(S)) \rightarrow A(-S)$ (transitivity fails).

In (33a) we have 'pretend' embedded inside 'ask to'. In Dialect A, 'ask to' works rather differently with respect to this phenomenon than 'ask whether'. 'Ask to' has the same first order presupposition as 'ask whether', namely that either Sam will pretend that he is sick or that Sam will not pretend that he is sick. This is shown in (33b). Given the principles of distribution and transitivity, one would expect that (33a) would have the same second-order presuppositions as (32a). These are indicated in (33c and d). Thus we would expect that (33a) would make no presupposition as to whether Sam assumed he was or was not sick. However (33a) presupposes that Sam assumed he was not sick, at least in Dialect A. Thus the principles of distribution and transitivity would appear not to fit in this case. Again, the principle at work here is mysterious.

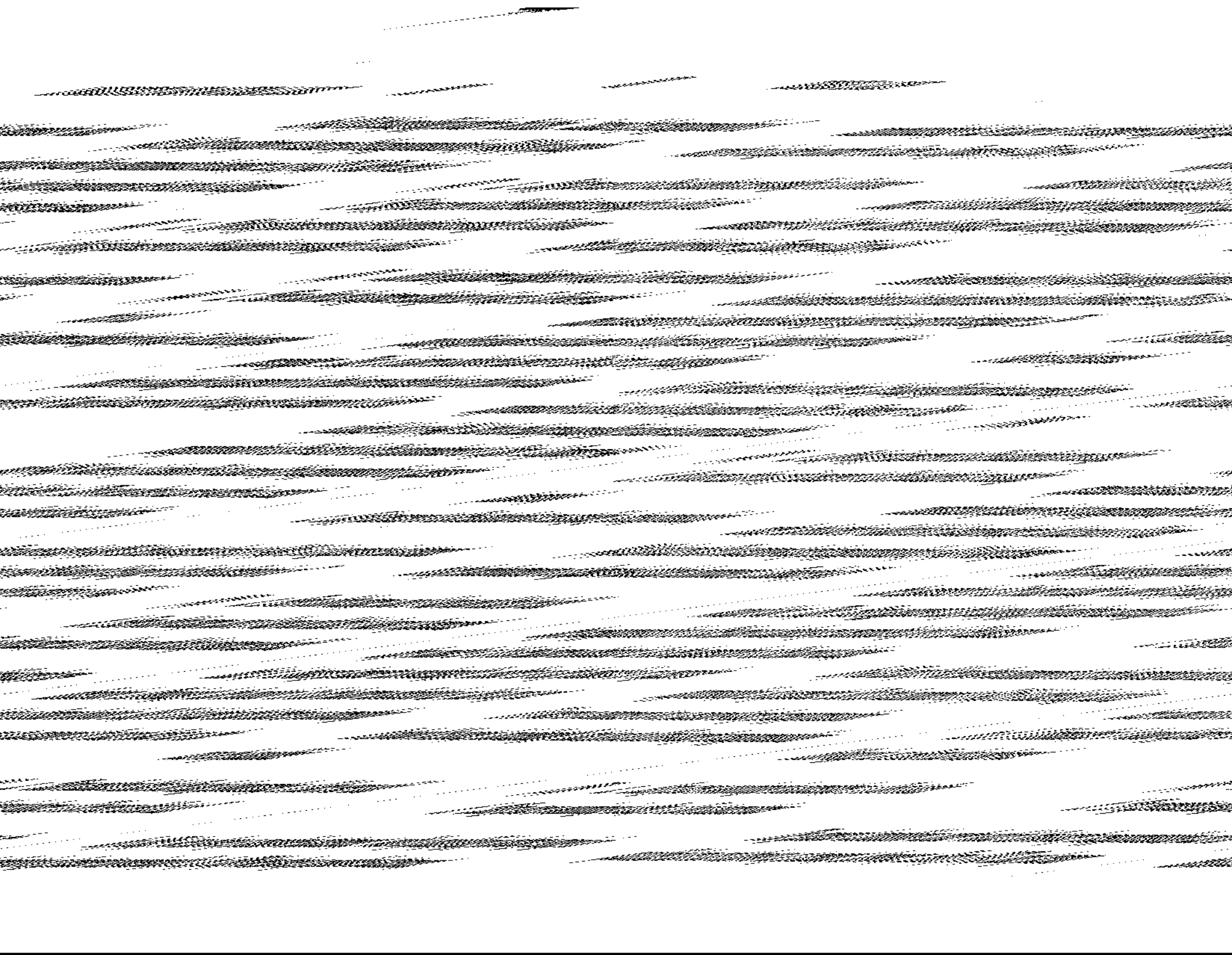
Although we do not know how (33a) works, we can use the fact that it does work as indicated to account for an otherwise mysterious fact in Dialect A. Consider (34a).

(34) a. Nixon refused to try to shut Agnew up.
b. REFUSE (S).

(34a) entails (though does not presuppose) (35a).

(35) a. Nixon didn't try to shut Agnew up.
b. $-S$.

Thus, if someone refuses to do something which involves an act of the will and which he has control over, then it is entailed that he didn't do it.



with a qualifying phrase going in the direction of less universality, and so the sentence is impermissible.

(51) a. Sam seldom goes swimming, if he ever does.
u. *Sam never goes swimming, if he seldom does.

In (51a) we have a negative statement in the main clause and a qualifying phrase in the direction of greater negative universality, namely, 'John seldom swims' versus 'John never swims'. In (51b), this is not the case, and the qualifying phrase is disallowed.

Horn's account of this phenomenon also provides an explanation for the difference between (52a) and (52b).

(52) a. John doesn't beat his wife anymore, if he ever did.
b. *John still beats his wife, if he ever did.

Both 'John doesn't beat his wife anymore' and 'John still beats his wife' have the first-order presupposition that John beat his wife at some point in the past. Thus, without Horn's hypothesis, one would guess that the same qualifying phrase could be used to cancel out both. But this fails in (52b). Horn's hypothesis, however, accounts for this. In (52a), the main clause is making a negative statement, namely, that at present John doesn't beat his wife. The qualifying phrase suggests that 'John doesn't beat his wife' may not only be true at present, but may have been true at all times in the past. Thus it is in the direction of greater (negative) universality. In (52b), however, the assertion is made that at present John does beat his wife, and thus the qualifying phrase does not constitute an extension of that assertion into the past, but rather suggests the contrary. Incidentally, Horn's hypothesis also appears to account for the sentences of (46), since the qualifying phrases there also seem not to go 'in the same direction as' the assertion.

It should be noted in addition that negative-attitude comments work differently than qualifications in cases like (46).

(53) a. Sam realized that Sue had gonorrhea, and it is surprising that she did.
b. Irv regretting leaving home, and it is strange that he ever left.

Thus, it would appear that negative-attitude comments allow all first-order presuppositions, while qualifications are limited by Horn's hypothesis.

A particularly interesting phenomenon, observed by Morgan (1969), is that of embedded presuppositions. We can approach the problem by considering (54) and (55).

(54) a. Nixon is pretending that everyone realizes that he is a homosexual.
b. $P^-(R^+(S)) \rightarrow A(+S)$.

(55) a. Nixon is pretending that he is a homosexual.
b. $P^-(S) \rightarrow A(-S)$.

In (54a) it is presupposed that Nixon is a homosexual, as indicated in (54b). This should be clear from the discussion above. In (55a) it is presupposed that Nixon is not a homosexual, as is indicated in (55b). Now consider (56a).

(56) a. Nixon is pretending that he is a homosexual and that everyone realizes it.
b. $P^-(S \,\&\, R^+(S))$ (first order)
c. $P^-(S) \,\&\, P^-(R^+(S))$ (by distribution over conjunction)
d. $A(-S) \,\&\, A(+S)$ (conjunction of the presuppositions of c).

(56a) contains a conjunction inside the complement of 'pretend'. The conjunction is 'Nixon is a homosexual and everyone realizes that Nixon is a homosexual'. Since the presupposition of 'Nixon is pretending that he is a homosexual' is that he is not a homosexual, and since the presupposition of 'Nixon is pretending that everyone realizes that he is a homosexual' is that he is a homosexual, one would expect that (56) would have contradictory assumptions, as indicated in (56d). However, (56a) is not contradictory at all. What went wrong? Lest anyone think that the step from (56b) to (56c) was unjustified, note that (56a) has the same meaning as (57), which has the overt structure of (56c).

(57) Nixon is pretending that he is a homosexual and he is pretending that everyone realizes it.

Morgan has suggested that the difficulty with (56a) lies in our assumptions that only sentences as a whole may presuppose other sentences.

Morgan suggests that embedded sentences may have presuppositions that entire sentences may not have. He notes that a verb like 'pretend' in essence defines a possible world (actually a class of worlds) such that the sentential complement of 'pretend' is true in that world. Morgan claims, correctly I think, that the way we understand (56a) is that 'Nixon is a homosexual' is true in the world of Nixon's pretense, but is presupposed to be false with respect to the world of the speaker. If Morgan is right, then we must distinguish between presuppositions of the entire sentence and presuppositions of embedded sentences. Unfortunately, we have no idea of how to represent embedded presuppositions at present in such a way that the relationship between presuppositions of embedded sentences and presuppositions of entire sentences can be stated naturally.[7a]

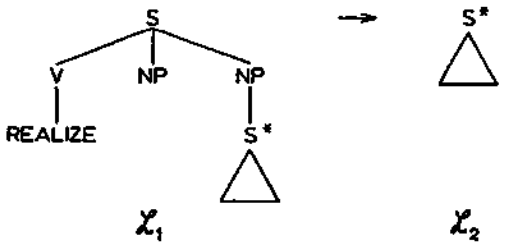
The question now arises as to how presuppositions are to be represented in terms of logical form. There is a precedent for incorporating presuppositions into the logical form of the sentences that presuppose them. For example, Von Wright and others have employed what is called a 'dyadic modal logic', using formulas such as those in (58).

(58) a. $L(p/q)$
b. $O(p/q)$.

(58a) is to be read 'p is necessary, given that q', and (58b) is to be read 'p is obligatory, given that q'. So far as I can tell, the reading 'given that q' is equivalent to 'presupposing q'. The notation in (58) is equivalent to representing the propositional and presuppositional content of a sentence by an ordered pair. This happens to be the approach I took in (G. Lakoff, in press). However, having an ordered pair of sentences is equivalent to having a relation between two sentences.[8] In the above discussion, we have represented such relation by '→'. Let us consider how we can make sense of this in terms of a relationship between the surface form of a sentence and its logical form, assuming that that relationship is to be given by rules of grammar. Let S_1 and S_2 stand for the surface forms of two sentences, and let $\mathscr{L}_1$ and $\mathscr{L}_2$ stand for the underlying forms of the corresponding sentences. Suppose now that S_1 is a sentence whose main verb is 'realize'. For instance, suppose S_1 is 'Sam realizes that Harry is a fink' and S_2 is 'Harry is a fink'. Then we will say that the surface form S_1 can be related to the logical form $\mathscr{L}_1$ only if the relation '→' holds between $\mathscr{L}_1$ and $\mathscr{L}_2$, as indicated in (59) and (60).

(59)
$$\begin{array}{ccc} \mathscr{L}_1 & \rightarrow & \mathscr{L}_2 \\ \vdots & & \vdots \\ S_1 & & S_2 \end{array}$$

(60)



Thus the presupposition relation, as strictly defined, will hold only between logical forms of sentences and not between surface forms. We will, however, speak of the presupposition relation holding between two sentences, S_1 and S_2, if the relation '→' holds between their corresponding logical forms. In this formulation presuppositions need not be considered part of the logical forms of sentences. In the cases where rules of grammar interact with presuppositions, such rules will be stated as transderivational constraints.[9]

On the basis of the above discussion, we can draw the following conclusions.

CONCLUSION 1: An account of the logical form of a sentence must include an account of the presuppositions of that sentence. The question is left open as to whether presuppositions should best be represented as separate logical forms, related to the main assertion by '→' or whether they should be incorporated into logical forms, as I believe they are in dyadic modal logic.

CONCLUSION 2: The presupposition relation is usually transitive, though transitivity fails in a number of cases. Thus, one cannot assume that there will be a simple, unrestricted axiom of transitivity for the relation '→'. Moreover, the restrictions on transitivity will differ from dialect to dialect, just as rules of grammar do.[10]

CONCLUSION 3: First-order presuppositions will have to be distinguished from higher-order presuppositions.

CONCLUSION 4: If Horn's hypothesis is correct, logical forms must be given in such a way that the notion 'in the same direction as' or 'in the

direction of greater (positive or negative) universality' can be stated formally for *all* relevant cases in natural language.

CONCLUSION 5: If Morgan's proposal is correct, logical forms must include some method of representing embedded presuppositions.

CONCLUSION 6: A method must be found for representing qualifications of first-order presuppositions without contradicting those presuppositions.[11]

VI. BAKER'S CONJECTURE AND NATURAL LOGIC

So far we have been speaking about 'logical forms' of English sentences as though the term meant something. However, it makes sense to speak of the logical forms of sentences only with respect to some system of logic. And systems of logic are constructed with specific aims in mind – there are certain concepts one wants to be able to express, inferences one wants to be able to account for, mysteries one wants to explain or explain away, fallacies one wants to avoid, philosophical problems one wants to elucidate. Most of the attempts made in recent years to provide logics for given fragments of English have been motivated by a desire to shed light on philosophical problems that require that certain concepts (e.g., logical necessity, change in time, obligation, etc.) be expressed and inferences (e.g., what is logically necessary is true) be accounted for.[1]

In this study we have set an additional goal. In Section I, we saw that there was some connection between grammar and reasoning, and we inquired as to whether it was accidental, and if not, just what the connection was. In Sections II and III, we saw that the connection was not accidental and we got an inkling as to what it was. We saw that the rules relating logical forms to the corresponding surface forms of English sentences must be identical to certain rules of English grammar, at least in the case of quantifiers and conditionals. These results were relative to another goal: that significant generalizations (especially linguistic ones) be expressed, that the same rule not be stated twice. From these results, and from a large number of other results not considered here,[2] we adopted the hypothesis known as 'generative semantics', which states that the rules of grammar are just the rules relating logical forms to surface forms of sentences. In Sections IV and V, we saw that such assumptions led to some rather interesting conclusions about logical form.

To recapitulate, we have made the following assumptions:

(i) We want to understand the relationship between grammar and reasoning.

(ii) We require that significant generalizations, especially linguistic ones, be stated.

(iii) On the basis of (i) and (ii), we have been led tentatively to the generative semantics hypothesis. We assume that hypothesis to see where it leads.

Given these aims, empirical linguistic considerations play a role in determining what the logical forms of sentences can be. Let us now consider certain other aims.

(iv) We want a logic in which all the concepts expressible in natural language can be expressed unambiguously, that is, in which all non-synonymous sentences (at least, all sentences with different truth conditions) have different logical forms.[3]

(v) We want a logic which is capable of accounting for all correct inferences made in natural language and which rules out incorrect ones. We will call any logic meeting the goals of (i)–(v) a 'natural logic'. As should be obvious, the construction of a full, nonfragmental natural logic is not an immediate practical goal. In fact, it may not even be a possible goal. Linguistic considerations alone, not to mention logical considerations, rule this out. For example, assumptions (ii) and (iii) require that a full, descriptively adequate grammar of English is required for there to be a natural logic. That is, all the relevant generalizations concerning the relation between logical forms and surface forms must be known. It would be ludicrous to think of this as a practical goal to be accomplished within the next several centuries, if it is possible at all. Serious grammatical studies are in their infancy. Moreover, the study of intensional logics has just gotten off the ground. So it should be clear that no one is about to successfully construct a full natural logic. The goals of (i)–(v) define a subject matter, and its viability depends not upon being able to construct full logics, but upon whether it leads to interesting results. The study of natural logic constitutes a program without an end in sight (like most programs) and the question to be asked is whether it is an interesting program.

If it makes sense to study a subject matter based on the assumptions of (i)-(v), one might expect that these assumptions might interact in some

empirically observable way. For example, if the rules of grammar are just those rules that relate logical forms and surface forms, and if it makes sense to speak of logical forms of sentences only in terms of some system of logic – with axioms, rules of inference, etc. – then it might be the case there might be an interaction between grammatical phenomena and logical phenomena. Perhaps there are grammatical constraints that are, for example, dependent upon one's choice of axioms. In fact, an example of such a phenomenon has been proposed by Baker (1969).

Baker considered cases like:

(1) I would rather go.

(2) *I would*n't* rather go.

(3) I did*n't* meet anyone who would*n't* rather go.

He noted that 'affirmative polarity' items like *would rather*, which cannot occur when one negative is present, can occur in some cases when two negatives are present.[3a] He first attempted to describe this phenomenon by saying that the item in question must be commanded by an even number of negatives. Faced with a number of counterexamples to this proposal, he observed that many of the double negation cases he had considered were logically equivalent to positive sentences, while none of the counterexamples were. He then conjectured that perhaps the distribution of affirmative polarity items like 'would rather' was determined by a principle involving logical equivalences. This conjecture, if true, would be a case of the above sort.

Let us begin by considering some apparent confirming instances of Baker's conjecture.

(4) *I did*n't* meet the man who would*n't* rather go.

(5) *I did*n't* meet anyone who claimed that he would*n't* rather go.

(6) *I did*n't* claim that I met anyone who would*n't* rather go.

(7) *I did*n't* claim that I would*n't* rather go.

Although (3) seems intuitively to be logically equivalent to a positive sentence, (4)–(7) seem not to be. Despite the occurrence of double negatives, *would rather* cannot occur in such cases. For example, in (6) the intervening complement construction with *claim* between the two negatives keeps the sentence from being logically equivalent to a positive sentence. Now compare (8a and b).

(8) a. *I do*n't* claim that I met anyone who would*n't* rather go.
b. I do*n't* think that I met anyone who would*n't* rather go.

The difference between (8a) and (8b) can be explained by the fact that *think* and not claim undergoes the rule of *not*-transportation, which moves a *not* from within the complement of *think* to the next highest clause. The existence of such a rule has been demonstrated beyond a reasonable doubt by R. Lakoff (1969).[4] Thus, the occurrence of (8b) follows from the occurrence of (9).

(9) I thought that I had*n't* met anyone who would*n't* rather go.

If Baker's conjecture is correct, it provides still more confirming evidence for *not*-transportation. Note that it is exactly those verbs that take *not*-transportation that can occur in the position of *think* in (8b).

An especially interesting class of confirming instances arises in the case of modal equivalences. For example,

(10) $\sim$ NECESSARY (S) $\equiv$ POSSIBLE $\sim$ (S).

