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THE TREATMENT OF QUANTIFIER SCOPE IN A TRANSFORMATIONAL GRAMMAR

by

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A dissertation submitted to the Graduate Faculty in Linguistics in Partial Fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

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ABSTRACT

This study investigates the syntactic and semantic parameters of scope assignment for two interacting quantifiers. Chapter one gives a review of the treatment of quantifier scope to date, both from a traditional logical perspective and from the perspective of transformational generative grammar. Various approaches to the representation of scope ambiguities and preferred readings are examined and compared, and an alternate model is suggested.

Chapter two defines a formal semantics for quantifier scope. In particular, it expands the formal semantic model developed in Keenan (1972). A new group semantics is formulated to account for the collective readings permitted by certain predicates. Justification is attempted of both a group/individual dichotomy and a wide-scope/narrow-scope dichotomy in the semantics. The remainder of the chapter is devoted to an investigation of the semantics of specificity.

Chapters three and four examine natural language sentences exhibiting quantifier scope interactions in order to ascertain the linguistic factors which are influential in determining the actual scope interpretations assigned to a sentence on its permitted readings. Chapter three treats two quantifiers interacting in a clause-mate relationship as members of the same simplex S at the surface level. Relative order at the surface is shown to be insignificant in ascertaining preferred or possible readings. The grammatical relations of the interacting noun phrases, as well as the inherent characteristics of the quantifiers, are the relevant parameters of scope assignment. Their universality is established through data collected from fifteen different languages.

Chapter four discusses two quantifiers interacting in an aysmmetric command relation where one quantifier commands the other at the surface level.

Deep structure command relations are shown to be more relevant predictors of scope assignment in such sentences than surface structure command. A considerable portion of the chapter is devoted to a justification of the standard theory analyses of complement sentences, for they are capable of offering an explanation of the data. In particular, a *tough*-movement analysis is argued for over a *tough*-deletion analysis. The chapter concludes with a lengthy discussion of the semantics of quantifier scope in complement sentences, to explain why the preferred readings occur as they do.

In the final chapter I conclude that the linguistic parameters of quantifier scope such as deep and surface command and the grammatical relations of noun phrases contribute to speaker preference in choosing one logically possible scope interpretation over another, but these parameters do not play a role in determining what scope readings are logically possible. A type of perceptual strategy is suggested capable of utilizing the relevant linguistic parameters in order to correctly determine judgments of ambiguity and preference. The final grammatical model developed is one in which all the known logically possible interpretations of a sentence are realized syntactically as alternate deep structures. Each of these is semantically interpreted. Some deep structures will be shown to be logically equivalent to others by the semantics. The number of readings actually perceived by a given native speaker will be determined at the pragmatic level.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter I

Introduction

Section 1: The General Problem

> "When two operators of the same sort occur, their order can be reversed. However, when two different operators occur, a reversal of their order will change the meaning of the expression." (Reichenbach, 1947:p. 101)

This quotation from Reichenbach embodies the central issue of the present study. Until very recently, Reichenbach's claims have gone unchallanged. The purpose of this study is first, to demonstrate that whenever the two operators are natural language quantifiers, both of the above assumptions are incorrect; and second, to determine exactly what the principles are that underlie the semantic behavior of two interacting quantifiers in natural language. With respect to quantifiers, Reichenbach can be said to have made the following two fundamental assertions:

> Assertion 1: If the order of two semantically identical quantifiers is reversed, there will be no change in the meaning of an expression.
>
> Assertion II: If the order of two semantically different quantifiers is reversed, there will be a change in the meaning of an expression.

The two assertions can be illustrated by examples of the following sort:

(1) a. Every dancer in the company learned their basics from a Russian instructor.

b. A Russian instructor taught every dancer in the company their basics.

(2) a. A real estate agent sold the worthless land to a

young couple.

b. A young couple bought the worthless land from a real estate agent.

The claim is that the two sentences of example (1) will not be paraphrases because the order of the quantifiers *every* and *a* was reversed and the two quantifiers are not semantically identical. On the other hand, the two sentences of example (2) will be paraphrastic since two identical quantifiers, *a* and *a* were reversed. The non-synonymy of sentences (1a and b) is manifest in the interpretation of the phrase *a Russian instructor*. Sentence (1a) is said to be making a claim about a possibly different instructor for each dancer, while sentence (1b) is said to be asserting something about one particular instructor in reference to a set of dancers.

It is my contention that the propositions put forth by Reichenbach are incorrect;[1] that is, that it is not always the case that: 1) the meaning of an expression is held constant when two semantically identical quantifiers reverse their order, or that: 2) a reversal in the order of two semantically different quantifiers will consistently result in a change in meaning.

Section 2: A Definition of Quantifier Scope

We speak of the changes affecting the interpretation of a quantified noun phrase as a matter of *scope* variation. Scope refers to the range of effect that a logical element, such as a quantifier, has on the remaining members of a sentence. Exactly how is the scope of a quantifier determined? Consider the following sentence.[2]

(3) Jane knows mathematics.

Jane is a linguistic unit called a *name* because it picks out an object.