Baker's conjecture would predict that, just as one can get (11),

(11) It is possible that I would rather go.

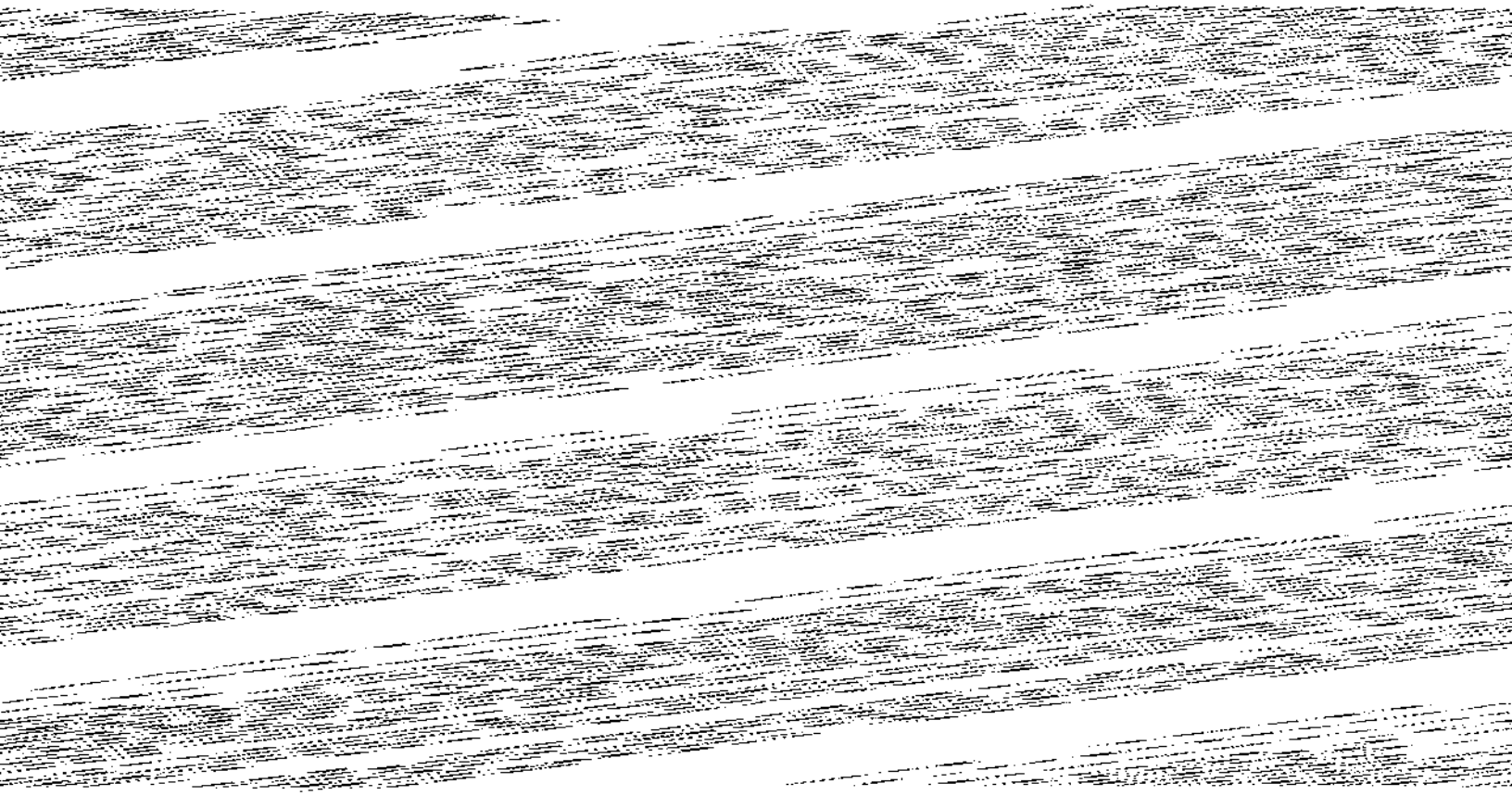
one should be able to get (12):

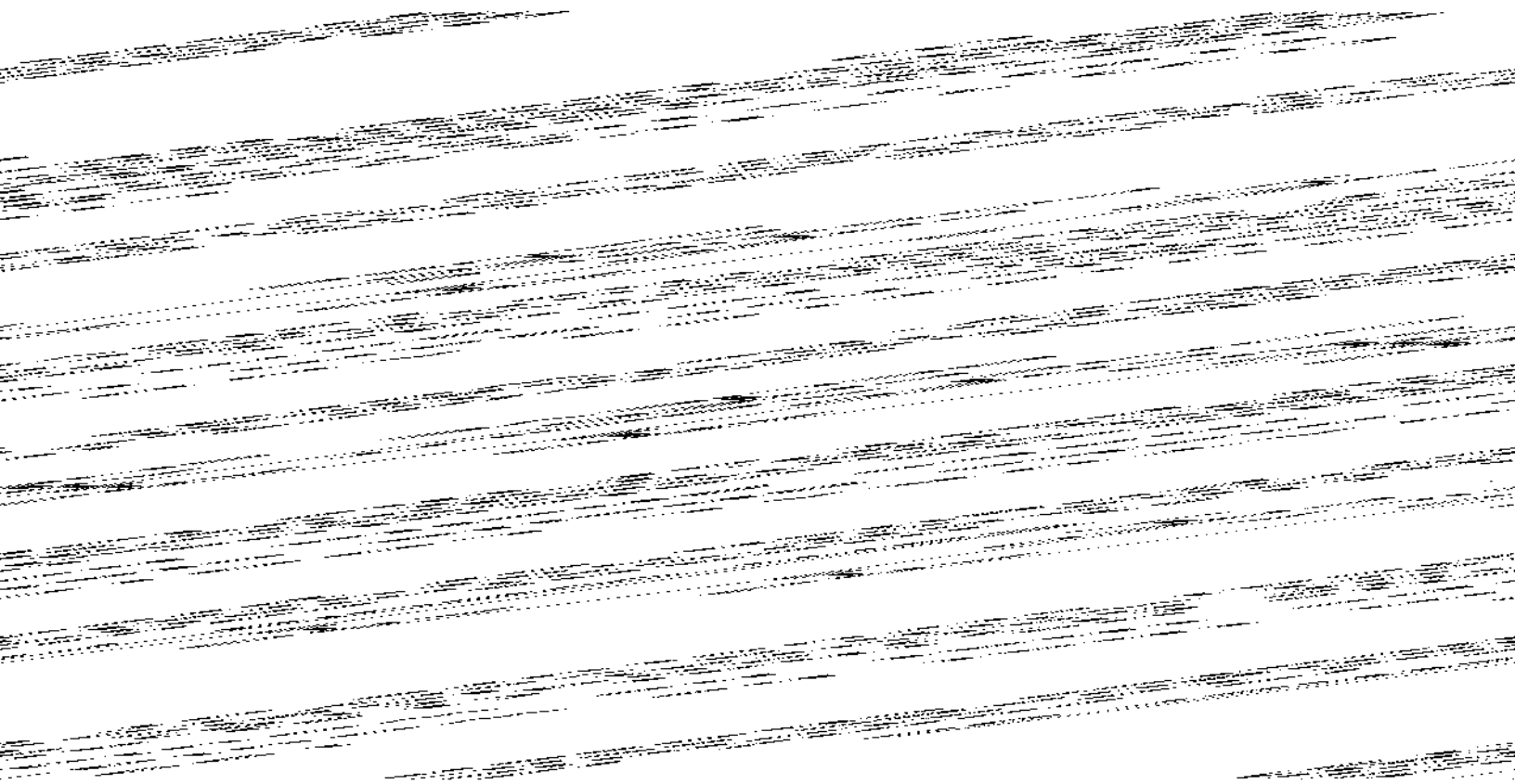
(12) It is *not* necessarily true that I would*n't* rather go.

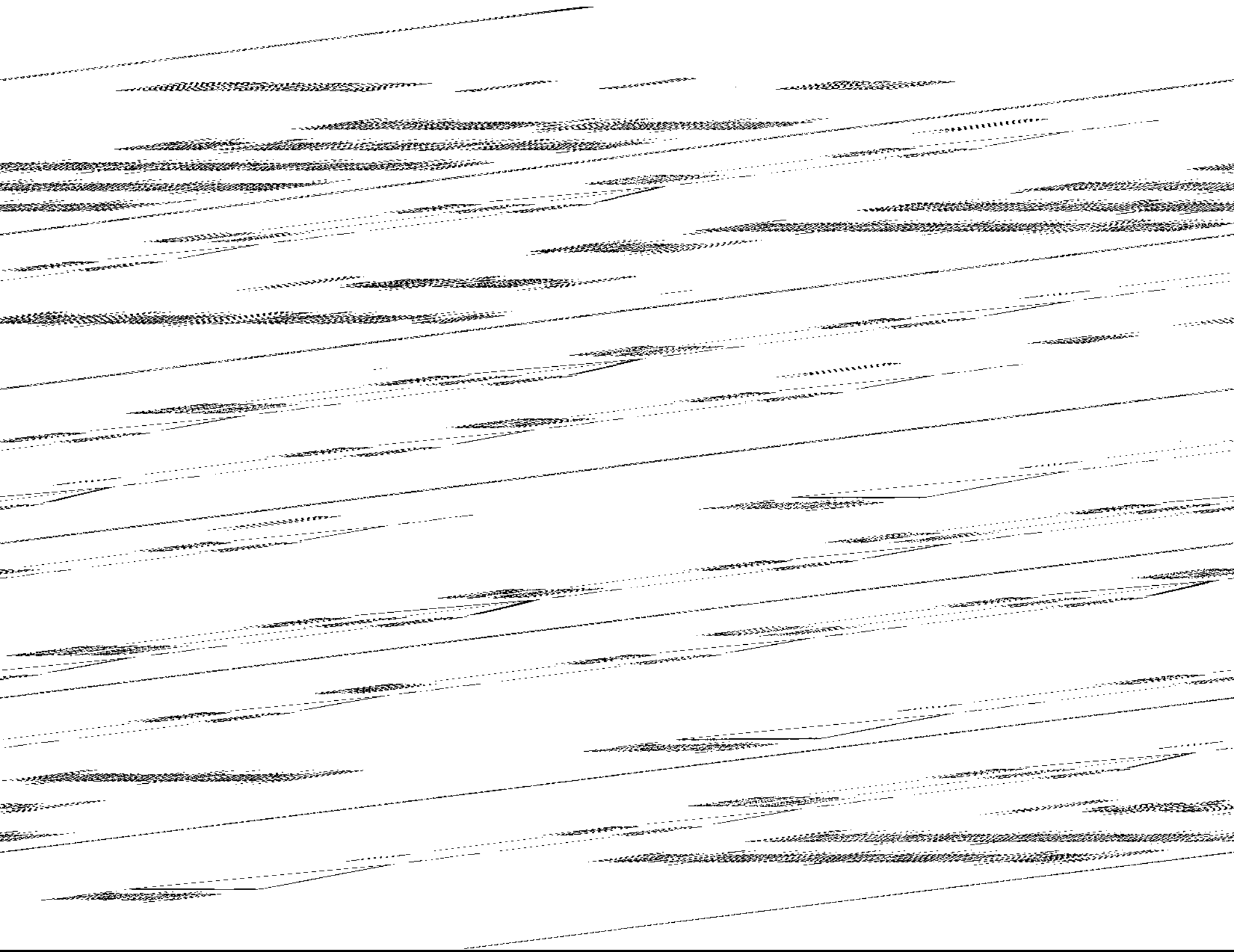
It is rather remarkable that this prediction is borne out. Compare (12) with (13), which is not logically equivalent to a positive sentence.[5]

(13) *It is *not* probable that I wouldn't *rather* go.

This 'confirmation' of Baker's conjecture raises some questions in itself. If 'logical equivalences' are involved here, just what sort of logic are they associated with? Baker speaks only of the predicate calculus. The above examples seem to indicate that his conjecture would have to be extended to some system of modal logic, presumably quantified modal logic. Let us consider for a moment what this means. Suppose, like formalist logicians, we were to think of a logic as simply an arbitrary formal system, with operators chosen from an arbitrary vocabulary and logical equivalences defined in some arbitrary way. From this point of view, first-order







lences like (24) and (25). The absence of such equivalences would keep the '~' from moving down into the clause below *claim* or *hope*, thus making it impossible for the two negatives to come to be in adjacent clauses and thereby ruling out the possibility that they could cancel out by the Law of Double Negation.[6a]

Whether Baker's conjecture is right or wrong remains to be seen. But I think that this discussion has at least shown that it makes sense, even for very complicated cases like (15)–(18). I'm not sure how seriously one should take the supposed equivalences of (19)–(22). If considered in detail, they would undoubtedly prove inadequate. Perhaps they could be fixed up, or perhaps an entirely different set of equivalences would do the job. However, (19)–(22) are at least plausible; they are not wild or far-fetched. Nor is it far-fetched to think that there are no natural logic equivalences like (24) and (25).

Baker's conjecture, given that it makes sense, raises questions of the utmost importance both for linguists and for logicians interested in human reasoning. For linguistics, its consequences are remarkable, since it claims that the *distribution of morphemes* (e.g., would rather) is determined not simply by which other elements and structures are present in the same sentence, or even in a transformational derivation of that sentence, but in addition by logical equivalences. As far as logic is concerned, Baker's conjecture would, if correct, show that natural logic is a field with real subject matter. At any rate, it would show that there was a relation between grammaticality and logical equivalence. Proposed equivalences for natural logic might be tested by constructing the appropriate sentences and seeing whether they were grammatical or not.

One apparent difficulty with the conjecture is that there are some cases where affirmative-polarity items are acceptable, but where there are no fairly obvious and reasonably plausible logical equivalences that can be invoked to yield a positive sentence. For example,

(26) I wonder if there is anyone who would*n't* rather go home.
(27) Is there anyone who would*n't* rather go home?
(28) Anyone who would*n't* rather go home now is crazy.

(26) and (27) seem to be rhetorical questions and to presuppose a negative answer, which would contain two negatives of the appropriate sort. (28) seems to involve some sort of negative judgment, which again would

contain two negatives. Perhaps there is a constraint to the effect that the negative presupposition or judgment of such sentences must be logically equivalent to a positive. It is clear that the conjecture alone is insufficient and that there are other conditions involved.[7] This does not invalidate the conjecture; it merely limits its scope of applicability. But even in such a limited form, the conjecture would lose none of its theoretical significance. If the distribution of morphemes is determined *even in part* by logical equivalences, then all of the consequences stated above still follow. There would have to be a natural logic, including some equivalences and excluding others.

VII. LEXICAL DECOMPOSITION VERSUS MEANING-POSTULATES

Lexical items are not undecomposable wholes with respect to the logical forms of the sentences that they appear in. We can see this clearly in a sentence like (1).

(1) Sam has always loved his wife.

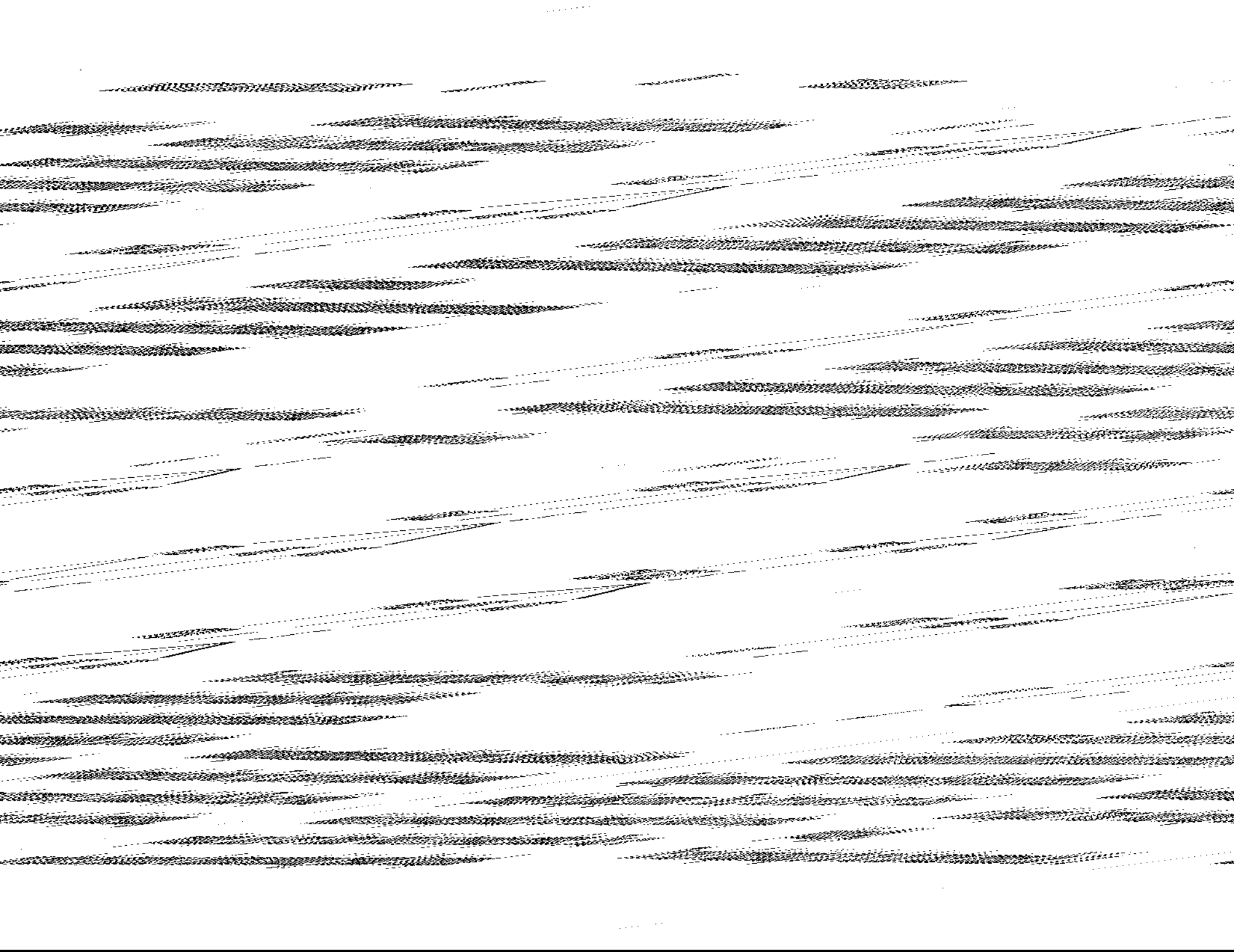
(1) is ambiguous. It can have the meaning of either (2a) or (2b).