In sentence (3) a property is attributed to Jane, namely, that of knowing mathematics. This property functions logically as a *predicate* in sentence (3) and the name *Jane* is referred to as its *argument*. The object referred to by the argument must be in the *extension* of the predicate for the sentence to be considered true. What if we wished to generalize sentence (3) and to attribute the property of knowing mathematics to a number of objects? Then we must express the sentence using quantifiers. Quantifiers are linguistic units which serve to indicate the amount of objects one is talking about. To attribute a property to a number of objects, we first attribute it to some arbitrary pronoun, say *she:*

(4) She knows mathematics.

Then we decide what proportion or how many members of some predetermined set we will generalize the statement to. Suppose the set we are talking about is the set of all women. If we wish to say that every member of the set has the property in question, then we use a universal quantifier:

(5) Every woman is such that she knows mathematics.

This statement is formally represented by replacing the argument pronoun in (5) by a variable and substituting for the phrase "every woman is such that" a quantifying expression which indicates the appropriate amount, in this case "$\forall x$". The quantifying expression is associated with the correct argument by matching the index on the quantifier with the argument variable. The predicate can be abbreviated to some arbitrary higher case letter.

(6) $\forall x\ (Kx)$

An expression which contains a variable with no quantifier operating on it is referred to as a *open sentence*, and the variable is said to occur *free* in it. An expression of this type cannot be assigned a truth

value. Once a quantifying expression is added to the open sentence, it *binds* the variable and serves to close the sentence, if there are no other free variables in the sentence and if the index on the quantifier matches the variable. The scope of the quantifier is the open sentence over which it ranges.

We arrive at a semantic interpretation of a quantified sentence by determining under what conditions the sentence is true. A quantified sentence is true just in case the correct number of objects specified by the quantifier, with respect to the domain of discourse, satisfies the open sentence. By satisfy we mean that the name of any one of the objects could be substituted for the variable in the open sentence and the result would represent a true state of affairs. The result of each substitution event is referred to as an *instance* of the complete expression. Consider sentence (5) above. After having selected the set of women, we examine each member of the set to determine if the open sentence is true of her; that is, to see if the property of knowing mathematics applies to her. If each member of the set is in the extension of the predicate, then the sentence is satisfied.

Sometimes a sentence contains two quantified expressions. One of them is then said to distribute over or have higher scope than the other. The quantifier with lower or inside scope is part of the open sentence over which the higher quantifier distributes. Therefore it will be interpreted in the instantiation of each member of the set specified by the higher quantified expression. In the following sentence:

(7) Each of my sisters has three children.

there are two quantified expression: *each of my sisters* and *three children*. One of them, *each of my sisters*, has to be interpreted with higher scope. Therefore, to each member of the set designated by it we ascribe the

property of having three children. The second quantified expression, *three children*, is part of the open sentence which the set of my sisters satisfies. The sentence can be represented as follows:

(8) (Each of my sisters x) ((three children y) (x have y))

Sentence (7) only makes sense if the quantified expression, *each of my sisters*, is interrpeted with wide scope. Some sentences, however, can be meaningful when either quantifier is given wide scope. These sentences are interpreted ambiguously, with a different set of truth conditions assigned to each scope ordering. An example exhibiting this type of semantics is the following sentence:

(9) All the rabbits are digging a hole.

Sentence (9) has two different paraphrases and therefore two sets of truth conditions. If the noun phrase quantified by *all* receives higher scope, then each rabbit digs its own hole. The following sentence is a paraphrase of this reading.

(10) Each of the rabbits is such that it is digging a separate hole.

The reading which ensues when the indefinitely quantified expression is assigned higher scope has the rabbits digging a single hole as a joint effort. A paraphrase which captures this interpretation is given in (11).

(11) There is one hole which is such that all the rabbits are digging it together.

Section 3: Logical versus Structural Ambiguity

The ambiguity which is exhibited by a sentence such as (9) I will refer to as a logical ambiguity. An ambiguity of this type is quite different from a structural ambiguity of the sort found in the following sentences:

(12) a. Visiting professors can be boring.

b. Elfrida Fallowfield despises turnips more than Winston.

Within transformational grammer structural ambiguities differ from logical ambiguities in two respects. First of all, they result from syntactic factors. For example, sentences (12a) and (12b) are each the products of two different derivations which are generated from distinct deep structures. In sentence (12a) we can interpret *professors* as either the underlying subject or object of *visiting*. What can be boring is either professors who are visiting somewhere or for someone to visit professors. Sentence (12b) may result from a deletion of either a [subject + verb] pair in an underlying complement of the form: *Elfrida Fallowfield despises Winston*, or a [verb + object] pair in an underlying complement of the form: *Winston despises turnips*.

There is no independent justification in transformational grammar to associate logical ambiguities with distinct syntactic descriptions. Within the theory it is possible to limit the syntax of a grammar to a representation of the immediate constituents of a sentence and to their grammatical and structural relations. In this respect, there are no syntactic factors, neither underlying nor superficial, which distinguish one reading of a logically ambiguous sentence from another. A sentence such as (9) has the same syntactic description for each reading at every level. Regardless of which quantifier is assigned higher scope, *rabbits* will still function as the deep and surface subject and *hole* will function as the deep and surface object. One can certainly choose to represent scope differences by a structural difference reflecting the order of the two quantifiers, but, as stated above, there does not appear to be any independent justification within the theory to treat these differences

in the syntactic component. In fact, to do so in the ways suggested so far in generative grammar, we must violate the apparent constituent structure of the sentence. Thus, a linguist constructing a grammatical model is faced with the problem of deciding at what point logical ambiguities are best expressed in the optimal grammar. Several alternatives are available and these will be discussed as we proceed.

A second difference between logical and structural ambiguities can be demonstrated. A native speaker's intuitions tend to be clear about structural ambiguities which can be associated with semantic differences; that is, with different sets of truth conditions. They are not so clear concerning logical ambiguities. A semantically ambiguous sentence which is assigned two different constituent structures at the surface will be acknowledged to be ambiguous by any native speaker, even though she has not perceived the ambiguity immediately. Once the ambiguity is pointed out, the native speaker will have no difficulty perceiving it thereafter. Though one reading may be more salient, native speakers will admit that both readings are possible when they are made clear. Take, for example, the following sentence:

(13) The baby felt good after its bath.

Most speakers, if questioned, would probably claim that the sentence was unambiguous, expressing only the idea that the baby was in a happy mood. That is, *baby* would be perceived as an underlying subject of *felt*. However, once the second meaning - that of someone touching the baby, where *baby* functions as underlying object - is pointed out, no native speaker can fail to acknowledge this as a valid interpretation.

Logical ambiguities do not enjoy such clear intuitions. Often native speakers will be undecided as to whether two interpretations are possible for a sentence containing multiple quantification (or two

operators of any sort). At certain times it may seem that the sentence can convey two meanings, and at other times, only one reading is deemed permissible. And we find a substantial amount of variation from speaker to speaker. Some speakers will claim to perceive an ambiguity in a sentence where a logical ambiguity is possible. Other speakers will insist that the sentence has only one reading. Because judgements are so hazy in this area, it is difficult for a linguist to make precise decisions about the range of meanings exhibited by sentences containing multiple logical operators and often conflicting data are used to support different theoretical approaches to logical ambiguities.

Section 4: The Treatment of Quantifier Scope in Transformational Grammar

A. The Standard Theory Approach

Let us examine the different approaches which have been proposed to handle quantifier scope ambiguities. In transformational generative grammar, the first mention of scope ambiguities occurs in Chomsky (1957: pp.100-1). At this stage in the development of the theory, Chomsky rejects meaning as a basis of grammatical description. Instead of "intuition about meaning", linguistic analyses are to be formulated using "intuition about linguistic form." As an illustration Chomsky cites the active-passive relationship. He observes that certain selectional dependencies obtain between an active sentence and its passive counterpart, but in reverse order. These dependencies are not semantically defined, but rather they are defined in terms of linguistic form; that is, in terms of which linear sequences are permitted in the language and which ones are excluded. To demonstrate that the active-passive pair cannot be related by synonomy, he cites an active-passive pair containing two quantifiers which are not semantically identical.

(14) Everyone in the room knows at least two languages.

(15) At least two languages are known by everyone in the room.

Chomsky states that under "normal interpretation" (14) may be true while (15) is false: for example, if each person in (15) knows two different languages, rather than everyone knowing the same two. The observed meaning changes accompanying scope differences function only to exclude semantics from a grammatical description at this stage of the theory. Scope differences occurring in transformationally related sentences are to be ignored since they are outside the realm of linguistic concern.

The *Syntactic Structures* model of Chomsky (1957) later developed into what is called the standard theory (ST), detailed in Chomsky (1965) and Katz and Postal (1964). One change from the earlier formulation is that a semantic theory has been incorporated into the model. Chomsky (1965) discusses the same active-passive pair which figured in his (1957) remarks, examples (14) and (15), above. The discussion occurs in a footnote (no.9: p.224) in reference to an assumption made in the main text that "the semantic interpretation of a sentence depends only on its lexical items and the grammatical functions and relations represented in the underlying structures in which they appear." (p.136). From this it follows that transformations should preserve meaning. At this stage of transformational grammar, meaning is essential to linguistic analysis. Therefore, the fact that transformations which apply to quantified noun phrases can effect a meaning change must be contended with. In this footnote Chomsky gives additional insights into the analysis of the pair (14) and (15) above. For him, they are still non-synonymous, but he maintains that each sentence has a "latent" interpretation - one identical to the predominant interpretation of the other sentence.

Although he is not clear on what is meant by latent, it can perhaps be construed to mean that each sentence is ambiguous, with one of the two readings being strongly preferred over the other. Chomsky stresses that the semantics of (14) and (15) do not invalidate his assumptions concerning the input to semantic interpretation. On the contrary, they give it additional support. The fact that sentences (14) and (15) have two interpretations (one apparent and one "latent") and that the same two interpretations are shared by both transformationally related sentences indicates that the semantic component must assign the same range of meanings to the two surface structures. Therefore, if they are given identical deep structures, they would automatically be assigned the same set of semantic interpretations. According to Chomsky's *Aspects* position, "extraneous" surface factors serve to filter out one of the two interpretations allowed by the deep structure. We see here that a single deep structure which underlies certain sentences containing two quantifiers must be constructed in such a way as to permit two interpretations by the semantic component. On this view, the logical ambiguity which is exhibited by a sentence like (14) or (15) is not to be represented by two distinct derivations. The ambiguity is to be constructed by the semantics from a single underlying structure. Chomsky does not offer or suggest any mechanism, formal or otherwise, which would accomplish this.