(2) a. Sam has always loved the person he is now married to.
b. Sam has always loved whoever he was married to at that time.

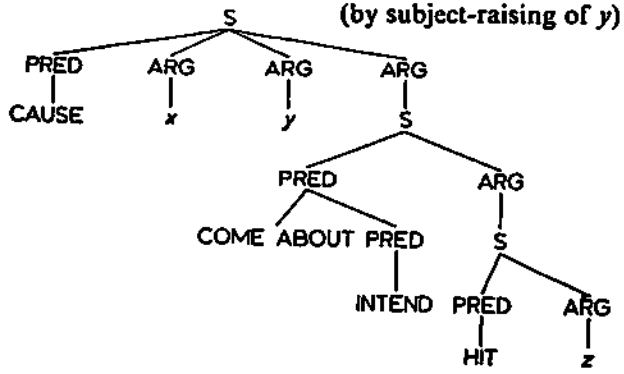
Suppose that Sam has had several wives, and that he may or may not have loved his previous wives, though he has always loved the woman he is presently married to. (1) has the reading of (2a). On the other hand, suppose that Sam did not love his present wife before he married her, but that whenever he was married to a woman, he loved her at that time. Then (1) has the reading of (2b). (2a) and (2b) can be represented as (3a) and (3b), respectively, where t_0 is the time of the utterance and 'LOVE' is assumed (for the sake of discussion) to be a 3-place predicate where 'x loves y at time t'.

(3) a. SAY (I, you, t_0, ($\forall t$ (LOVE (Sam, Ix (WIFE (x, Sam, t_0)), t))) $t < t_0$
b. SAY (I, you, t_0, ($\forall t$ (LOVE (Sam, Ix (WIFE (x, Sam, t), t))). $t < t_0$

Note that 'wife' must also be a 3-place predicate including a time-index.

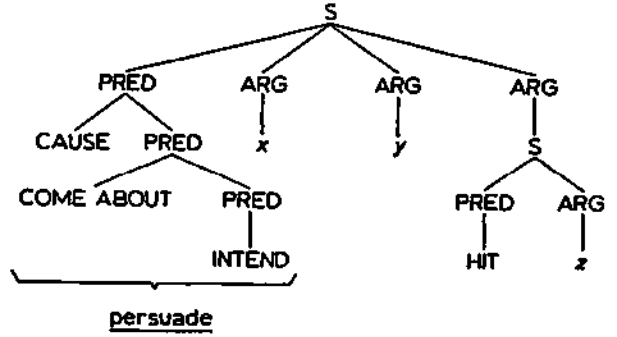


(4) e. (by subject-raising of *y*)



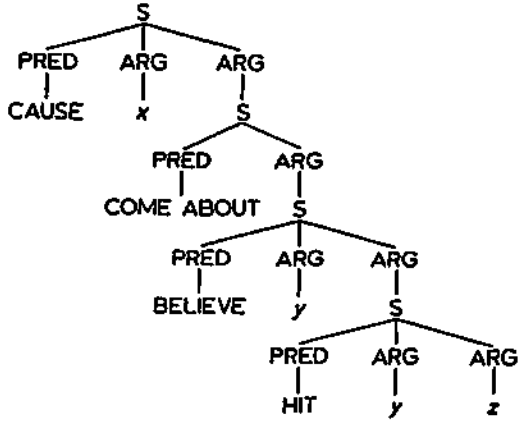
(by predicate-lifting of COME ABOUT-INTEND)

(4) f.



(5) a. *x* persuaded *y* that *y* hit *z*.

b.



ently needed structures by, for the most part, independently needed rules.

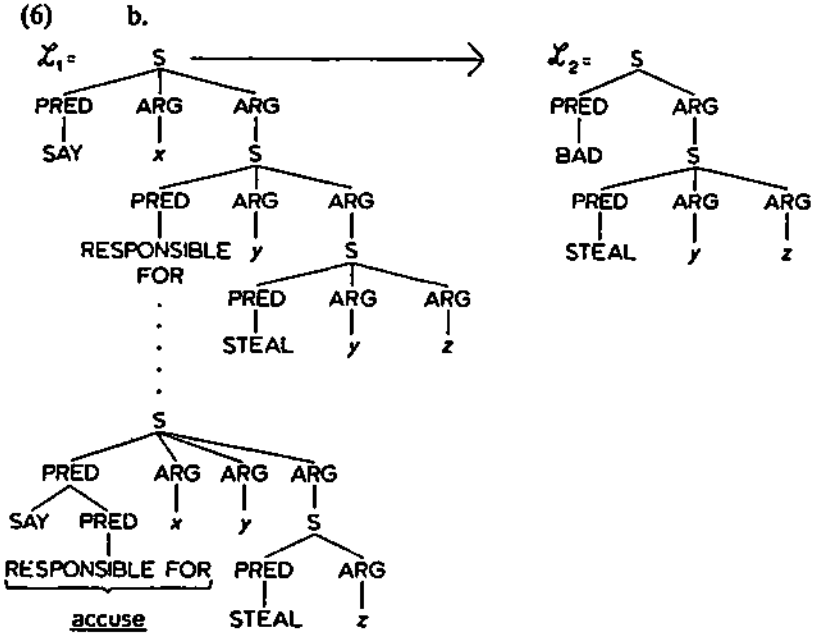
So far, we have only considered 'persuade to', and not 'persuade that'. The former means 'cause to come to intend', while the latter means 'cause to come to believe'. Consequently, it was proposed that sentences like (5a) be derived by similar means from structures like (5b), where 'BELIEVE' appears instead of 'INTEND'.

Fillmore has added to analyses such as these considerations of presuppositions. For example, Fillmore observed that (6a),

(6) a. *x* accused *y* of stealing *z*.

asserts that *x* said that *y* was responsible for stealing *z* and presupposes that it was bad for *y* to steal *z*. We might represent such an analysis as in (6b).

(6) b.



In (6b) the logical form $\mathscr{L}_1$ is related by the presupposition relation '→' to $\mathscr{L}_2$, and $\mathscr{L}_1$ is related by transformational rules of English grammar to the surface form of (6a). The lexical item 'accuse' is substituted in for the derived predicate 'SAY-RESPONSIBLE FOR' under the condition that the

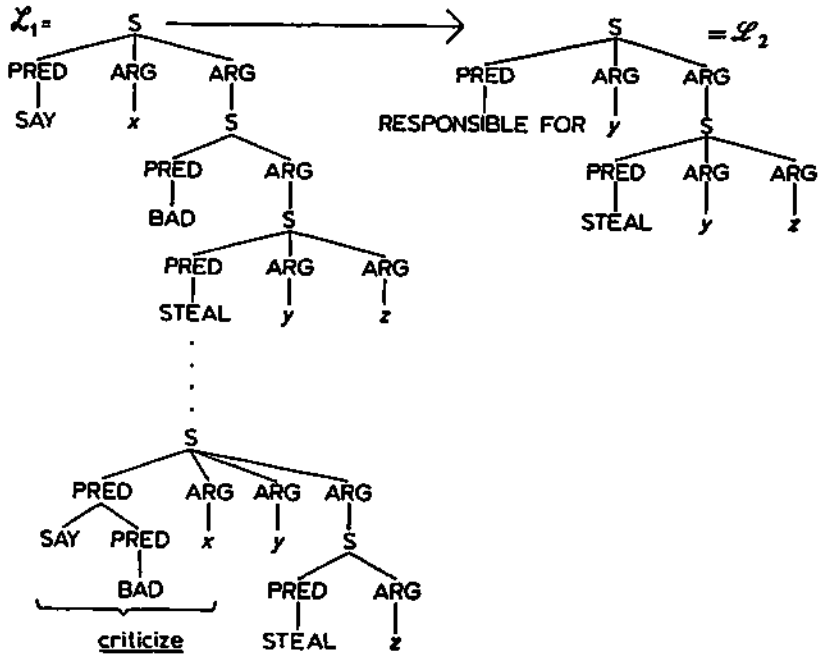
corresponding logical form $\mathscr{L}_1$ presupposes $\mathscr{L}_2$, where the encircled S's in $\mathscr{L}_2$ and $\mathscr{L}_1$ are identical.

Fillmore observed that the verbs 'accuse' and 'criticize' differ minimally in that what is part of the assertion of 'accuse' is the presupposition of 'criticize' and vice versa.

(7) a. *x* criticized *y* for stealing *z*.

That is, (7a) asserts that *x* said that it was bad for *y* to steal *z* and presupposes that *y* was responsible for stealing *z*. (7a) might be given the corresponding analysis of (7b).

(7) b.

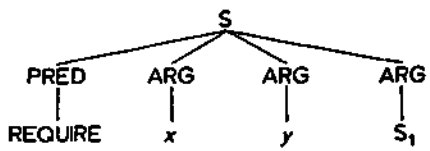


Similar analyses have been proposed by many others, including especially Binnick, Gruber, McCawley, and Postal.

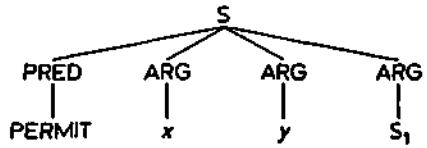
Such proposals as the above make empirical claims as to the relationship between logical form and grammatical structure. These proposals seem especially appealing from the logical point of view, since they

obviate the necessity for stating certain axioms (and/or rules of inference) in natural logic to account for certain inferences. For example, from (5a), '*x* persuaded *y* that *y* hit *z*', it follows that *y* came to believe that he hit *z*. Under an analysis such as (5b), no special axiom for 'persuade' is necessary. The independently needed axioms for 'CAUSE' will do the job. However, there is at least one other proposal under which this will also be true, which does not involve grammatical analyses like those given above. Before we consider this proposal, let us take up some preliminary considerations. Consider the question of whether the logical form of a sentence, as we have been considering that term, is a representation of the meaning of that sentence. Consider, for example, sentences of the form '*x* requires *y* to do S_1' and '*x* permits *y* to do S_1'. Let us, for the sake of argument, consider these sentences as having the logical forms (8a) and (8b), respectively.

(8) a.

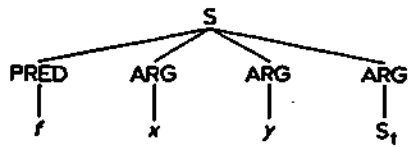


b.



These logical forms differ only in the specification of the predicate. 'REQUIRE' and 'PERMIT' are to be understood not as words of English, but as symbols for certain atomic predicates. The symbols we have chosen happen to be English words in capital letters, but they could just as well have been a box and a diamond, or any other arbitrary symbols. Thus, in effect, both (8a) and (8b) have the same form, namely that of (8c),

(8) c.

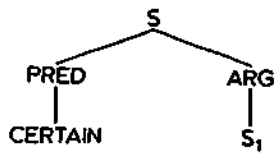


except that they contain different arbitrary symbols indicating atomic predicates.

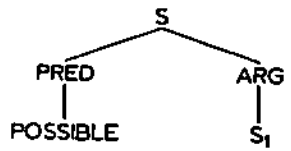
Considering this, in what sense can we say that (8a) and (8b) reflect the different meanings of the sentences given above?

Note that (8a) and (8b) are not isolated cases. Any two sentences whose logical forms have the same geometry will raise the same questions. For example, consider sentences of the form 'It is certain that S_1' and 'It is possible that S_1'. Let us assume that these sentences have logical forms like those of (9a) and (9b) respectively.

(9) a.

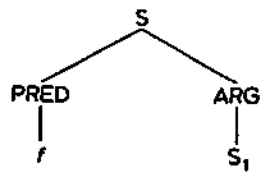


b.



Both of these have basically the same form, namely that of (9c), except that they contain different arbitrary symbols indicating the atomic predicate of the sentence.

(9) c.



Again, how can we say that (9a) and (9b) represent different logical forms corresponding to different meanings?

It is clear that there is more to representing meanings than simply providing logical forms of sentences. In addition, we must provide certain axioms, or 'meaning-postulates', which indicate how certain atomic predicates are related to other atomic predicates. For example, we would want to include meaning-postulates like those in (10), but not like those in (11).

(10) a. $\text{REQUIRE}(x, y, S_1) \supset \text{PERMIT}(x, y, S_1)$

b. $\text{CERTAIN}(S_1) \supset \text{POSSIBLE}(S_1)$.

(11) a. $^*\text{PERMIT}(x, y, S_1) \supset \text{REQUIRE}(x, y, S_1)$

b. $^*\text{POSSIBLE}(S_1) \supset \text{CERTAIN}(S_1)$.

If something is required, then it is permitted, but not vice versa. And if something is certain, then it is possible, but not vice versa. Such axioms, or meaning postulates, together with the logical forms of the sentences and other appropriate logical apparatus will, hopefully, characterize a class of models in terms of which truth conditions for the sentences can be given. It is only in terms of such models that the logical forms of sentences can be said to represent meanings. Providing logical forms is only half of the job. At least as much work is involved in finding the right meaning-postulates, truth definitions, etc. Including analyses such as those in (4), (5), (6), and (7) as part of English grammar lessens the job of providing meaning-postulates. The question now arises as to whether there might not be a possible trade-off between the work done by rules of English grammar and the work done by meaning-postulates.

Suppose someone were to claim, for example, that the grammatical analyses of (4), (5), (6), and (7) were incorrect for English grammar, and that the paraphrase relations accounted for by such analyses could be done just as well by the use of meaning postulates. Instead of the grammatical analyses of (4) and (5), one might propose that 'persuade' in both cases be represented in logical form by atomic predicates (PERSUADE_1 and PERSUADE_2), and consequently that the verb 'persuade' was not decomposable in terms of English grammar. Instead, one might propose that the job done by the grammatical analyses of (4) and (5) could be done just as well or better by meaning-postulates like (12a) and (12b).

(12) a. $\forall x, y, z(\text{PERSUADE}_1(x, y, z) \equiv \text{CAUSE}(x, (\text{COME ABOUT } (\text{BELIEVE}(y, z)))$

b. $\forall x, y, z(\text{PERSUADE}_2(x, y, z) \equiv \text{CAUSE}(x, (\text{COME ABOUT } (\text{INTEND}(y, z)))))$.

Similarly, one might say that the analyses given in (6) and (7) were not to be part of English grammar, but instead, that the work done by such analyses should be captured by meaning-postulates such as (13a) and (13b).

(13) a. $\forall x, y, z(\text{ACCUSE}(x, y, z) \equiv \text{SAY}[x, (\text{RESPONSIBLE FOR}(y, z)/\text{BAD}(z)])$

b. $\forall x, y, z(\text{CRITICIZE}(x, y, z) \equiv \text{SAY}[x, (\text{BAD}(z)/\text{RESPONSIBLE FOR}(y, z)])$.

In (13) the '/' represents the presupposition relation, as in dyadic modal logic.

The problem posed by such an alternative proposal is whether there is any empirical evidence favoring one proposal or the other. In other words, are there any empirical considerations which limit the role of meaning-postulates? It should be noted at the outset that there are certain immediate differences between these proposals. One of these is that rules of grammar may operate on structures containing either atomic predicates or lexical items with actual phonological shapes. Meaning-postulates on the other hand are defined only in terms of structures containing atomic predicates, variables, etc., but not lexical items with phonological shapes. (4f) thus differs in an important way from (12). In (4f), the complex predicate CAUSE – COME ABOUT – INTEND is represented by the phonological shape *persuade*. Similarly, the complex predicate CAUSE – COME ABOUT – BELIEVE is to be represented by the same phonological shape. In (12a) and (12b) however, we have atomic predicates PERSUADE_1 and PERSUADE_2. These are not to be confused with the single phonological form *persuade*. PERSUADE_1 and PERSUADE_2 are arbitrary symbols standing for atomic predicates; they are different symbols and have nothing whatever to do with each other. They are as different as 'I' and '?'. Consequently, no regularities which can be stated only in terms of the phonological forms of lexical items can be stated by meaning-postulates, though it is possible that such regularities might be stated by rules of grammar. Another difference is that grammatical transformations are subject to certain constraints, such as Ross' constraints on movement transformations. There is no reason to believe that meaning-postulates should be subject to such constraints. Another difference is that under the meaning-postulate hypothesis there will be many more atomic predicates than under the lexical decomposition hypothesis. In fact, every lexical verb, will correspond to an atomic predicate. Since the stock of lexical verbs varies tremendously from language to language, the meaning-postulate hypothesis requires that the overwhelming proportion of meaning-postulates will vary from language to language. Thus, there will not be a single natural logic for natural language in general, but rather a vastly different one for each different natural language.

Given such differences between the proposals, we can begin to consider what sorts of empirical evidence could confirm or disconfirm either of these proposals. Let us start with the observation that rules of grammar may describe regularities involving both atomic predicates and phonological forms, while meaning-postulates may state regularities involving atomic predicates but not phonological forms. Robert Binninck and Charles Fillmore, working independently, have noted certain regularities having to do with the lexical items 'come' and 'bring'. Consider (14).

(14)

come	bring = CAUSE to *come*
come about	bring about = CAUSE to *come* about
come up (for discussion)	bring up = CAUSE to *come* up
come to (awaken)	bring to = CAUSE to *come* to
come together	bring together = CAUSE to *come* together
come in (land, of an airplane)	bring in = CAUSE to *come* in
come out (of a newspaper)	bring out = CAUSE to *come* out
etc.	

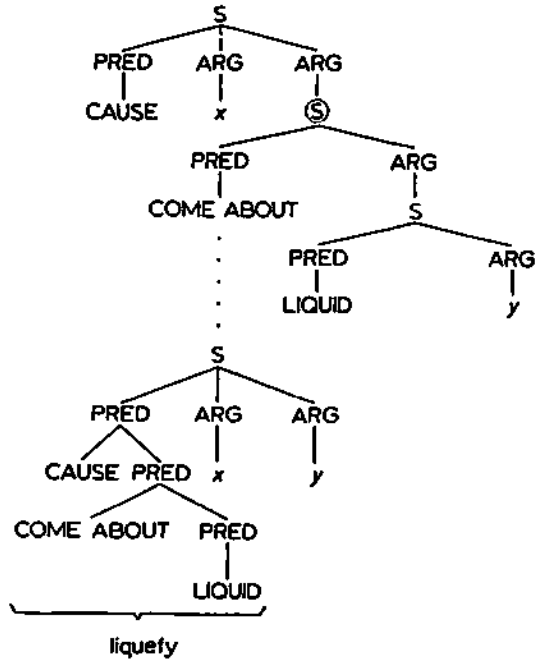
bring = CAUSE – to – *come*, where CAUSE is an atomic predicate and *come* is the phonological form corresponding to a lexical item.