Katz and Postal (1964) come to identical conclusions in their discussion of sentences (14) and (15) above. They also argue that the active and passive versions of multiply quantified sentences are completely paraphrastic, exhibiting the same range of meanings. The deep structure of either sentence must be interpreted in such a way as to permit both readings. They do not suggest that one of the two

readings may be "latent" due to some extraneous surface factors, as does Chomsky. Although many aspects of semantic interpretation are formalized in this work, an analysis of the semantic interpretation of scope relations is not presented. One difference between the Chomsky and Katz and Postal discussions of this pair of sentences is that Katz and Postal deny that the theory requires them to be synonymous since their deep structures differ by the presence of a passive trigger in the configuration underlying (15). However, because this node dominates dummy elements, it should not contribute to the meaning; therefore, the two sentences should be assigned the same set of interpretations.

B. Problems for the Standard Theory Approach

After the completion of these two works, work in linguistic theory began to develop in many directions. No longer was any one theory adhered to by all transformational linguists, as was the case when the standard theory prevailed. Many of the doubts which were raised concerning the standard theory grew out of the analysis of data focusing on the logical properties of language, among them those concerning the semantic behavior of quantifiers. When noun phrases were quantified, transformations which deleted or pronominalized one of two coreferent noun phrases tended to alter the meaning assigned to the underlying phrase marker. Transformations like the one referred to above which permuted one of two quantified noun phrases could also alter meaning. Partee (1971) discusses some of the problematic sentences and their implications for linguistic theory. There were two types of quantified sentences which caused difficulty, each necessitating different approaches to a solution.

i. The multiple occurrences of quantifiers in a sentence may

all be coreferential. When one occurrence was deleted or pronominalized by a ST transformation, the resulting surface structure appeared to convey a different meaning from the one assigned to its deep structure by the semantic interpretation. Sample sentences fitting this description are the (a) sentences below. The corresponding (b) sentences represent the type of underlying structure that they would be derived from. It is clear that the (a) sentences could be true and the (b) sentences false. The two members of each pair must be assigned different truth conditions.

(16) a. Every amoeba can reproduce itself.

b. Every amoeba can reproduce every amoeba.

(17) a. All members of our Future Homemakers of America club want to be successful career women.

b. All the members of our Future Homemakers of America club want all the members of our Future Homemakers of America club to be successful career women.

ii. The multiple occurrences of quantifiers may be nonidentical. A ST transformation had the ability of rearranging the structural configuration in such a way that the resulting configuration required a new semantic interpretation. In most cases the relative order of the quantifiers was affected, but a change in structure could affect the grammatical relations or the command hierarchy without modifying the linear order of the quantifiers. Three semantic shifts were possible.

(a) An underlying structure which was assigned a logically ambiguous interpretation in ST may have been judged unambiguous after one or more rearranging transformations

had applied.

(b) An underlying structure which was unambiguously interpreted in ST, having been assigned one of two (or more) possible scope interpretations, may, after the application of one or more transformations, be judged ambiguous with both interpretations permitted.

(c) The type of semantically interpreted underlying structure given in (b) may still be judged unambiguous at the surface, but a previously impossible scope interpretation now prevails.

The following diagrams illustrate the three possibilities ($i \neq j$):

(a) Ambiguity $\Longrightarrow$ Non-ambiguity

$$\begin{array}{ccc} DS & \Longrightarrow & \{SI_i, SI_j\} \\ \Big\Downarrow \{T\} & & \\ SS & \Longrightarrow & SI_i \ \overline{v} \ SI_j \end{array}$$

(b) Non-ambiguity $\Longrightarrow$ Ambiguity

$$\begin{array}{ccc} DS & \Longrightarrow & SI_i \\ \Big\Downarrow \{T\} & & \\ SS & \Longrightarrow & \{SI_i, SI_j\} \end{array}$$

(c) $\text{Non-ambiguity}_i \Longrightarrow \text{Non-ambiguity}_j$

$$\begin{array}{ccc} DS & \Longrightarrow & SI_i \\ \Big\Downarrow \{T\} & & \\ SS & \Longrightarrow & SI_j \end{array}$$

The following sentences were considered by critics of the standard theory to be problematic in the ways described in conditions (a), (b) and (c).

(a) Jackendoff (1972:pp.305-6)

i. Some of the boys told me a story.

ii. A story was told to me by some of the boys.

(i) is the ambiguous ST source for the allegedly unambiguous (ii).

(b) Jackendoff (op.cit.)

i. A boy told me some of the stories.

ii. Some of the stories were told to me by a boy.

(i) is the allegedly unambiguous ST source for ambiguous (ii)

(c) Lakoff (1971:p.238)

i. Many men read few books.

ii. Few books are read by many men.

(i) is the ST source for (ii), but it is claimed that (i) and (ii) are each assigned different interpretations.

C. Some Possible Solutions

A number of possible solutions could be worked out to save the standard theory. In the first area of difficulty, that of coreferential quantified NP's, a single solution which successfully salvages the ST in one problematic area, seems capable of being generalized in a systematic way to the other structures causing difficulty. One could imagine a workable solution which replaced in the deep structure all but one of the fully specified coreferential NP's with either a pronoun, a variable or an indexed dummy element. This will not guarantee a problem-free set of interpretation rules, but it will insure that the same rules apply to both quantified and unquantified coreferential NP's to give systematic readings in all cases. Possible deep structures following these

suggestions for (16a) and (17a) above would resemble the strings given in (18) and (19).