The ordinary sense of 'come' is related to the ordinary sense of 'bring' by a predicate of direct causation, which, as in (14), we represent as CAUSE. In addition, there are many idiomatic expressions containing the phonological form *come*, whose corresponding causative has the phonological form *bring*. (14) contains an abbreviated list of such cases. Binnick (1969) lists many additional similar cases. There are also a number of cases in which the correspondence does not hold, for example, 'John came at me with an ax' does not have the corresponding '*Harry brought John at me with an ax'. There are several other cases where the correspondence fails. However, the overwhelming preponderance of such cases works as

in (14). There are enough of such cases to require that a rule be stated relating the cases with 'come' and the cases with 'bring' (though there will, of course, be exceptions to any such rule). In the lexical decomposition framework, the rule of predicate-lifting will create complex predicates such as 'CAUSE – *come*'. The regularity is that 'bring' substitutes for such a complex predicate.[1] Such an analysis is possible only under the lexical decomposition hypothesis. In the meaning-postulate hypothesis, no such regularity can be stated. The reason is that logical forms do not contain phonological shapes.[2] Thus the predicates 'BRING ABOUT', 'BRING UP', and 'BRING TO', will all be separate and distinct symbols for atomic predicates, having nothing whatever in common. Similarly 'COME ABOUT', 'COME UP', and 'COME TO', will also be symbols for atomic predicates having nothing whatever in common. Consequently, the regularity concerning their phonological shapes cannot be stated in terms of the meaning-postulate hypothesis. Hence, we have at least one case where a lexical decomposition of the sort we have discussed above is required on

(15) a. LIQUEFY (x, y).

b.



linguistic grounds. Otherwise a linguistic regularity would have to go unstated.

Another case providing confirmation of the lexical decomposition hypothesis is given in Lakoff (1968). Under the lexical decomposition hypothesis, sentences of the form (15a) receive an analysis like that in (15b). (15a) means that *x* caused *y* to liquefy, and '*y* liquefied' means that *y* came to be liquid. If the transitive verb 'liquefy' is taken to be an atomic predicate in a logical form like (15a) then the intransitive sentence '*y* liquefied' would not be represented as a subpart of (15a). However it would be represented as a sentence in (15b), as the encircled S in (15b) indicates.

Now consider (16a).

(16) a. The metal liquefied, but it took me an hour to bring *it* about.

b. The chemist liquefied the metal in an hour, but it would have taken me a week to bring *it* about.

In (16a) the *it* takes as its antecedent the sentence 'the metal liquefied'. Now look at (16b). In (16b) the *it* is understood as taking as its antecedent not 'the chemist liquefied the metal', but, as before, 'the metal liquefied'. If the transitive verb 'liquefy' is represented in logical form as an atomic predicate, then there would be no antecedent for the 'it' in (16b). If, however, sentences with the transitive verb 'liquefy' are represented as in (15b), then the encircled S could serve as an antecedent for 'it' in (15b). For further arguments in favor of the lexical decomposition hypothesis on the basis of syntactic facts, see (Postal, 1970) and (Lakoff, in press).[3]

The fact that the meaning-postulate hypothesis provides for a great many more atomic predicates than the lexical decomposition hypothesis suggests another argument in favor of lexical decomposition. Consider sentences like (17a).

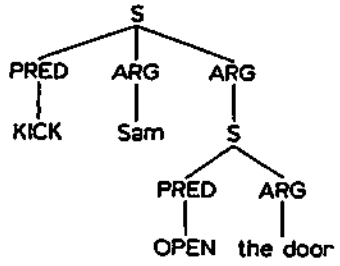
(17) a. Sam kicked the door open.

b. Sam caused the door to come to be open, by kicking it.

(17a) essentially has the meaning of (17b). In (17b) 'kick' is used in its basic sense, that of striking with the foot. If (17a) is derived from a

grammatical structure like that suggested by (17b), then the same sense of 'kick' will appear in both sentences, and only one atomic predicate (or perhaps a complex one) will be required for 'kick'. However, if 'kick' in (17a) is taken to be undecomposable, as the meaning-postulate hypothesis would require, then one would need more than one atomic predicate corresponding to the verb 'kick'. The one needed for (17a) would be quite peculiar in that it would have to act as a sentential operator, that is, it would have to take a sentential complement as its object, as indicated in (18).

(18)



The same would be true of not only of 'kick', but also of verbs like 'scrub', 'beat', and many others.

(19) a. Sam scrubbed the floor clean.
b. Sam caused the floor to become clean, by scrubbing it.

(20) a. Sam beat Harry into submission.
b. Sam caused Harry to submit, by beating him.

(17a), (19a) and (20a) all show a regularity in their paraphrases. Sentences of the form (21a) have paraphrases of the form (21b).

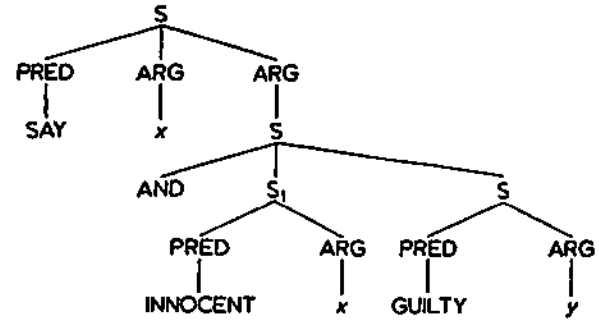
(21) a. Sam VERBed *x* ADJ.
b. Sam caused *x* to come to be ADJ, by VERB-ing *x*.

If sentences like (21a) are derived by grammatical transformation from structures underlying sentences of the form (21b), then verbs like 'kick', 'scrub', and 'beat', will not have to be represented as sentential operators in the *a* sentences, but can be given their simple senses, as in the *b* sentences. Only with the lexical decomposition hypothesis can we avoid the oddness of calling 'kick' in (17a) a sentential operator.

Moreover, since the relationship between sentences of the forms (21a and b) is not regular, there is a further argument in favor of the lexical decomposition hypothesis. Under that hypothesis, the relationship between (21b) and (21a) will be given by transformational rules. Since grammatical rules can have lexical exceptions, such semi-productive relationships can be described by rules of grammar. However, the notion of a lexical exception makes no sense for meaning-postulates. There can be no semi-productive meaning-postulates.

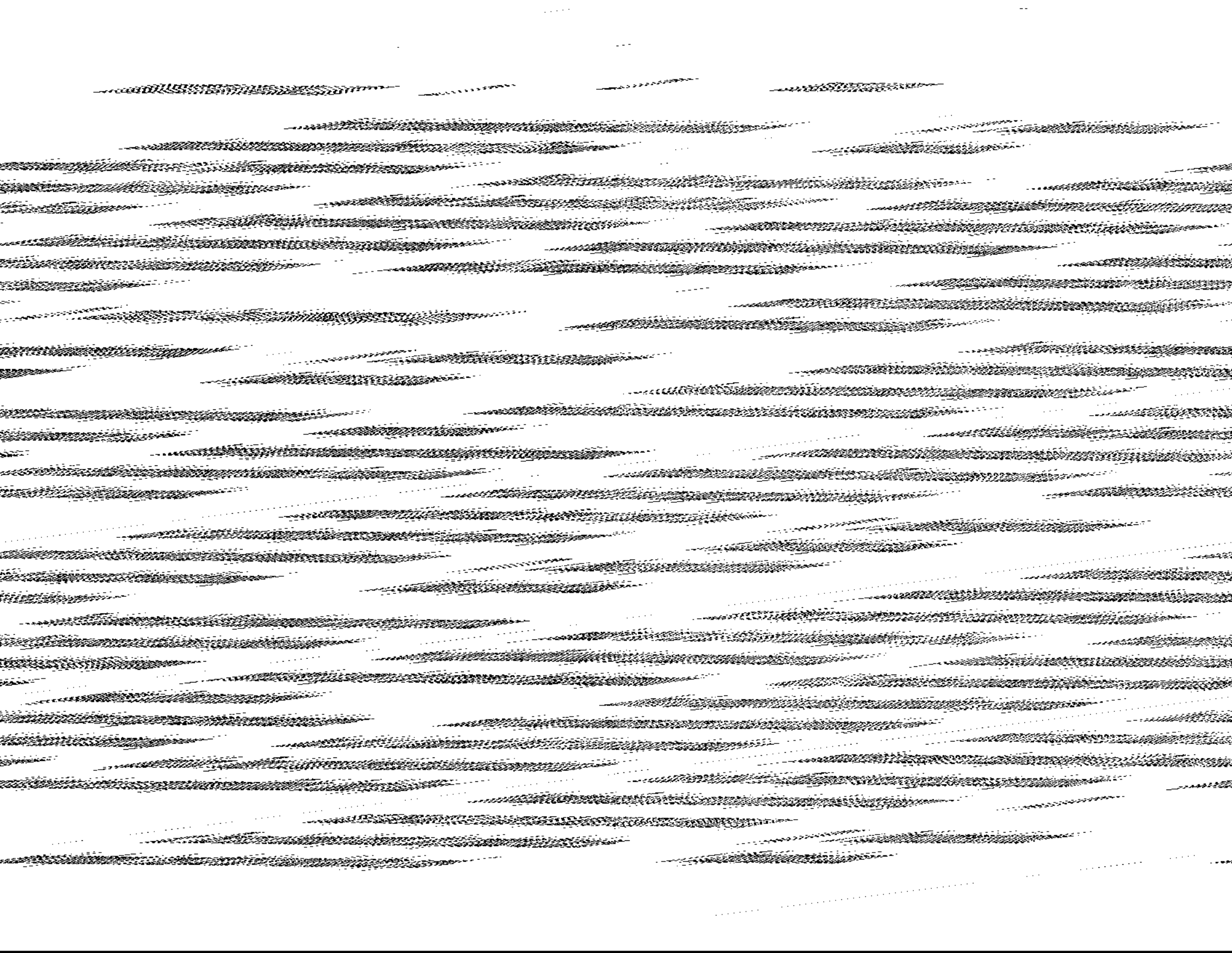
Let us now consider the arguments from the point of view of constraints on transformational rules. According to the meaning-postulate hypothesis, the notion 'possible lexical item' is to be characterized in terms of possible meaning-postulates. Under the lexical decomposition hypothesis however, the notion 'possible lexical item' is to be characterized partially in terms of constraints on transformational rules. There is no reason to believe that constraints on transformational rules should be the same as constraints on meaning postulates. We know a good deal about constraints on transformational rules, and, so far as we can tell, they do in part determine the concept of a possible lexical item. Consider, for example, Ross's coordinate structure constraint. Ross's coordinate structure constraint, under the lexical decomposition hypothesis, makes certain predictions about possible lexical items. For example, it predicts that there cannot be a lexical item 'accusate' such that '*x* accusated *y* that S_1' means that '*x* said that S_1 and that *y* was guilty'.

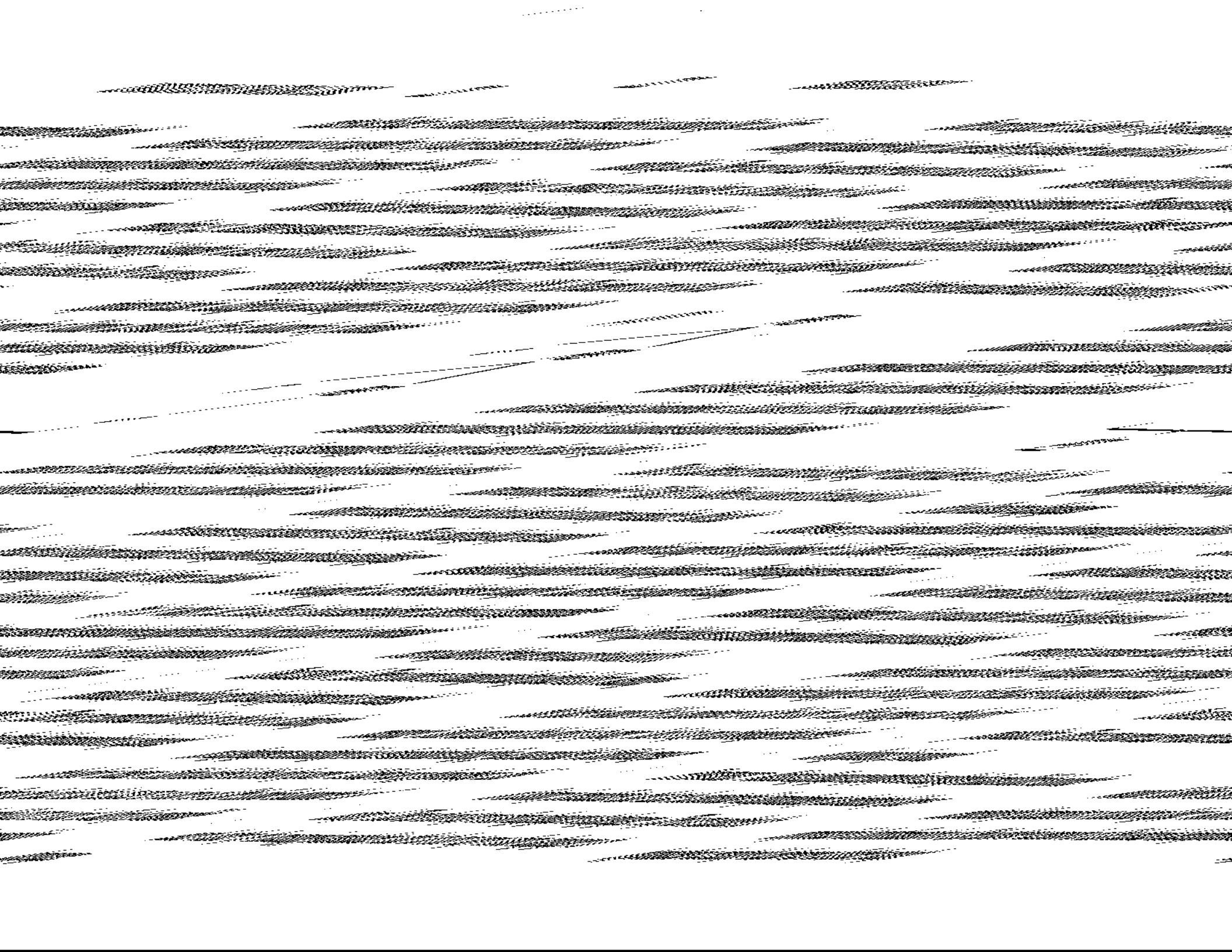
(22)



(23) a. *x* accusated *y* that S_1.
b. *x* said that S_1 and that *y* was guilty.

(24) a. *x* accusated *y* that *x* was innocent.
b. *x* said that *x* was innocent and that *y* was guilty.





VIII. MEANING-POSTULATES, POSSIBLE WORLDS, AND PRONOMINAL REFERENCE

As we saw above, natural logic will require certain meaning-postulates and theorems and will rule out certain others, as indicated in (1) and (2).[1]

(1) a. CERTAIN(S) ⊃ POSSIBLE(S)
b. *POSSIBLE(S) ⊃ CERTAIN(S).

(2) a. REQUIRE(x, y, S) ⊃ PERMIT(x, y, S)
b. *PERMIT(x, y, S) ⊃ REQUIRE(x, y, S).

If something is certain, then it's possible, but not vice versa.[1a] And if x requires y to do something, then x permits y to do it, but not vice versa. And as (3) shows, POSSIBLE and CERTAIN are duals, as are PERMIT and REQUIRE.

(3) a. POSSIBLE(S) ≡ ∼ CERTAIN(∼ S)
b. PERMIT(x, y, S) ≡ ∼ REQUIRE(x, y, ∼ S).

For any natural logic containing these concepts, truth conditions will be required. One way of providing truth conditions for such cases is to employ a model containing possible worlds and alternativeness relations holding between worlds. For each dual pair there will be one alternativeness relation. Let R_1 be the alternativeness relation corresponding to CERTAIN and POSSIBLE. Then we can define truth conditions for CERTAIN(S) and POSSIBLE(S) as in (4).

(4) a. CERTAIN(S) is true in $w_0 \leftrightarrow (\forall w)\,(w_0 R_1 w \supset$ S is true in $w)$
b. POSSIBLE(S) is true in $w_0 \leftrightarrow (\exists w)\,(w_0 R_1 w \supset$ S is true in $w)$.

For cases like REQUIRE and PERMIT we will need an alternativeness relation for each different pair of subject and indirect object. For the sake of discussion, let us fix the subject and indirect object for REQUIRE and PERMIT and call the corresponding alternativeness relation R_2.[2] Then we can state truth conditions as in (5).

(5) a. REQUIRE(a, b, S) is true $\leftrightarrow (\forall w)\,(w_0 R_2 w \supset$ S is true in $w)$
b. PERMIT(a, b, S) is true $\leftrightarrow (\exists w)\,(w_0 R_2 w \supset$ S is true in $w)$.

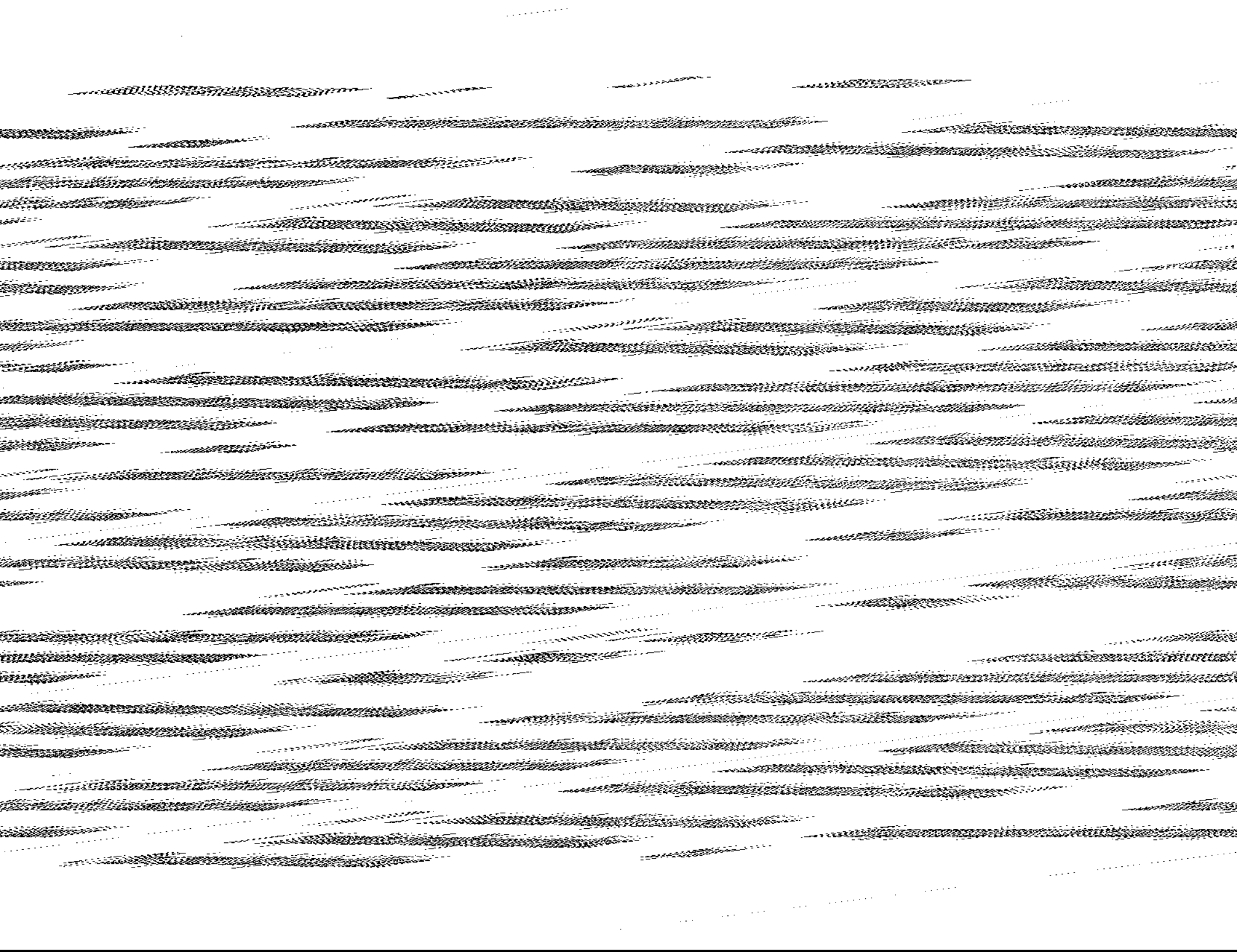
Thus, a sentence of the form 'a requires b to do S' is true just in case S is true in all worlds related to the actual world by R_2. In this way, we can

assign truth conditions for the entire sentence based on the truth conditions for its parts. Moreover, the nature of the alternativeness relation (that is, whether it is transitive, reflexive, symmetric, or whatever) will depend upon what meaning-postulates there are for the corresponding operators. In other words, the meaning-postulates will determine which worlds are related to which other worlds.

A priori, one might think that such considerations would have nothing whatever to do with linguistics. But as it turns out, such matters are crucially important for the solution of certain very deep and difficult linguistic problems. Baker (1966) raised the problem of when a pronoun can refer back to an unspecified noun phrase. For example, he noted that while 'John wants to catch *a fish* and he wants to eat *it*' is grammatical, '*John wants to catch *a fish* and he will eat *it*' is not.[2a] Karttunen (1968) suggested that some notion of 'discourse referent' would be necessary for such problems. Although he did not come close to solving the problem, he did point out a great number of interesting examples, upon which a good deal of the following is based. Consider (6).

(6) a. It's certain that Sam will find *a girl* and possible that he will kiss *her*.
b. *It's possible that Sam will find *a girl* and certain that he will kiss *her*.[3]

In (6a), 'a girl' can be the antecedent of 'her', but not in (6b). If one compares (6) with (1), one finds a correspondence. Somehow, the grammaticality of (6a) corresponds to the valid meaning-postulate of (1a), while the ungrammaticality of (6b) corresponds to the invalid meaning-postulate of (1b). Looking at the possible world model, it becomes clear why. The truth conditions for 'It's certain that Sam will find a girl' say that that sentence is true just in case Sam finds a girl in every possible world related to by R_1 to w_0, which we might take to be the actual world. If 'Sam finds a girl' is true in a world, then there must exist in that world a girl that Sam found. And because of the truth conditions for CERTAIN, that girl will exist in *every* world w related by R_1 to w_0, the actual world. Now consider the truth conditions for 'It is possible that he will kiss her'. That will be true just in case 'he kisses her' is true in *some* possible world w related to w_0 by R_1. Since we already know that there will be an appropriate girl in every world, w, we are guaranteed that a referent for 'her'



Given out truth definitions and principle (8), the grammaticality of (12a) will follow from the postulate of (11a). Correspondingly, the lack of grammaticality of (12b) will follow from the lack of validity of (11b). Whether or not (12c) will be considered grammatical, will depend on whether or not it is assumed that in this instance, Sam will do what he is required to do.

(13) a. Sam will kiss the girl who it is certain that he'll find.
b. *Sam will kiss the girl who it is possible that he'll find.
c. (*)Sam will kiss the girl who he is required to find.

The facts of (13) follow accordingly.

So far, we have considered only postulates and theorems in which modal operators are not mixed. Now let us turn to cases in which they are mixed.

(14) INTEND(x, S) $\supset$ BELIEVE(x, (POSSIBLE(S)).

(14) appears to be a good candidate for a theorem, if not a postulate of natural logic. Let us assume that truth definitions for INTEND and BELIEVE are given as in (14'), using alternativeness relations R_i and R_b respectively.[6]

(14') a. INTEND(a, S) is true $\leftrightarrow$ $(\forall w)$ (w_0 R_i $w \supset$ S is true in w)
b. BELIEVE(a, S) is true $\leftrightarrow$ $(\forall w)$ (w_0 R_b $w \supset$ S is true in w).

Given (14), (14') and other obvious postulates involving INTEND and BELIEVE, principle (8) will then account for the grammaticality of the sentences in (15).

(15) a. Sam intends to find *a girl* and he believes that it's possible that he'll kiss *her*.
b. Sam believes that it's possible that he'll kiss the girl he intends to find.

Given the fact that (16) will be neither a postulate nor a theorem of natural logic,

(16) *BELIEVE(x, POSSIBLE(S)) $\supset$ INTEND(x, S)

it follows from principle (8) that sentences of (17) will be ungrammatical.

(17) a. *Sam believes that it's possible that he'll find *a girl* and he intends to kiss *her*.

b. *Sam intends to kiss the girl he believes it's possible that he'll find.

Incidentically, the effect of (14) can be captured by placing the following restriction on the alternativeness relations of R_i, R_b, and R_t:

(18) $(\forall w)$ [w_0 R_i $w_2 \supset (\exists w_1)$ (w_0 R_b w_1 & w_1 R_t w_2)].

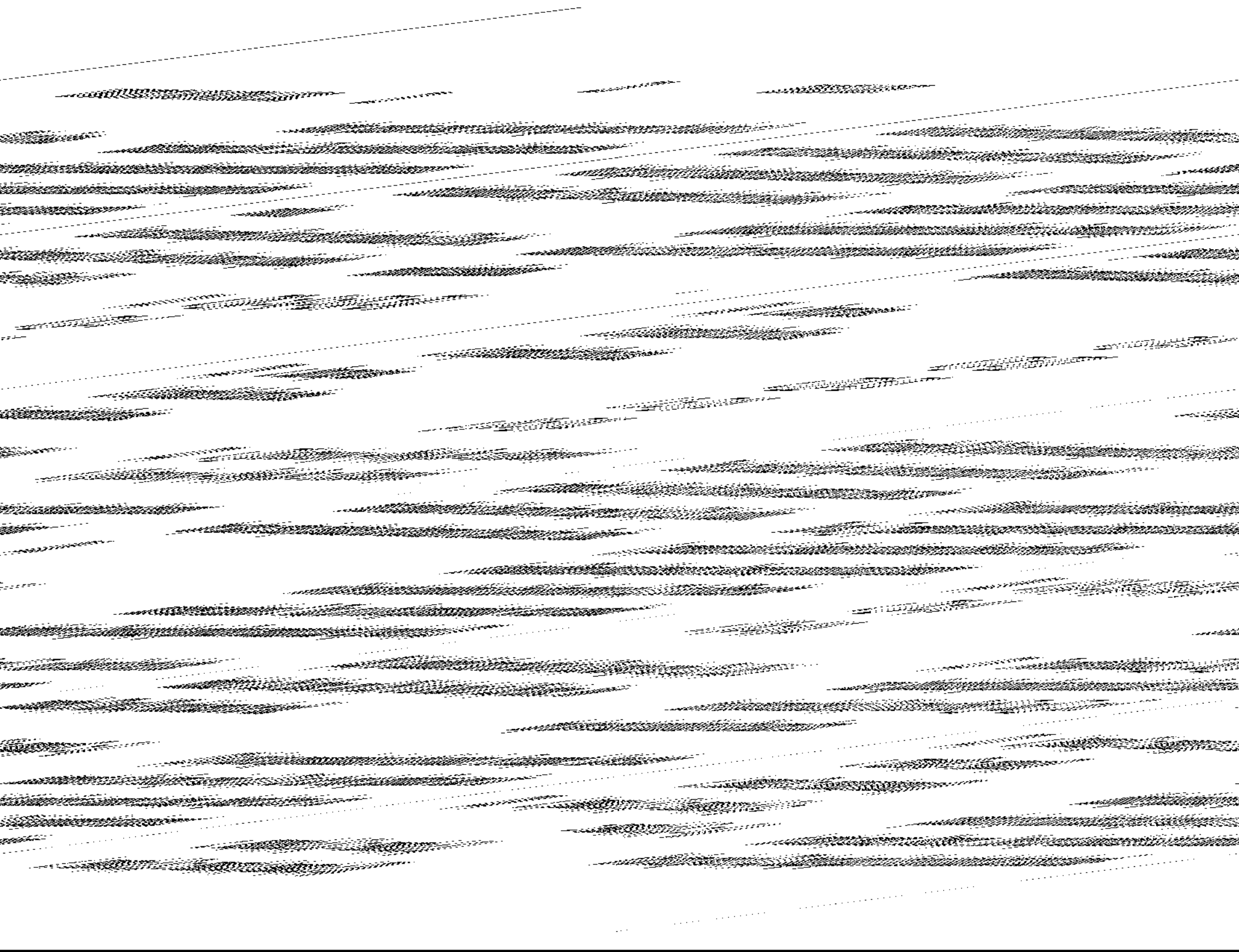
Postulates like (14) give the meanings of certain concepts such as INTEND in terms of the meaning of other concepts such as BELIEVE and POSSIBLE. This raises certain interesting questions. For example, are there any modal concepts whose meaning is not defined in terms of other modal concepts. Let us call such concepts if they exist 'primitive concepts'.

(19) F is a *primitive concept* if and only if natural logic contains no meaning-postulates of the form '$F(S) \supset \phi$', where ϕ contains modal operators which are not identical to the dual of F.

In natural logic, it is an empirical question as to whether primitive concepts exist. Moreover, it is conceivable that there is a hierarchy of concepts, defined by (20).

(20) F is *more primitive than* G if and only if there are meaning-postulates (or theorems) of the form '$G(S) \supset \phi$', where ϕ contains F, but there are no meaning-postulates (nor theorems) of the form '$F(S) \supset \phi$', where ϕ contains G.

A priori, we cannot tell whether natural logic will contain a hierarchy such as that defined by (20). Again, it is an empirical question. If natural logic contains primitive concepts and a concept hierarchy, what does this say about the nature of the human mind? Would such primitive concepts also be psychologically primitive in some significant sense? Would there be a corresponding psychological hierarchy in some significant sense of the term? One could also imagine that there might be linguistic correlates of such notions. For instance, would every natural language contain words or morphemes corresponding directly to the primitive concepts? Would it be the case in every natural language that if it contained a word for a concept at some point on the hierarchy it would contain words for all concepts higher on the hierarchy? It seems to me that these are questions worth investigating.



(27) and (28) show that POSSIBLE and PERMIT share at least three postulates and theorems of the same form, namely, those of the forms given in (26). Robin Lakoff, observing these facts, raised the question of whether it was an accident that the two concepts of possibility and permission could be expressed by the same word 'may'. She suggested that it was no accident. One would like to be able to say that such cases are possible only if the concepts involved, in this case possibility and permission, are in the same linguistically significant semantic class. According to the definition of semantic classes given in (23), the concepts of permission and possibility would be in the intersection of at least four linguistically significant semantic classes. That is to say, their meanings have great deal in common. Thus, as R. Lakoff has suggested, a single lexical item may be used to represent two concepts only if those concepts are in the same semantic class. Moreover, one might add, the more of such classes two concepts are in, the more natural it is for the same lexical item to represent those concepts. Note that this makes a rather interesting claim. Namely, that there will be no natural language in which the same lexical item will represent the two concepts of permission and certainty, or the two concepts of requirement and possibility. That is, it is no accident that while (24b and c) above may be represented as the same sentences, (24a), (25b and c) above may not be represented as the same sentence, (25a).[7]

To consider another example, somewhat less formally, the logic of time and the logic of place will have a great deal in common. The logic of time will involve a linear dimension, while the logic of place will involve three linear dimensions. Notions such as 'later than' and 'farther from' will both be irreflexive, asymmetric and transitive. In both cases, there will be an axiom of density. Just as there will be a postulate saying that if S is always true, then S is sometimes true, there will be a postulate saying that if S is true everywhere, then S is true somewhere. And so on. The logic of time and the logic of place will have many postulates in common. Correspondingly, it is not surprising that the same grammatical constructions are very often used for both. Consider the prepositions 'at', 'within', 'up to', 'around', etc. These prepositions can be used to represent corresponding spacial and temporal concepts. By principle (23), this is to be expected, since such concepts will fall into natural classes due to the similarity of spacial and temporal postulates.

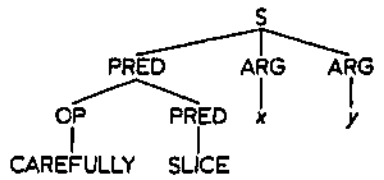
IX. MISCELLANEOUS TOPICS

A. *Manner Adverbs*

It has been proposed by Reichenbach and, more recently by Parsons, that adverbs of manner such as 'carefully' are operators that map a predicate into another predicate.

(1) Sam sliced the salami carefully.

(2)

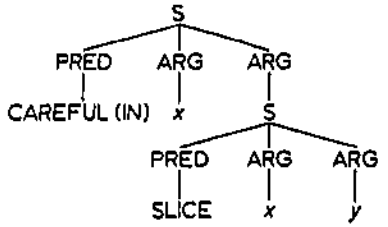


Thus (1) would, under such a scheme, be represented as (2). In Lakoff (1965) it was suggested that sentences like (1) are to be derived transformationally from structures like that underlying (3).

(3) Sam was careful in slicing the salami.

That is, it was claimed that 'carefully' was not an underlying adverb, but rather a transitive adjective, as in (3), or in other words, a two-place predicate relating an agent and an action. This might be represented roughly as in (4).

(4)



Thus we might ask whether the logical form of sentences like (1) should be more like (2) or like (4). What sort of empirical evidence bears upon an issue of this kind?

As we noted in Section IV, there is a difference in meaning between (5a) and (5b).

(5) a. Every boy likes some girl.
b. Some girl is liked by every boy.

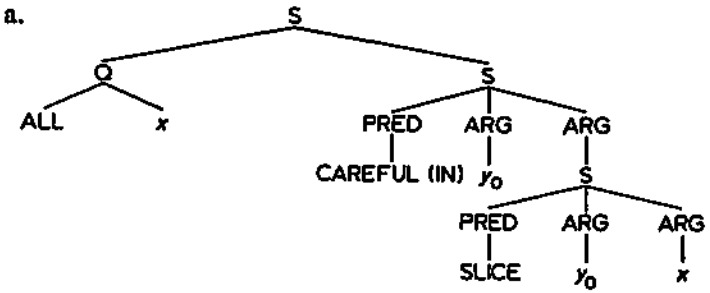
(6) a. $\forall x(\exists y(\text{LIKE}(x, y)))$
b. $\exists y(\forall x(\text{LIKE}(x, y)))$.

(5a) has a logical form like (6a), while (5b) has a logical form like (6b). As we noted above, there is a regularity in these cases, at least in my speech. When two quantifiers are in the same surface structure clause, the leftmost one is understood as having wider scope. As it turns out, this principle is not simply limited to quantifiers, but also works with adverbs, and with adverbs mixed with quantifiers.[1] Consider, for example, the difference between (7a) and (7b).

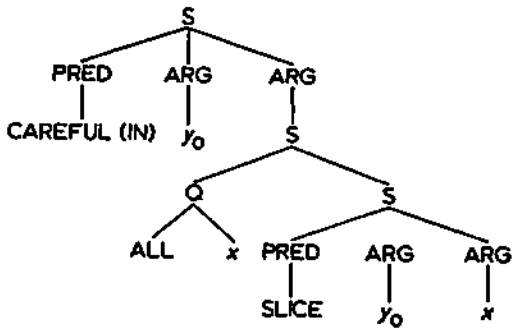
(7) a. Sam sliced all the bagels carefully.
b. Sam carefully sliced all the bagels.

Here 'all' and 'carefully' appear in the same surface structure clause. As in (5), the leftmost of these elements as understood as having wider scope.[2] Thus, if we assume that sentences with 'carefully' such as (1) have a logical

(8) a.



b.



form such as (4) above, then we can state the difference between the logical forms of (7a) and (7b) as (8a) and (8b).
If, on the other hand, we assume that (1) has a logical form like (2), then there is no apparent way to provide a logical form which shows the distinction between (7a) and (7b). We conclude from this that manner adverbs such as 'carefully' are not to be represented in logical form as operators mapping predicates into predicates, but rather as sentential operators, that is, predicates taking sentential complements.

B. *Absolutely*

Consider the two occurrences of 'anyone' in (1a) and (1b).

(1) a. Anyone can cook Peking duck.
b. Sam didn't see anyone.

It is generally acknowledged that the "anyone" in (1a) is an instance of a universal quantifier, as in (2).

(2) $\forall x(x$ can cook Peking duck).

Many linguists have assumed, on the other hand, that the 'anyone' in (1b) is a variant of 'someone', which occurs in certain contexts, for example, in the presence of the negative, as in (1b). However, Quine has suggested that both occurrences of 'anyone' are instances of universal quantifiers and that there is a constraint on 'anyone' to the effect that it always takes the widest scope it can. According to Quine's proposal, (1b) should be represented as (3a), whereas according to other proposals (1b) should be represented as (3b).