(18) Every amoeba$_i$ can reproduce Δ_i.

(19) All the women in our Future Homemakers of America club$_i$ want Δ_i to be successful career women.

Surface structures which were identical in meaning to (16b) and (17b) above would continue to have sequences of this type as their underlying structures.

A transformational rule which deletes or pronominalizes would need to be restrained so as to prevent its application to noun phrases which were lexically identical but non-coreferential. Of course, the more difficult problem of how to correctly state the semantic interpretation rules so that they assign the correct readings to structures like (18) and (19) remains.

There does not seem to be any one solution that can be generalized to all the problematic cases of the second type, that of multiple occurrences of non-identical quantifiers. Katz (1972) attempts to redeem the standard theory by formulating just such a solution. His discussion centers around a set of sentences exhibiting an interaction between a quantified NP and a negative element, but he generalizes the solution to the interaction of all logical operators. In an earlier work (1964) he and Postal had stated that the active and passive versions of a doubly quantified sentence were fully synonymous; therefore, the presence of a dummy passive element in the structure underlying the passive version should not lead to a different interpretation. And the fact that it doesn't follows from the requirement that dummy elements contribute nothing to the interpretation. The passive element in the underlying structure is required only to trigger the passive transformation, thereby

rendering the transformation obligatory, rather than optional. In the (1972) work, Katz changes his position vis à vis the semantic contribution made by the passive marker (pp. 435ff). All deep structure elements which function to make a transformation obligatory will carry semantic information. And that information in the case of the passive marker will be just what is needed to construct the appropriate scope relations between the two logical operators. This information will be functional in those cases where the passive transformation effects a change in logical interpretation. Katz admits that the theory still lacks the appropriate lexical reading for "Passive" which would state the correct scope relations between logical elements for the various types of passive sentences.

This type of solution will not work for all cases. There are a number of transformational rules which are optional, among them several movement and restructuring rules. Often they are able to change the scope interpretation assigned to a sentence. Dative shift is a rule which is usually considered optional. Both Jackendoff and Lakoff claim that a quantified sentence where dative shift has applied is not synonymous with the non-transformed version. Jackendoff cites the following two sentences (1972:p.307)

(20) a. I told three of the stories to many men.

b. I told many of the men three of the stories.

Lakoff gives very similar examples involving PP-shift (1962:p.241).

(21) a. John talked to few girls about many problems.

b. John talked about many problems to few girls.

Jackendoff and Lakoff both maintain that their sentence pairs are non-synonymous. However, they have different intuitions about the nature of the interpretations assigned to them. Jackendoff insists that

both (20a) and (b) are ambiguous, but each has a meaning it does not share with the other. Both of them have a reading in which one group of men hears a total of three stories. The two sentences supposedly differ in that (20a) has a second reading where there are many groups of men, each group hearing a single story. The second reading of (20b) is interpreted to mean that each of many men in a single group hears three stories which are not necessarily the same for each. Lakoff maintains that sentences like those in (20) and (21) are unambiguous. Each sentence should have only one meaning and it differs from that of the other member of the pair. According to him, only sentence (21a) can be paraphrased by (22).

(22) There are few girls who John talked to about many problems.

and only sentence (21b) can be paraphrased by (23).

(23) There are many problems which John talked about to few girls.

Lakoff does not attempt to explain the semantic differences in (21a) and (b) by offering disparate sets of truth conditions; hence we must for the present trust his intuitions concerning the meaning difference espoused for (22) and (23).

If it is true that optional transformations have the affect of producing a meaning change, then what recourse is open to a linguist wishing to preserve the standard theory hypothesis that all meaning is determined from the deep structure? The most obvious adjustment to the theory would be to require that all transformations be obligatory. At the time of semantic interpretation, information would be available to indicate what the final shape of the sentence would be. Every deep structure that would be transformed would contain a marker to signal

each rule application. Such transformational triggers would then contain the necessary information to insure the correct interpretation of the logical operators. To justify the modification as more than an ad hoc device, one must present independent syntactic evidence to motivate its introduction into the base component, as well as giving a clear idea of how the addition of a trigger is capable of producing the correct semantic results.

However, it seems that formalization of the proper generalization may be difficult to accomplish. *Tough*-movement is a rule which can cause a meaning change when logical elements are involved. This rule raises an embedded object NP into the matrix subject position.[3] It seems that the rule does not systematically result in a novel interpretation. The possibility of changing the semantic reading depends on the nature of the logical operators that are affected. In example (24) below the (a) and (b) sentences appear to have identical meanings. However, in example (25), there is felt to be a shift in meaning when the (a) sentence is transformed into the (b) version.

(24) a. It is hard for every cellist to play a violin sonata.

b. A violin sonata is hard for every cellist to play.

(25) a. It is hard for a cellist to play every violin sonata.

b. Every violin sonata is hard for a cellist to play.

Sentences (24a) and (b) appear to be true under the same conditions where all violin sonatas are compositions which cellists have trouble playing. Its synonymy can be contrasted to the (a) and (b) sentences of (25), where each sentence requires a different set of truth conditions. Sentence (25a) states that, given some set of violin sonatas, a cellist

would have difficulty playing every one of then, although it might be the case that she or he could play a large number with ease. For sentence (25b) to be true each violin sonata must have the property of being difficult for a cellist to play; none of them would be easy. If a *tough*-movement trigger is developed, it would need to be supplied with information concerning the behavior of each combination of operators that could be semantically affected as a result of the permutation. Such a statement would be cumbersome, at the very least.