(3) a. $\forall x(\sim(\text{Sam saw } x))$
b. $\sim(\exists x(\text{Sam saw } x))$.

Since (3a) and (3b) are logically equivalent, it doesn't make much difference from the viewpoint of logic alone, and one could decide the matter arbitrarily. But if one were considering how such sentences were to be represented, not in terms of first-order predicate calculus, but in terms of a natural logic, which involves empirical linguistic considerations, the question would become an empirical one. Is there a right way and a wrong way to represent (1b)? In fact, would one want both universal and existential quantifiers as primitives in natural logic, or could

one get away with one of these, and if so, which one? Let us consider one sort of argument that might bear on such questions.

Quine has argued that treating (1b) as having the form of (3a) rather than (3b) would make for a uniform treatment of 'any'. However, there is some syntactic evidence which goes counter to Quine's proposal. This depends on certain properties of the word 'absolutely', which were first uncovered by Östen Dahl (1970) and investigated more thoroughly by Robin Lakoff. Consider (4). As (4a) shows, 'absolutely' can modify a universal quantifier. But 'absolutely' cannot modify an existential quantifier, as (4b) shows, though it can modify a negative existential, as (4c) shows.

(4) a. Sam hates absolutely everyone.
b. *Sam hates absolutely someone.
c. Sam hates absolutely no one.

As Robin Lakoff has observed, application of this test to the sentences of (1) shows that 'absolutely' can modify 'anyone' in (1a), but not in (1b).

(5) a. Absolutely anyone can cook Peking duck.
b. *Sam didn't see absolutely anyone.

If it correct that 'absolutely' goes with universal but not existential quantifiers, that would indicate that (1b) should be given a logical form like (3b) with an existential quantifier, rather than one like (3a) with a universal quantifier. This conclusion is further substantiated by the fact that other occurrences of 'anyone', as in (6a and b), may not take 'absolutely'.

(6) a. *Did absolutely anyone leave?
b. *If absolutely anyone leaves, Sam will commit suicide.

The constraints on 'absolutely' have even more interesting consequences. Dahl noticed that they were not restricted to constraints on quantifiers, and pointed out cases like (7), (8), and (9).

(7) a. That is absolutely necessary.
b. *That is absolutely possible.
(8) a. That is absolutely required.
b. *That is absolutely permitted.
(9) a. You absolutely must go.
b. *You absolutely may go.

Dahl made the extremely interesting proposal that the facts of (7) through (9) followed from the constraints involving quantifiers, since in a possible world semantics, the *a* sentences would be statements about *all* alternative worlds, while the *b* sentences would be statements about *some* possible alternative worlds. 'Absolutely' would go with universal quantification over possible alternative worlds, but not with existential quantification. Under this fascinating proposal, facts about grammaticality of English sentences would follow from facts about the truth conditions for such sentences in a possible world semantics.

Unfortunately a damper, at least a tentative one, has been thrown on this alluring proposal by some further facts uncovered by Robin Lakoff. As (10) shows, the negatives of the above *b* sentences may also take 'absolutely'.

(10) a. That is absolutely impossible.
b. That is absolutely not permitted.
c. You absolutely may not go.

This is entirely in line with what happens in quantification, as (4c) shows. However, there are a number of cases where 'absolutely' can occur and which seem essentially to be of the same sort as the above cases, but which involve neither universal quantifiers nor negative existentials, nor predicates that can be understood (at least not in any obvious way) in terms of a possible world semantics. Consider (11) through (13).

(11) a. That is absolutely fascinating.
b. *That is absolutely interesting.
c. That is absolutely uninteresting.
(12) a. I absolutely love snails.
b. *I absolutely like snails.
c. I absolutely loathe snails.
(13) a. That's absolutely wonderful.
b. *That's absolutely good.
c. That's absolutely terrible.

Each of these cases seems to involve some sort of scale. In (11) it is a scale of interest running from the uninteresting through the relatively and very interesting up to the fascinating. 'Uninteresting' and 'fascinating' seem to represent end-points (or at least distant parts) of the scale. It is

these that can be modified by 'absolutely'. Similarly (12) and (13) seem to involve scales of fondness and goodness respectively. However, there seems to be no obvious way in which one can associate the *a* sentences with universal quantifiers, the *b* sentences with existentials, and the *c* sentences with negative existentials, though that is what would be required in order to reduce these cases to the quantifier cases. In the absence of such an analysis, R. Lakoff has suggested that the restrictions on 'absolutely' are to be understood in terms of such scales, and restricted so that they go with the extremes on such scales. She suggests moreover that quantifiers are really special cases of such scalar predicates, and that 'all' and 'none' can also be understood as end-points on a scale. What follows from this is that quantifiers must be cross-classified with predicates (that is, adjectives and verbs). This suggests that they are in the same category as adjectives and verbs, in other words, that quantifiers are predicates. This might be taken as more support for the claim to that effect, as made in Lakoff (1965), Carden (1968) and (1970), and McCawley (1970). On the other hand, it may be the case that predicates on these scales are not to be represented in logical form as atomic predicates, but are rather to be decomposed into quantifier expressions which range over a scale and an atomic predicate which defines the scale. If the latter analysis is correct, we would expect to find scope differences involving the understood quantifiers that range over such scales. However, there is no known evidence for such an analysis.[1]

Incidentally, there are cases where a word may be understood either literally or figuratively, and the possibilities for the occurrence of 'absolutely' or 'absolute' will depend not on the occurrence of the word itself but on whether either of its meanings is understood as the end point on some scale. Consider for example (14) through (17).

(14) a. Sam is an absolute elephant.
b. *Sam is an absolute wombat.

(15) a. Sadie is running an absolute whorehouse.
b. *Sadie is running an absolute apartment house.

(16) a. Moe is an absolute bastard.
b. *Moe is an absolute illegitimate child.

'Elephant' can be taken in its literal sense, in which case (14a) is meaningless. It would be absurd to assert (14a) of an elephant named Sam. (14a)

said of a person named Sam, means that he is enormous. That is because we have come to associate elephants with what is, from the point of view of our culture, their most outstanding property, their size. (14b) is strange, because it cannot be taken literally and because, in our culture (or at least in my subculture), wombats are not viewed as having any special defining property. In a culture where, say, wombats represented the quintessence of smelliness, (14b) would be perfectly fine. Thus our ability to understand sentences like those in (14) depend in part on our cultural assumptions. (15) and (16) are similar cases. (15a) is not understood literally. It is not the sort of thing you would say of a madame. It might be the sort of thing you would say figuratively if Sadie had a number of promiscuous daughters. (15b) is strange because in our culture there is no way of understanding it figuratively, though perhaps those with different cultural assumptions or wilder imaginations may find (15b) perfectly fine. (16) works in the same way.

C. *Presuppositions and Propositional Functions*

An *n*-place propositional function is a function mapping a sequence of *n* individuals into a proposition. In some instances two or more of the individuals may be coreferential. (1) and (2) below are two common ways of representing propositional functions.

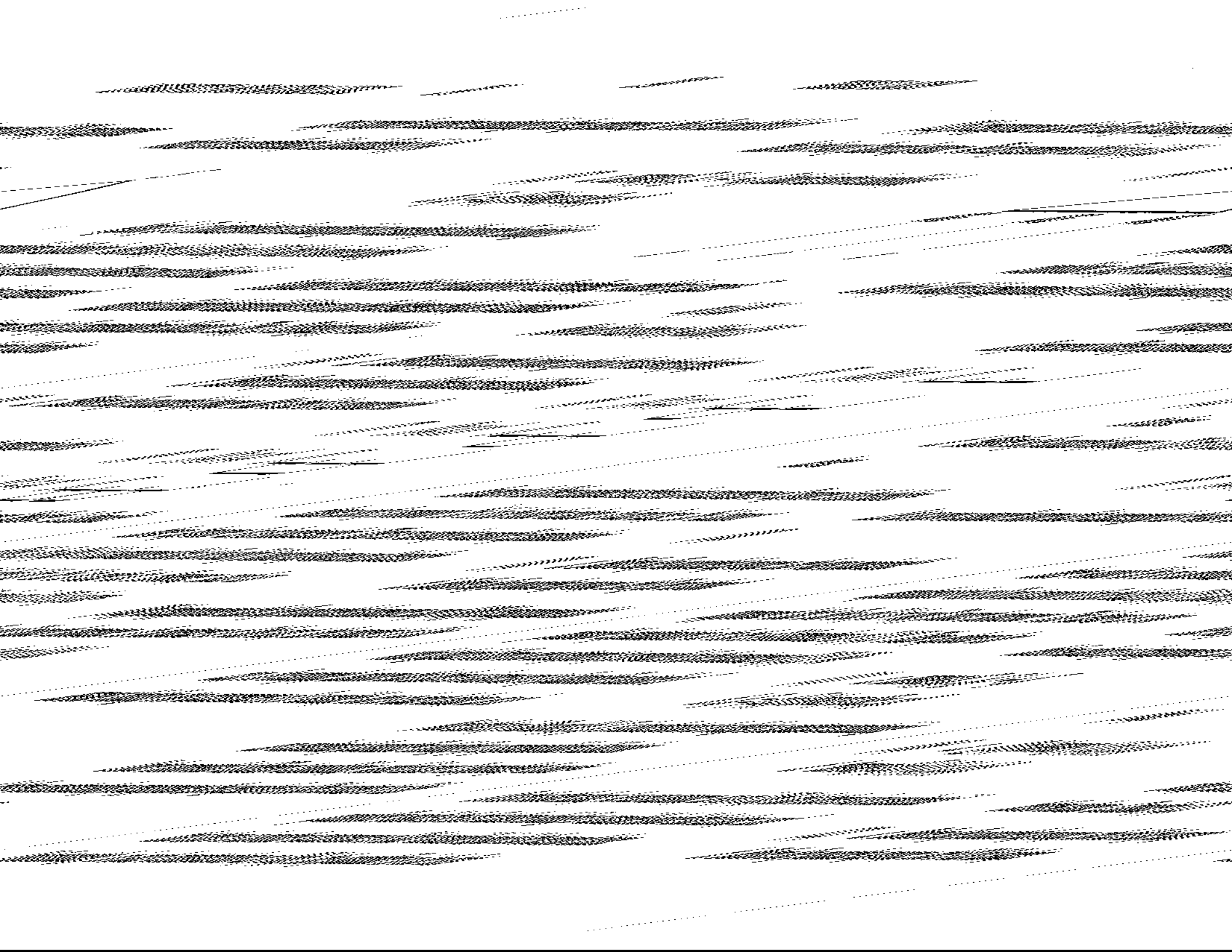
(1) $f(x, y, x)$.

(2) $f(\underbrace{\quad, \quad, \quad}\,)$.

Propositions may be formed from (1) and (2)[1] either by substituting individual constants for the variables in (1) or the slots in (2), or by binding the variables or the slots by quantifiers. In (1), coreference is indicated by the use of the same variable letter, *x*. This indicates that the first and third places refer to the same individual. In the notation used in (2), this is indicated by drawing a line between the first and third places. It should be noted that, although the '*f*' in (1) and (2) may be an atomic predicate, it need not be. For example, (1) or (2) may be a representation of an extremely complex sentence, as in (3).

(3) *x*'s sister thought that the man who kicked *y* was disturbed by the fact that *x* was rich.

In terms of tree structures, we will consider (1) to be an abbreviation for



clause cannot bind the variable in the second clause. Thus, if such an analysis is necessary, we have an explanation for why the sentences of (15) are ungrammatical. However, one can always retreat to an analysis like (16a). As it turns out, (16a) also offers us an explanation for the ungrammaticality of (15). Recall that both sentences of (15) must presuppose the content of the before-clause, as in (11a) above. This would give us a presupposition-relation as given in (17a).

(17) a. $[(Qx)\,(\text{BEFORE}\,(f(x), g(x))] \rightarrow (\exists x) f(x)$

b. $[(Q\_)\,(\text{BEFORE}\,(f(\_), g(\_))] \rightarrow (\exists\_) f(\_)$

c. $\text{BEFORE}\,(f(\_), g(\_))$

d. $f(\_)$.

(17a) is equivalent to (17b), using the slot-and-line notation for propositional functions instead of the identical-variable-letter notation. However, (17b) cannot be a schema of the form (11a). Note that the expression in the square brackets of (17b) contains the propositional function of (17c), in which two slots are joined by a line. If that line, the indication of coreference, is an integral part of the propositional function, then the expression of (17d) is not a proper subpart of (17c). That is, if we call (17d) S_1, then S_1 does not occur as a proper subpart of (17c). Consequently (17b) cannot be an instance of (11a), or any similar statement. The reason is that there can be no identity statement between anything on the right side of the arrow in (17b) and anything on the left side of the arrow. One propositional function, say that of (17d), cannot be identical to part of another propositional function, say that of (17c). Thus, assuming that the line connecting the slots, the indication of coreference, is an integral part of a propositional function, we have an explanation for the ungrammaticality of the sentences of (15). Under no possible analysis can 'him' in (15) be bound by the quantifier corresponding to 'any' in (15). Thus analyses like (16a) are ruled out, as well as analyses like (16b).

So far, everything works pretty much as it should. The assumption that the indication of coreference is an integral part of a propositional function and that (17d) is not a proper subpart of (17c) has paid dividends.

Unfortunately, the market is about to collapse. Consider (18).

(18) Before Sue punches *anyone*, she tries to get *him* to leave.

'Any' in (18) might well be said to be understood as a universal quantifier. Thus (18) might be given the form of (19).

(19) $(\forall x)\,\text{BEFORE}\,(f(x), g(x))$.

Now, (18) presupposes that Sue punches people. Thus we should have an instance of (11a). The presupposition relation of (18) is given in (20).

(20) a. $[(\forall x)\,\text{BEFORE}\,(f(x), g(x))] \rightarrow (\exists x)\,(fx)$

b. $[(\forall\_)\,\text{BEFORE}\,(f(\_), g(\_))] \rightarrow (\exists\_) f(\_)$.

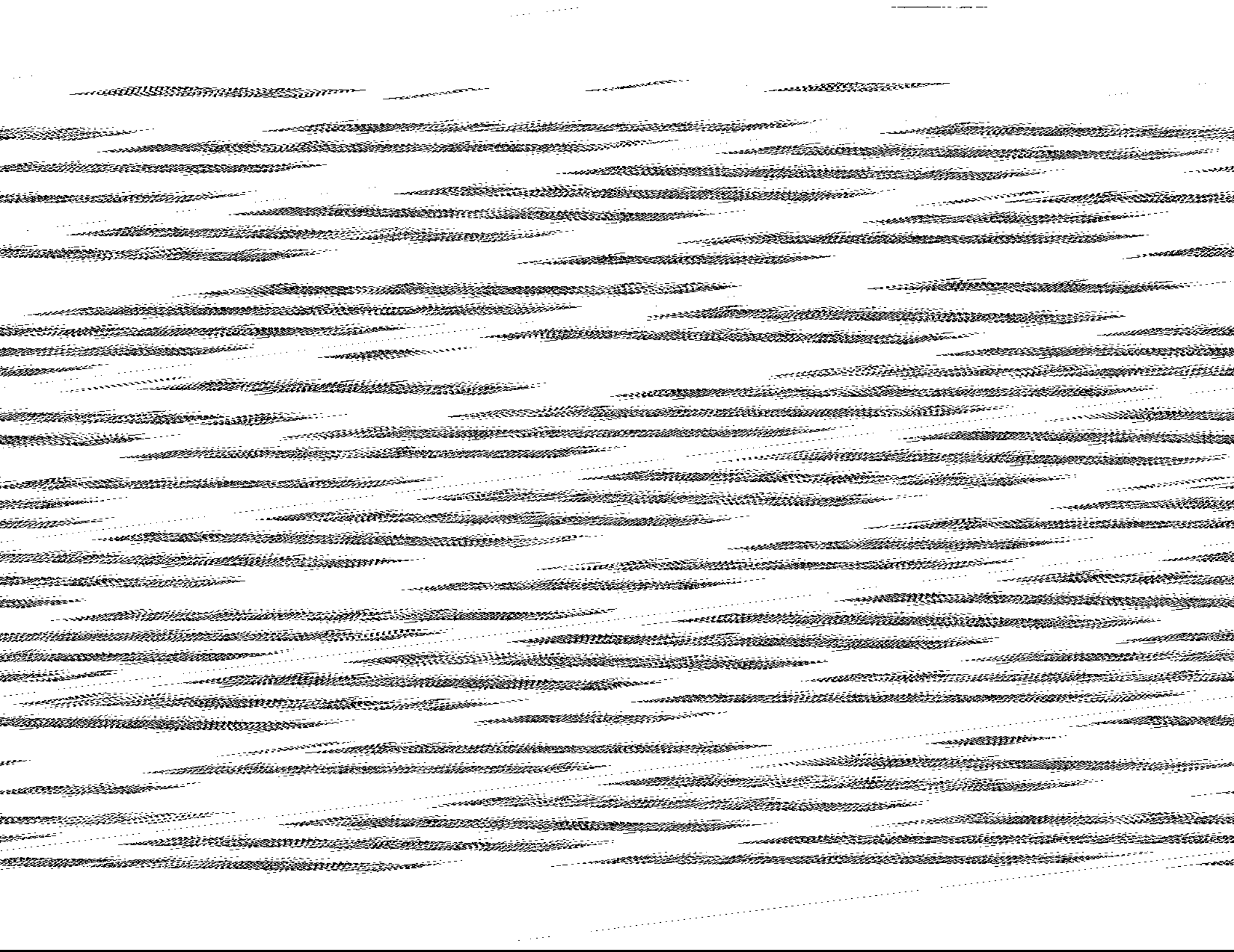
Unfortunately, neither (20a) nor (20b) can be an instance of (11a). (20e) and (20b) are of the same form as (17a and b) above. As we saw, under the assumption that the indication of coreference, the line between the slots, is an integral part of a propositional function, there cannot be any identity condition between the expression on the right of the arrow in (20b) or any of the propositional function it contains and any part of the expression on the left. Thus it is impossible for (20a) to be an instance of (11a), or any similar statement. In fact, it would be impossible to account for the presupposition relation in (18) generally, since any general account must contain an identity condition between a proposition or a propositional function in the expression on the left side of the arrow and a proposition or propositional function in the expression on the right side of the arrow – if it is true that (17d) cannot be a proper subpart of (17c). Thus, given our assumptions, we can neither account for the grammaticality of (18), nor can we state a general rule accounting for the presuppositions of before-constructions. Something is wrong. And what appears to be wrong is the assumption that the indication of coreference is an integral part of the structure of the propositional function. That is, we need to be able to say that (17d) is a proper subpart of (17c). This leaves us with two problems. Why is (15) ungrammatical but (18) grammatical? And how can we represent coreference in a propositional function in such a way that the indication of coreference is not a proper part of the structure of the propositional function?

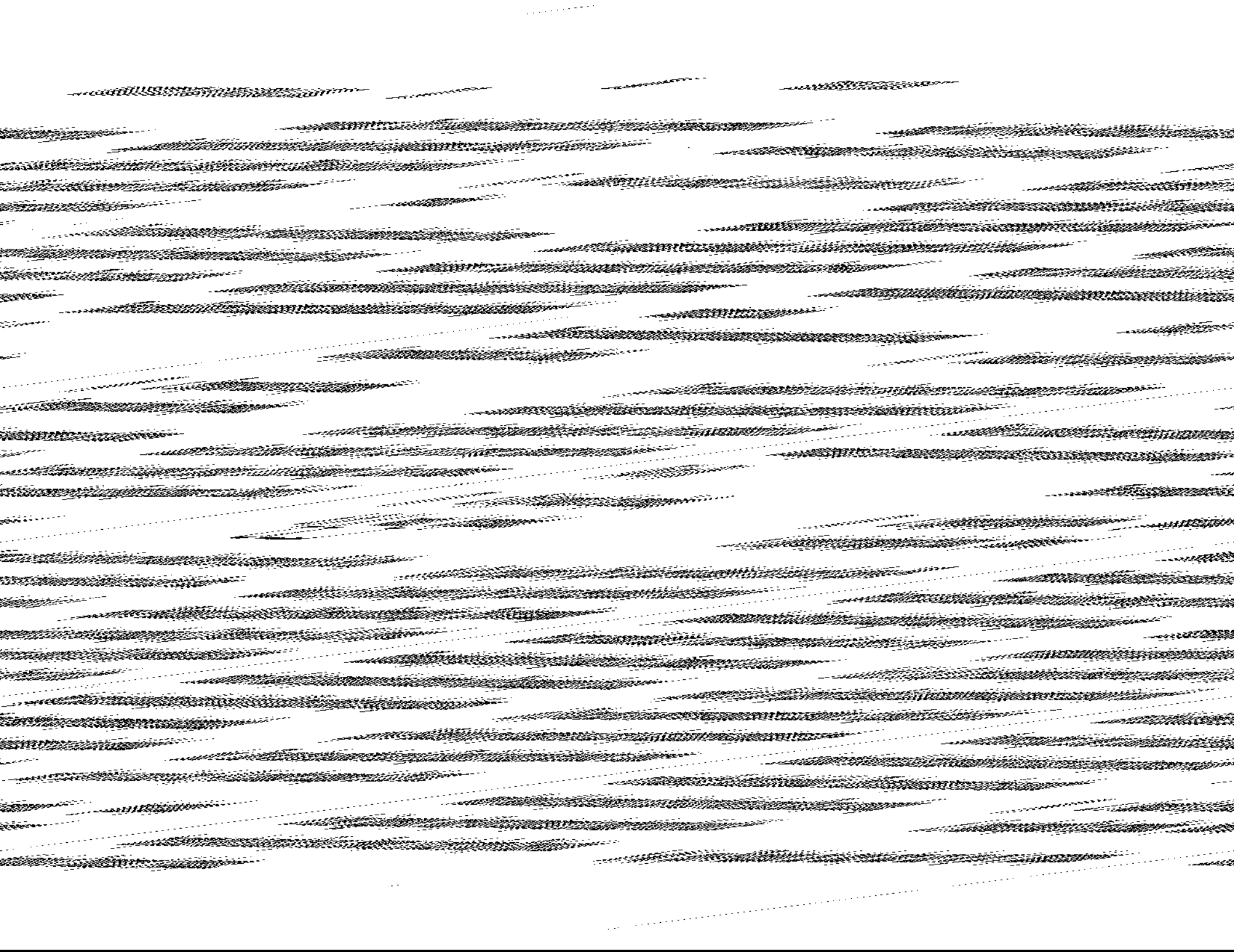
Before concluding let us consider some further examples.

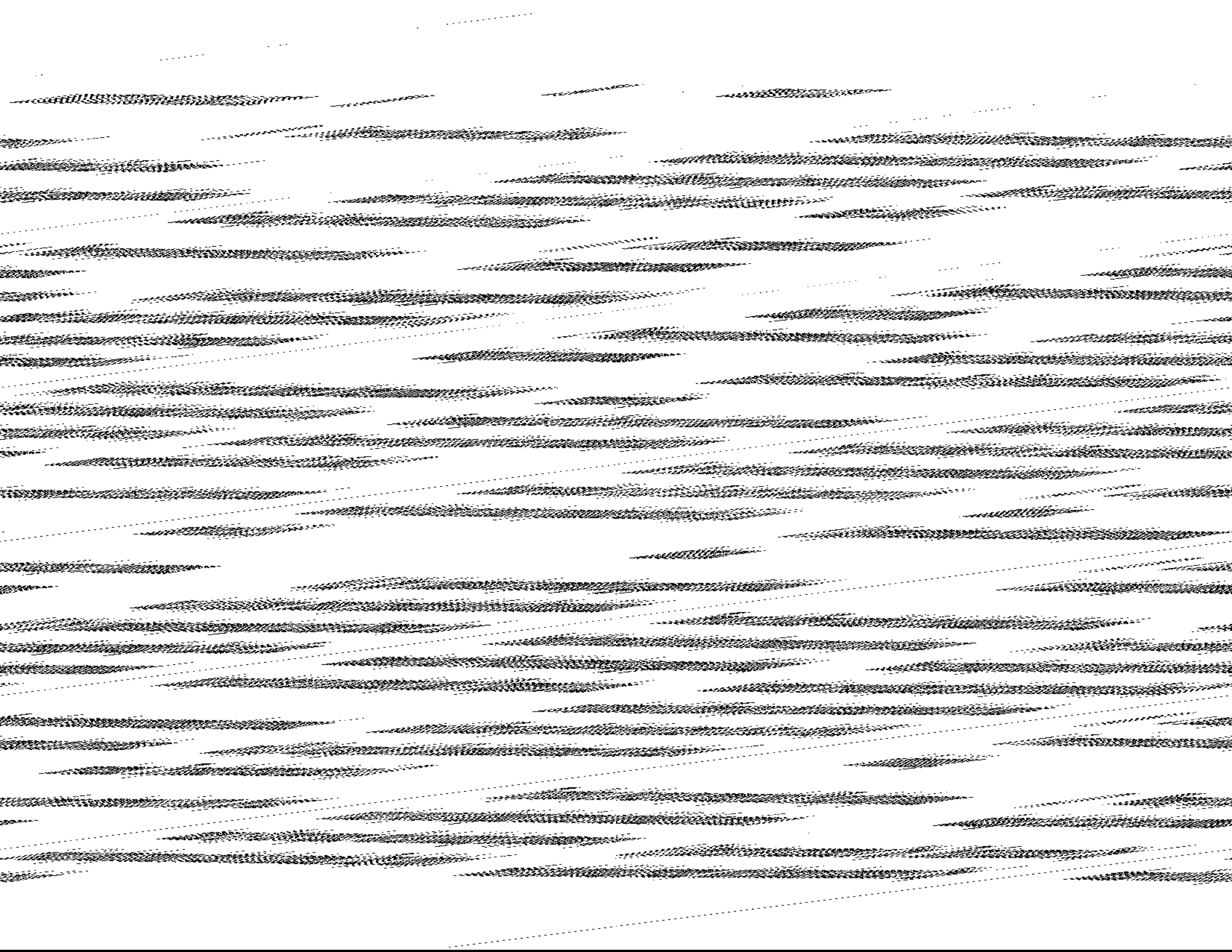
(21) a. Whenever *someone* comes to the door, I let *him* in.

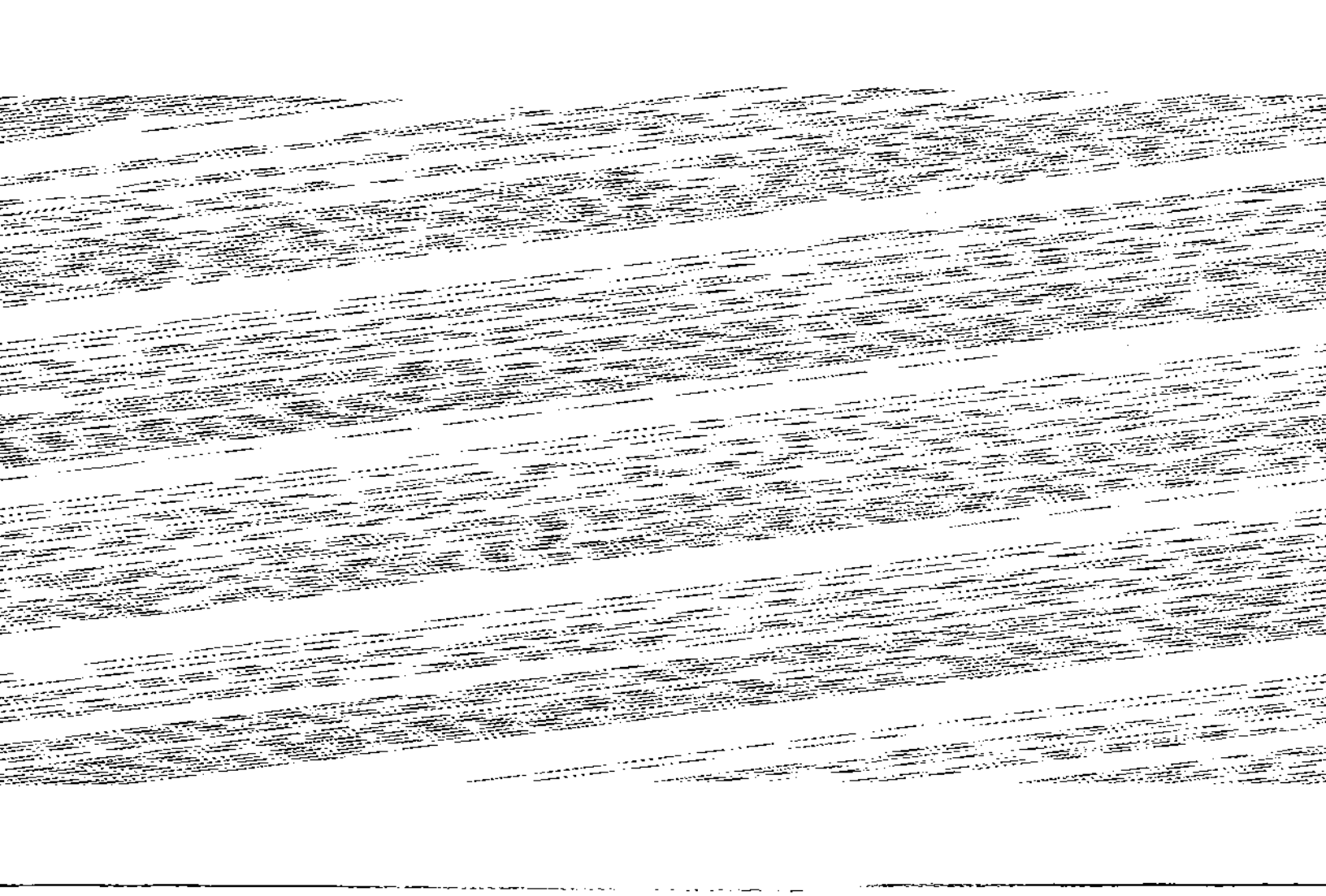
b. $(\exists x)$ (x comes to the door).

(21a) presupposes (21b). How can 'him' in (21a) be found by the quanti-









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because he happened to put them down on paper. So far as short-term goals are concerned, Scott's seem to me to be not unreasonable for someone in his position. Good logic will undoubtedly be served through the refinement and vigorous development of the present techniques of modal logic. However, if one is interested in natural logic and in its long-term goals, then there are courses other than Scott's that one can follow. One can attempt to extend logic to deal with presuppositions, and there are a number of able logicians involved in this enterprise. One can study the group-reading of quantifiers mentioned in Section II above. One can study the logic of scalar predicates such as *like-love*, *interesting-fascinating*, etc., and how they are related to the quantifiers *some-all*. (One measure of success for such an endeavor would be the ability to state a general rule governing the occurrence of the word 'absolutely'.) In addition to studies in the logic of time, one might attempt parallel studies in the logic of location and linear dimensions in general, e.g., weight, cost, etc. One might study the various counterpart relations: individual-counterparts, body-counterparts, participant-counterparts, and observer-counterparts. Are all of these different types really necessary? Do they overlap in any way? What properties do they have? Can one use the notion of counterpart to revise our current notion of propositional function so as to make it adequate for doing natural logic? In short, there are many new things that logicians might be doing if they are interested in the goals of natural logic.

Natural logic, taken together with linguistics, is the empirical study of the nature of human language and human reasoning. It can have right and wrong answers. For example, as we saw in Section IXA above, any treatment of manner adverbs as operators mapping predicates into predicates is simply wrong. It is wrong because in principle it cannot provide different logical forms for sentences that require them – on logical grounds (see Example (7) in IXA and Footnote 2 in that section). An analysis of logical form can be wrong because it does not account for the logical facts. But under the assumptions of natural logic, analyses of logical form can be inadequate for other reasons. If, for example, an analysis of the logical form of some sentence or class of sentences does not permit the statement of some significant linguistic generalization, then that analysis is inadequate on linguistic grounds. Take, for instance, the case of scalar predicates. As we saw above, the word 'absolutely' can

occur with words indicating extreme points of a scale (*fascinating*, *uninteresting*), but not some intermediate point on the scale (*interesting*). We saw that the same was true of quantifiers (*all* and *none* versus *some*), and that, in this sense, quantifiers seemed to act like scalar predicates. Although quantifiers have been very well studied, scalar predicates have not. There is at present no known analysis of the logical forms of both quantifiers and scalar predicates such that the similarities between them are brought out. Consequently, we cannot say for sure that we have an adequate analysis of the logical forms of quantifiers such as *all*, *some*, and *none*, in the absence of a corresponding analysis of the logical forms of scalar predicates. Further study may show either that the traditional analysis of quantifiers is essentially correct, or that it is partly correct, or that it is entirely wrong, depending on how the study of scalar predicates turns out. One of the criteria for the correctness of such analyses of logical form will be the extent to which the similarities between quantifiers and scalar predicates are brought out. Unless these similarities are made sufficiently explicit so that a general rule governing the occurrence of 'absolutely' can be stated, our analyses of these concepts must be considered inadequate on linguistic grounds. Under the assumptions of natural logic, logical analyses must be linguistically adequate and vice versa. Thus the criteria for adequacy in natural logic are rather stringent. Since the criteria for adequacy of both linguistics and logic must be met at once, the inherent interest of natural logic is so much the greater.

In recent years, much attention has been paid to the ontological claims made by logical systems. Since a natural logic will undoubtedly contain just about all of the things most commonly questioned in such discussions – quantifications over propositions, classes, non-existent individuals, etc. – we ought to consider what it would mean to adopt some particular natural logic as being 'correct'. Are we saying that the universe contains non-existent or hypothetical individuals? If natural logic requires, in part, a possible world semantics, would we be claiming that the universe contains possible worlds? Certainly not. Recall that natural logic is a theory, a theory about the logical structure of natural language sentences and the regularities governing the notion of a valid argument for reasoning in natural language. That is, it is a theory about the human mind, not a theory about the universe. If natural logic requires a possible world semantics, then that might mean that people conceive of things in terms

of possible worlds, not that the physical universe contains possible worlds. If natural logic requires quantification over propositions, then that means that people can conceive of propositions as entities, not that there are propositional entities floating around in the universe. If natural logic requires that space and time be independent dimensions, then it is claimed that people conceive of space and time as independent dimensions, not that space and time are independent dimensions (which we know they are not). If one wants a logic capable of dealing with the physical facts of a Einsteinian universe, then it seems pretty sure that one doesn't want a natural logic. This is not to say that the ontological commitments of a natural logic are irrelevant or uninteresting. Quite the contrary. Though a natural logic, if one could be constructed, would not make claims about the universe, it would make claims about the way human beings conceive of the universe. And in the gap between the way the universe is and the way people conceive of the universe, there is much philosophy.

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Section II

[1] The conditions under which adverb-preposing is blocked vary somewhat from person to person. The assignment of asterisks in the following examples corresponds to the author's speech. Readers whose idiolects disagree with these examples can easily construct similar examples in their own speech. The argument in this section does not depend on the particular examples given being correct for all dialects, but only on the *existence* of examples of this sort for *some* dialects.

[2] It should be noted that adverb-preposing can optionally move the adverb to the front of its own clause as well as to the front of the higher clause.

a. I think that, if he can get it cheap, *then* Sam will smoke pot.
b. It is possible that, if he can get it cheap, *then* Sam will smoke pot.

The point here is that *then* is introduced following preposing, and that the placement of *then* depends on how far the *if*-clause has been preposed. It should be noted, incidentally that the *if*-clause may also be preposed to the front of a clause more than one sentence up the tree.

c. If he can get it cheap, *then* I think it's possible that Sam will smoke pot.

These are just the cases where other adverbs can prepose:

d. Tomorrow, I think it's possible that Sam will smoke pot.

Section III

[1] For a fuller account of dialect differences see (G. Lakoff, in press) and (Carden, 1970a, 1970b).

[2] In (G. Lakoff, 1965), (G. Lakoff, 1970), (G. Lakoff, in press), and (McCawley, to appear) it was argued that quantifiers are predicates, not simply operators of the usual sort. Though I still maintain such a position, I am leaving the issue aside here for the sake of avoiding controversy.

In (11) and (12), *V* is meant to indicate atomic predicates and *NP*, arguments. The tree structure reflects the bracketings of most normal logical notation.

Section IV

[1] For discussions of generative semantics, see (Lakoff, in press), (Lakoff, in preparation), (McCawley, 1968), and (Postal, 1970).

[2] I will consider hierarchical structures like (A) to be equivalent to expressions like: ORDER (x, y, S_1).

[3] Sentences like (1) are not normal in standard English, and are restricted to certain dialects. These are most common in urban centers in which there are, or were, a large number of Yiddish speakers. Again, the facts given here are from the author's native dialect and the argument is based on the existence of a dialect in which such facts hold.

[4] The next two arguments are due to John R. Ross.

[5] The following three arguments are due to David Perlmutter, John R. Ross, and William Cantrell respectively.