There is another alternative which might be employed to save the standard theory hypothesis concerning the preservation of meaning throughout the derivation. It is a suggestion which was alluded to by Chomsky in the *Aspects* footnote cited earlier. This alternative would permit an optional transformation to make an apparent change in meaning. The interpretation would continue to be constructed from the underlying phrase marker. A change in meaning is then attributed to "extraneous" surface factors which are perceptual in essence and therefore part of a theory of performance. A well defined set of perceptual strategies would be required to explain why the surface structure deviated from the semantics assigned to the deep structure. Otherwise this approach would be a vacuous artifice. One could assign a semantic interpretation randomly to a given deep structure and then claim that the surface string did not reflect this interpretation only because some yet to be discovered perceptual strategy resulted in a divergent reading.

For either modification of the standard theory to be seriously considered much more research has to be carried out to determine the range of factors which influence the various ambiguous and unambiguous scope interpretations. Until these facts are known, one cannot predict what kind of effect a given restructuring transformation will have on

the interpretation of logical elements. Therefore, the proper generalizations, required either to state the lexical content of a deep structure trigger, or to formulate the proper perceptual strategies, cannot be stated.

D. Solutions within Generative Semantics and Interpretive Semantics

Neither of the alternatives just described was adopted by the critics of the standard theory. Instead they chose other modifications of the theory to accomodate the problematic sentences. There were two main revisionist trends, referred to as generative semantics and interpretive semantics. The generative semanticists wished to retain in the theory the hypothesis that transformations were meaning preserving. They questioned instead the assumption implicit in Chomsky (1957,1965) and Katz and Postal (1964) that a logically ambiguous sentence is to be assigned only one underlying representation, which then receives two interpretations. They viewed a logically ambiguous sentence in the same light as one that is structurally ambiguous. Both required two deep structures, one for each interpretation. However, logically ambiguous sentences are problematic in a way that distinguishes them from structural ambiguities. The ambiguity of a sentence due to structural factors is predictable from the structural information available. Any string manifesting certain structural properties in its surface phrase marker is consistently judged ambiguous in the same way. In the standard theory if two syntactically distinct underlying structures are transformed into identical surface structures, then the result is an ambiguous sentence. The problem with sentences containing multiple logical operators is the fact that so far linguists

know of no way to systematically predict when that string will be ambiguous. A sentence containing two operators is capable of being derived from two logically distinct generative semantics underlying structures, each one bearing a different interpretation, whether or not it is an ambiguous sentence.

To guarantee that the correct logical representations are paired with their proper surface phrase markers, generative semanticists developed a system of global derivational constraints which match underlying structures with the appropriate surface structures. These constraints are defined on surface factors which generative semanticists believe reliably determine the logical interpretation. Two essential surface features are command and precedence (i.e. linear order) relations.[4] The first of these applies to operators located in different surface clauses and the second to clause mates. Using these global constraints, generative semanticists could ensure that each sentence containing logical operators was represented by the correct underlying structures. These underlying configurations, in turn, were to be constructed in such a way that they permitted the necessary semantic interpretation for each sentence. The form of the generative semantics underlying structures and an articulation of the global derivational constraints are found in G. Lakoff (1971).

The interpretive semanticists felt it was more correct to distinguish underlying structures by syntactic factors alone. Semantic distinctions which had no syntactic justification were not to be used to determine classes of deep structures. The interpretativists preferred to deal with the problems arising from the logical properties of a sentence by abandoning the requirement that all meaning be determined from the deep structure phrase marker. Chomsky, in a 1971 paper, argues that certain aspects of semantic interpretation can only be determined from

a consideration of surface level information. Grammatical and structural aspects of meaning continue to be represented at the deep level. With reference to the logical properties of a sentence, if a single ST deep structure underlies two surface versions, each with a distinct logical interpretation, the derivation need not be modified. Those semantic properties which distinguished the two versions can be determined from the surface phrase marker. Likewise, if a single ST deep structure resulted in a surface structure which was logically ambiguous, the information needed to determine the two readings could be obtained from the surface alone. The rules for the surface interpretation of logical elements are worked out in Jackendoff (1972). These rules, like the derivational constraints of generative semantics, are defined on two structural properties of the surface tree, that of command for operators in different surface clauses and precedence for operators in a clause mate relation.

Even with their revisions, both generative semanticists and interpretive semanticists had difficulty giving an adequate analysis of quantified sentences. Specific shortcomings of their treatment of quantifier scope will be discussed below in Chapters 3 and 4. The principle cause of the theories' inadequacy is the lack of workable hypotheses to systematically predict the correct analysis of any randomly selected quantified sentence. Within the generative semantics framework this is an especially troublesome weakness. Proponents of this theory make no distinction between syntactic factors and semantic factors. Therefore underlying structures become semantic structures. All the relevant syntactic and semantic information which contributes to the meaning of a sentence must necessarily be represented in the deep level. There is no interpretive mechanism to construct the semantic

representation. Instead the grammar generates the semantic representation of a sentence by means of a system of rules specifying conditions of well-formedness. It is crucial to the theory then that the underlying phrase marker represent the exact and complete semantics of its surface structure on any given reading. Since the derivation begins with the semantic representation, there can be no filtering devices or adjustment rules to modify a semantic representation which is not quite accurate. Consequently, because the syntax and the semantics have been fused into one level, the grammatical description cannot overgeneralize on one level and compensate for it at another to enable the derivation to capture the relevant generalizations.

We will see that the rules to accurately predict scope readings may be too complex to incorporate into just one level. Both the standard theory and the extended standard theory advocated in Chomsky (1971) interpret the semantics from syntactic descriptions; therefore the two theories have more flexibility in the manner in which they can incorporate new generalizations concerning scope readings into the grammar.[5] All the current theories require more accurate descriptions of the regularities operating in scope assignment in order to give the correct logical interpretation to sentences. It is the aim of this study to examine and refine the principles of scope interpretation as they pertain to the interaction of two quantifiers. A framework will be suggested in which the generalizations may be utilized to give the proper interpretation to the sentences in question. Of course, the principles which are worked out can be employed by any theory to perfect their treatment of quantifier scope.

E. Logically Based Models

Two innovative approaches to the theory of grammar permitted

quantificational structures to receive a more extensive analysis and thereby encouraged more research into the refinement of quantificational semantics. These theories assigned descriptions to the sentences of the language via a grammar comprising a syntactic component combined with a model theoretic semantics. The two grammatical models were developed independently by Montague (1970,1973) and Keenan (1972). With respect to the treatment of the logical properties of a sentence, these two theories stand somewhere between the approach taken by the standard theory and that of generative semantics.

Both Montague grammar (MG) and Keenan's semantically based grammar (KG) retain the standard theory separation of syntax and semantics. However, their syntax is not motivated independently of the semantics. The formal properties of the syntax are ascertained according to two criteria. The syntax must be structurally motivated to enable it to derive the surface sentences of the language, and in addition, it must be constructed according to the needs of the semantic interpretation. Therefore, every element occurring in the syntax must be semantically relevant; that is, it must play a role in the interpretation. In standard theory, underlying syntactic structures are converted into semantic representations before semantic interpretation takes place. In MG and KG the syntactic structures can serve as the semantic representations. As a result, an integral part of the syntax of both MG and KG is a definition of the logical properties of the surface sentence. It naturally follows then that a sentence will be assigned at least as many syntactic representations as there are logical interpretations for it. In this respect MG and KG are closer to generative semantics than to the standard theory. A sentence of the language which is logically ambiguous will have two (or more) derivations. However, neither MG nor KG have worked out the rules of mapping which

guarantee that each surface sentence is assigned all and only the correct number of derivations, based on the internal logical properties of the sentence. It is left to the native speaker's or the linguist's intuitions to determine what the possible logical interpretations of a given sentence are. After this has been decided, the grammars of both theories have the mechanisms to assign a description and set of truth conditions to each interpretation, for quite a large class of sentences.[6]

The syntactic component of Montague grammar departs radically from the standard theory in some of its central aspects. The standard theory defines levels of description and distinct sets of rules generate the structures which are relevant to each level. Every derivation consists of a deep structure phrase marker generated by the set of phrase structure rules and a surface structure phrase marker produced by the set of transformational rules. The semantic component obtains the necessary structural information from the structural configuration representing the deep structure level. MG has only one set of syntactic rules and therefore only one descriptive level. There are no intermediate stages which are structurally relevant. The semantic rules of MG do not operate on the structural output of the syntactic rules. Every syntactic rule must have a corresponding semantic interpretation rule which indicates the meaning of the whole as a function of the meaning of the parts. Derivations are distinguished from one another by differences in the type and order of rule application. And it is these differences which indicate changes in semantic interpretation.

Keenan's semantically based grammar adheres more closely to the organizational framework of the standard theory. The syntax is made up of two distinct levels, one deep and one superficial. Each level is the product

of a different system of rules. The deep structure configurations comprise the class of well-formed formulae specified by a set of recursive definitions. Semantic interpretation is made from the structures which have been defined by the recursive difinitions. These deep structures are, in turn, mapped into the actual sentences of the language by a set of transformational rules. A major difference between KG and the standard theory lies in the treatment of logical ambiguities. Whereas the standard theory would assign only one underlying syntactic structure to a sentence that was logically ambiguous, the KG would derive it from two underlying representations. As was noted above, KG makes no provisions for predicting the actual reading of a sentence. These have to be determined by the intuitions of the speaker rather than by the rules of grammar.

It may seem as if KG is a type of generative semantics grammar. But there are many points of departure which serve to distinguish KG from generative semantics. Most important, KG has a well developed model theoretic semantics defined over the semantically based class of syntactic deep structures. This requires that the deep structures be specifically designed to meet the needs of the interpretive component. Hence, given two competing underlying formalisms to represent some arbitrary property of the language, it is the form of the rules determining the truth conditions, rather than intuitions about meaning, paraphrase relation, etc., that choose between them. If the proper set of truth conditions can be determined using one formalism, but not another, then the former is selected over the latter.

Generative semantics has not developed the rules of interpretation, so they justify one derivation over another using other means. The result has been that generative semantics underlying structures are very abstract.