[5a] Strictly speaking, the pronoun must be coreferential with the underlying subject of 'shove', which, in turn, must be coreferential with the next highest indirect object. Agreement in number, person, and gender follows automatically.

[6] This argument is due to R. Lakoff.

[7] See (Baker, 1970b) and (Langacker, 1969). Baker concludes that in addition to the indirect question verb, there is an operator that binds the items questioned. Langacker argues convincingly that it is the verbs that do the binding.

[8] Since it is not at all clear what it means for a verb like 'ask' to *bind* an item being questioned, we would naturally prefer an analysis in which the binding function was assumed by a quantifier associated with 'ask'. Hopefully such an analysis would increase our understanding of the nature of questions. In fact, such analyses have been proposed. Baker (1970b) suggests that verbs taking indirect questions have a new operator, *Q*, embedded directly below them, the operator functioning only to do the binding. This is little more than giving a name to the problem; it provides us no new insight. Belnap, on the other hand, attempts to identify the logical form of a question with the logical form of its primary (first-order) presupposition. Thus, '*a* knows who left' would have the logical form '($\exists x$) (KNOW (a, (LEFT x)))'. Åqvist and Hintikka also assume such logical forms for indirect questions. Unfortunately, this proposal is inadequate in a number of ways. First, there is a sense of '*a* knows that someone left' which has that logical form and which is not synonymous with '*a* knows who left'.

Secondly, that proposal does not explain why sentences like '*a* believes who left' and '*a* expected who left' should be impossible, since logical forms like '($\exists x$) (BELIEVE (a, LEFT x)))' and '($\exists x$) (EXPECT (a, (LEFT x)))' are possible, and in fact occur as possible readings for '*a* believed that someone left' and '*a* expected someone to leave'. Thirdly, there is the observation by J. R. Ross (personal communication) that some indirect questions involve disjunctions, while other involve conjunctions.

(1) a. I want to know who left, Sam or Irving?
b. *I want to know who left, Sam and Irving.
(2) a. I don't know who left, Sam or Irving.
b. *I don't know who left, Sam and Irving.
(3) a. *I know who left, Sam or Irving.
b. I know who left, Sam and Irving.

When one doesn't know the answer, one gets disjunctions; when one does know the answer, one gets conjunctions. Why? Any serious account of indirect questions must explain this. Fourthly, the Belnap-Hintikka-Åqvist analysis fails to indicate that in '*a* knows who left' the content of *a*'s knowledge is some identifying description or proper name for the individual who left (or the ability to point him out), not simply the fact that that individual left, which is all that their analysis specifies. I wish that I had something positive to contribute at this point, but unfortunately I am as much in the dark as to the real logical form of questions as everyone else seems to be at the moment.

[9] 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''.

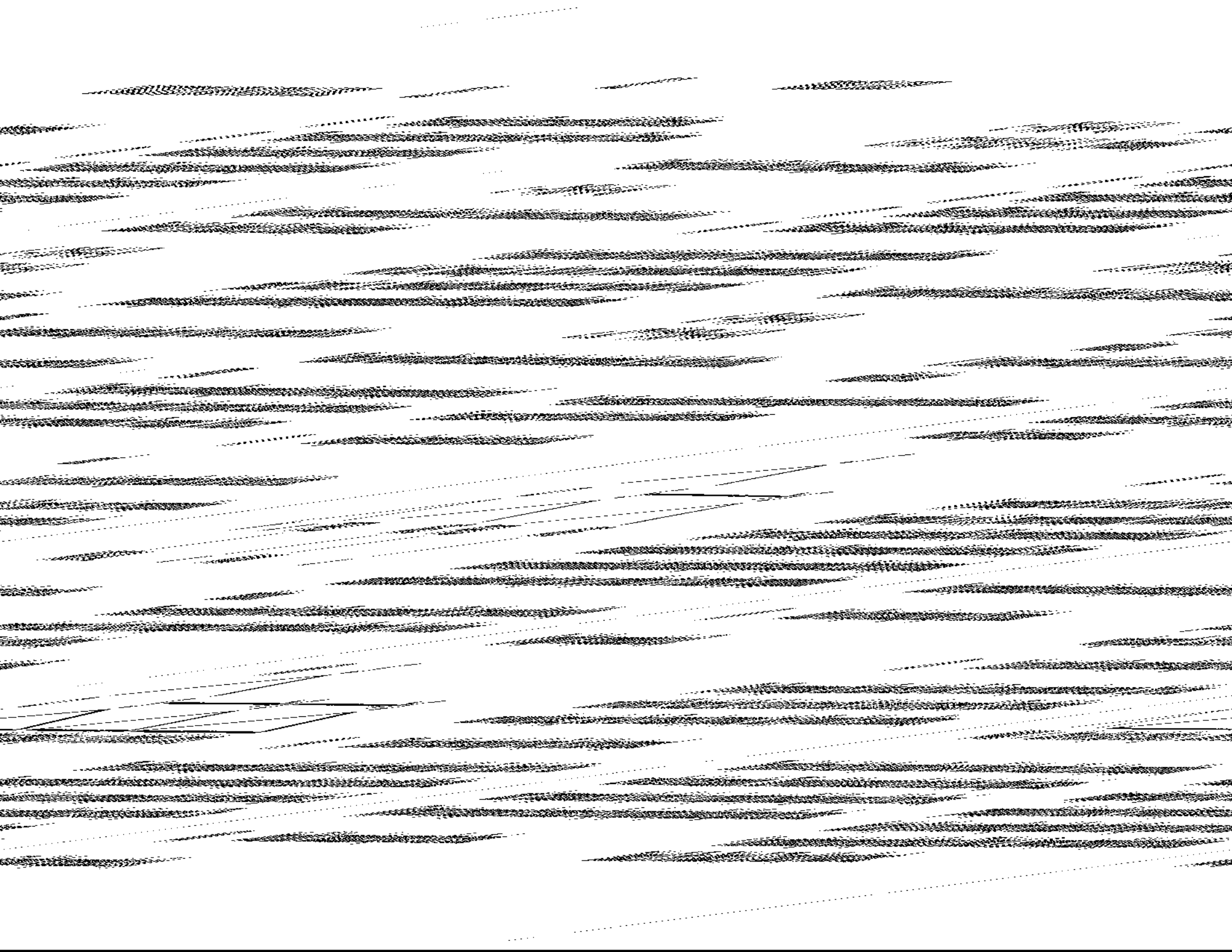
The assignment coordinate will have to assign a value corresponding to the speaker for person variables, since the speaker would presumably be in the worlds in question. The same for the audience. If times are assigned to time variables by the assignment coordinate, presumably the time of the utterance 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 analyis 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.

Section V

[1] The felicity conditions governing successful speech acts are special cases.

[2] This notation is introduced purely as a device to keep track of what is going on. It is not meant to have any theoretical significance. I take the term 'presupposition' as meaning what must be true in order for the sentence to be either true or false.

[2a] Unfortunately, this account of qualifications is by no means adequate. A brief look at qualifications in the case of definite descriptions will verify this.



[6] I have found that there is some dialect variation in the following examples which would indicate that, at least for some speakers, there are further complicating grammatical factors at work here. The examples given here are from my own speech, though I have found that a goodly number of other speakers agree with my judgments in these cases. In any event, the dialect variation is irrelevant to the argument at hand, since it is an existence argument. That is, if there exists a dialect where these phenomena hold, rules must be given for that dialect. The question is whether those rules involve natural logic equivalences.

[6a] It has been suggested to me that LEAVE OPEN is a possible candidate for BLIK in (24). I disagree. Just because one does not claim S, one need not be leaving open the possibility that ~S. One may fail to claim something, for example, because one thinks it is obviously true, or because to do so would be impolite, even though everyone knows it is the case. To my knowledge, there is still no candidate for BLIK.

[7] In the face of such difficult cases as

(i) *You should*n't* make Sue believe that I would*n't* rather go.

which should be equivalent to a positive according to (19)–(22), Baker and Horn have proposed an alternate conjecture that a sentence of the form

(ii) BELIEVE (*x*, WOULD RATHER (S))

be deducible from the sentence in question. ('*x*' would be identical to the subject of the next-highest verb of saying or thinking above 'would rather'). This, of course, requires deducibility in some system of logic, presumably a natural logic. Moreover, even under this conjecture, one would have to assume the equivalences of (19)–(22) and rule out (24)–(25). Baker's revised conjecture appears in (Baker, 1970a).

Section VII

[1] At the 1970 La Jolla Conference on English syntax, David Perlmutter provided a further argument in favor of this proposal. Take sentences of the form:

(1) ____ came to ____'s senses.

The two occurrences of ____ must be coreferential:

(2) *I* came to *my* senses.
(3) *Sam* came to *his* senses.
(4) **Sam* came to *my* senses.
(5) **I* came to *his* senses.

We might account for this by principle I:

(I) The idiom 'come to ____'s senses' requires that the pronoun filling the blank be coreferential with the subject of 'come'.

Now consider the idiom:

(6) ____ brought ____ to ____'s senses.

Here a pronoun filling the third blank must be coreferential to the noun phrase filling the second blank.

(7) *I* brought *Sam* to *his* senses.
(8) **I* brought *Sam* to *my* senses.

If (6) is considered a separate idiom from (1), we would need principle (II).

(II) The idiom 'bring____ to ____'s senses' requires that the pronoun filling the last blank be coreferential to the object of 'bring'.

However, if we accept the Binnick-Fillmore proposal, (6) will not be a separate idiom but will be analysed into (9).

(9) ____ CAUSE (____ come to ____'s senses).

In this way, (6) is reduced to (1), and we have no need for principle II. Instead, principle I will suffice for both cases. In this case, lexical decomposition permits one to state a true linguistic generalization, which could not be otherwise stated.

[8] The matter of which phonological shapes correspond to which atomic or molecular predicates is highly language-specific. Only in the case of borrowings, or closely related languages, or in a rare accident will the same atomic or molecular predicate have the same phonological shape. One of the points of postulating logical forms is to provide a *language-independent* characterization of meanings and meaning-relations. Presumably, the concepts characterized by atomic predicates are language-independent, and of the more primitive ones, many will be universal; those that are not will be culture-specific, rather than language specific. (It should be recalled that the question of whether a language has a word for a concept is distinct from the question of whether the members of a culture share the concept itself).

[9] The distribution of adverbials provides more evidence in favor of lexical decomposition.

(1) Nixon had persuaded the nation, until he invaded Cambodia, that he was serious about ending the war.
(2) Nixon nearly persuaded Harry that he was serious about ending the war.

'Persuade' in (1) means 'CAUSE to COME to BELIEVE' (see (5b) above). The *until*-clause in (1) modifies BELIEVE, not CAUSE to COME to BELIEVE. (1) means only that the nation believed that Nixon was serious about ending the war until he invaded Cambodia, not that he repeatedly persuaded them until that time. Similarly, (2) can mean that Nixon brought it about that Harry nearly believed that he was serious about ending the war. If adverbial modification is to be represented in logical form, then 'persuade' must be decomposable in some fashion such as (5b) above.

[10] It should be noted that this is not an ad hoc constraint, imposed just to make things work out. Such a constraint would follow from independently needed constraints on possible lexical items. For discussion of such constraints, see Horn, in preparation.

Section VIII

[1] (1a) will be a theorem rather than a postulate, if the postulate

CERTAIN (S) ⊃ S

is accepted.

[1a] In saying that if something is certain, then it is possible, I am speaking only of

logical relations, not of what it is appropriate to say in a given situation where I know that something is certain. For example, suppose that I am testifying as a trial and I know that it is certain that Collins was the killer, then it would be misleading for me to *say* that it is possible that Collins is the killer, even though that proposition is consistent with what I know. Grice has, I believe, given an essentially correct account of what is going on in this example. According to his Cooperative Principle (Grice, 1968), it is assumed in conversation that one gives all of the relevant information. In the above case, we are in violation of this principle (or at least, of one of its maxims). According to Grice's account, if I *say* that S is possible, then it is conversationally implicated (Grice's term) on the assumption that I am obeying the cooperative principle, that S is not certain. As Grice observes, conversational implicatures are quite distinct from logical relations between propositions such as implication. In the examples below, I am concerned only the logical relations, not with conversational implicatures.

[2] We are here evading the problems involved in working out the details, in this matter as well as in others, because they are irrelevant to the point being made in this section.

[2a] In all of the examples to follow, I will be discussing only what Baker calls the 'nonspecific' reading of 'a fish', 'a girl', etc. In this reading, one can qualify 'a fish' by 'some fish or other', not by 'the one we were just talking about'.

[3] (6b) can be made grammatical by adding 'if he finds one', since then the certainty will be relative to those worlds in which Sam finds a girl. On the other hand, the addition of 'regardless' or 'in any event' will reinforce the ungrammaticality of (6b), as would be expected.

[4] The noun phrase 'The girl that it is certain that he will find' presupposes 'It is certain that he will find a girl'. Since preceding conjoined sentences act like presuppositions, (7) reduces to (7'), which reduces to (6).

[5] As in (6b), (10b) becomes grammatical if 'if you find one' is added, but remains ungrammatical if 'in any event' or 'regardless' is added. See footnote 3 above.

[6] As is well-known, *believe* is non-intensional in the sense that the intension of the whole is not a function of the intension of its parts, since one may not believe distant logical consequences of one's conscious beliefs. Thus, strictly speaking, one should not be able to use a possible world semantics for *believe*. However, if principle (8) is correct then a possible world semantics will be necessary due to the facts of (15) and (17) below. My feeling is that we should extend the normal concept of a possible world semantics to handle *believe* to permit impossible worlds. Instead of a world being equivalent to a maximal consistent set of sentences, certain types of inconsistency might be permitted, and the set of sentences limited to a nonmaximal set. For a system in which this is done, see Tinnon, in preparation.

Inconsistent beliefs pose problems, but no more so for *believe* than for, say, *order*, a generally tamer modal operator. Inconsistent beliefs, such as (i) are paralleled by impossible orders such as (ii).

(i) Sam believes that he'll find a round square.
(ii) I order you to find a round square.

If *order* is to have a semantics along the lines given in (Chellas, 1969), where, corresponding to each order, there is a set of 'possible' worlds in which the order is carried out, this cannot be the null set in cases like (ii), since the following sentences have different meanings and, so require different truth conditions.

(iii) I order you to find a round square, sell it, and give me the profits.
(iv) I order you to find a round square, sell it, and give the profits to charity.

Both orders are impossible to carry out, but they are different orders. It should be noted incidentally that the same problem arises in the case of definite descriptions. Does (v) denote a 'possible individual'?

(v) The man who found a round square.

Do (vi) and (vii) denote different possible individuals?

(vi) The man who found a round square, sold it, and kept the profits.
(vii) The man who found a round square, sold it, and gave the profits to charity.

It seems to me that it might make sense to speak of the man in (vi) as being selfish and of the man in (vii) as being charitable, if such men could exist. Be this as it may, the problem of inconsistent beliefs is no worse than problems encountered elsewhere.

[7] With respect to the claim that *may* could never be a lexical representation for atomic predicates POSSIBLE and REQUIRE, Guy Carden has brought to my attention the following citation in the OED:

Law. In the interpretation of statutes, *may* = *shall* or *must*. 1728.
'For *may* in the Case of a public Officer is tantamount to *shall*'. 1728.

Carden also cites cases where a master says to a servant 'You may go', which can be a command, not a simple granting of permission. The issue raised is whether such cases constitute evidence against the claim that *may* can never be a lexical representation for atomic predicates POSSIBLE and REQUIRE. I think the answer is no. The above cases seem to me to arise from certain culture-specific conversational laws. In many cultures, including many British and American subcultures, politeness and civility require that persons with the power to give orders 'soften' them whenever possible. When a schoolteacher says 'It would be nice if you opened the window, Johnny', she is giving a softened order, not just making a statement about one of the things that would be nice. But this does not mean that the logical form of 'it would be nice if S' is 'ORDER (I, you, S)'. It simply means that certain cultures have conversational laws, whereby a statement as to what would give the speaker pleasure is to be construed in certain situations as a request or command to do what is necessary to bring that about. Similarly, certain cultures have conversational laws whereby the granting of permission under certain circumstances is to be construed as a command. When a master says 'you may go' to his servant, he is giving an order without literally giving an order, and such 'restraint' is taken to indicate civility and deference to one's servants. After all, 'You may go' is the order of a genteel master, not of a barbarian. In such cultures, it would be appropriate for a servant to reply 'Thank you, sir' to 'You may go', though not to 'Get out of here'. In the former case, he would be recognizing the master's deference to him, while in the latter case he would either be making a sardonic remark or showing masochism. It is interesting that the case cited by the OED involves 'a public Officer', that is, a constable, sheriff, etc. The above quotation actually puts in writing the content of the implicature. It specifies that when a constable says 'You may stand aside', that is to be taken as an order, punishable by law if you violate it. It should be clear that the cases cited by Carden involve culture-specific conversational implicatures, and so are irrelevant to the claim made above.

Section IX–A

[1] For a fuller discussion see (Lakoff, in press).
[2] Thus there are different inferences that can be drawn from (7a) and (7b). For instance, it does not follow from (7b) that Sam sliced any bagel carefully. He may have done a careless job on all to them. This is not true of (7a). Consequently, (7b) is compatible with

a. Sam sliced some of the bagels carelessly.

while (7a) is not compatible with (a).

Section IX–B

[1] It should be noted that 'fascinating' and 'interesting' also act like universal and existential quantifiers with respect to Horn's hypothesis that qualifying expressions must go in the direction of greater universality.
Compare

(i) a. Some students are striking, if not all.
b. *All students are striking, if not some.
(ii) a. That claim is interesting, if not fascinating.
b. *That claim is fascinating, if not interesting.

Section IX–C

[1] For a discussion of propositional functions of the form (2), see (Jeffrey, 1967, p. 130ff).

Section IX–D

[1] I am assuming here the concept of 'counterpart' as discussed in (Lewis, 1968).

Section IX–E

[1] These facts were discovered by McCawley and myself.

Section IX–F

[1] This technique is discussed at length in David Kaplan's 'What is Russell's Theory of Definite Descriptions?' UCLA mimeo, 1967. A technique of this sort was discussed earlier in Lambert, 1962.
[2] Such sentences were first brought to my attention by Donald Forman.

Section X

[1] Actually, Scott's notion of logical elegance in some cases is reminiscent of the linguist's notion of a significant generalization. For example, Scott (1967) defines a general binding operator, β (for quantifiers and description operators), and a general equivalence predicate, e (for $\leftrightarrow$ and $=$), so that he can state a single general axiom for substitution of identicals that will apply to both terms and formulas.