The vocabulary over which the well-formed trees are defined contains only three non-terminal members: a noun phrase, a verb, and a sentence. These three elements were originally intended to correspond to the argument, predicate and proposition concepts of first order logic. Generative semantics makes no distinction in its underlying structures between elements which function as sentential operators in standard logic and those which function as predicates. In natural language sentences not only are these categories differentiated syntactically by their distributional properties, but predicates are further subdivided into syntactically distinguishable elements such as verb, common noun and adjective. Keenan's semantically based grammar assigns operators, common nouns and verbs to different grammatical categories at the deep level. Moreover, operators are further classified according to the syntax of their operands. Quantifiers, for example, are distinguished from the other operators by their binding property. The result is that the syntactic description assigned to a sentence on a given interpretation at the deep level resembles much more closely the surface description than it does in generative semantics.

Because KG closely adheres to the basic tenents of transformational generative grammar, and in addition, has developed the formal mechanisms necessary to a rigorous investigation of quantificational semantics, it is this model that will be employed in the present study, both to explicate the data and as a framework into which the resulting hypotheses will be incorporated. Using the Keenan model, this study will attempt to ascertain what parameters operate to determine the relative scope interpretations of two interacting quantifiers and to develop a workable grammatical model incorporating these parameters. Chapter two of the study will define the semantics of quantifier scope. Chapters three and four will investigate

quantifier interactions in various syntactic configurations - chapter three concentrating on quantifiers which occur as clause mates, and chapter four presenting quantifiers in an asymmetric command relation. The concluding chapter will suggest and develop a framework by which scope semantics can be correctly assigned. In the model we present, a distinct deep syntactic description is assigned to a sentence to represent all the known logically possible interpretations. If a sentence permits three logically possible interpretations, then it will be assigned three underlying structures regardless of how many interpretations it actually receives. Each of these deep structures will then be interpreted by the semantics and the sentence will be assigned a set of readings, one for each deep structure. A well defined set of perceptual strategies will determine whether all the logically possible readings actually occur, and further when certain of these readings will be more salient than others. Therefore, the grammar will overgenerate readings in many cases, although it will never undergenerate. The perceptual strategies then serve as output filters to guarantee that the proper set of readings results. The model we propose will retain certain essential features of the standard theory; namely, all semantic interpretation will be possible from the underlying phrase marker. However, this will be defined on syntactic as well as semantic criteria.

Footnotes

1. These claims, although stated explicity by Reichenbach, are by no means restricted to him alone. They are implicit assumptions which follow from all first order logics, beginning with those of Pierce and Frege. Recent investigations treating the logic of natural language are beginning to question some of these basic assumptions. Quine (1960:pp.138 ff) gives evidence which implicitly disproves Assertion II while the work of Bennett (1972) and Dahl (1973) leads to a rejection of Assertion I. We will give additional evidence against these claims in the chapters to follow. It is important, however, to note that traditional logic only defined two quantifiers, the universal and the existential. It is these two quantifiers that Reichenbach considers, and his assertions are quite valid for these operators. When the class of quantifiers is expanded to include those found in natural language, Reichenbach's claims can no longer be supported.

2. The system I am describing is one of extensional logic. A semantic analysis employing an intensional logic would determine quantifier scope in a different way.

3. There is another analysis of *tough*-movement which claims that the rule is actually a deletion rule. I will argue in Charter 4 that a raising analysis is actually the correct one.

4. Other features such as intonation and context are influential in determining scope assignment. But the studies mentioned so far and my own work deal only with the syntactic factors which affect scope readings.

5. Kroch (1974) has indeed recommended that the extended standard theory employ adjustments of the type we have just alluded to. According to his account, basic principles of scope interpretation operate to assign a logical representation to a given surface structure. Then semantic reinterpretation rules change the initial scope representations if certain environments require it. Output filters also operate on the initial assignments to rule out the readings assigned by basic principles that do not actually exist.

6. The semantics of Montague grammar and Kennan grammar differ in that Montague uses an intensional logic, while Kennan uses an extensional logic.

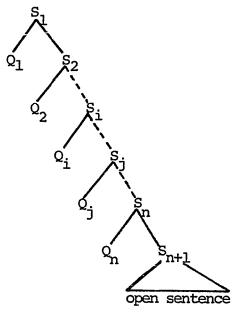
Chapter II

The Semantics of Quantifier Scope

Section 1: The Treatment of Quantified Noun Phrases in Keenan Grammar

At this point it is necessary to give a formal semantic analysis of the various possible scope ambiguities which manifest themselves in quantified sentences. Since these ambiguities result from changes in scope assignment, we must define precisely what it means for a quantified noun phrase to be assigned higher scope. As noted earlier, the Keenan model will be used as a basis for our analysis. In Keenan grammar (KG), the underlying phrase marker distinguishes between open sentences and quantified sentences. Well-formed open sentences are S's in the deep structure that have substituted a pronominal index for any quantified noun phrase (Q). Quantified sentences are formed by combining Q with any well-formed S, provided that the pronominal index on Q occurs free in S. The structure used to indicate that some quantified noun phrase (Q_i) has higher scope over another (Q_j) is shown in (1):

(1)



or: $(Q_1\ (Q_2\ (\ldots Q_i\ (\ldots Q_j\ (\ldots Q_n\ (S_{n+1}))_{S_n}\ \ldots)_{S_j}\ \ldots)_{S_i} \ldots)_{S_2})_{S_1}$

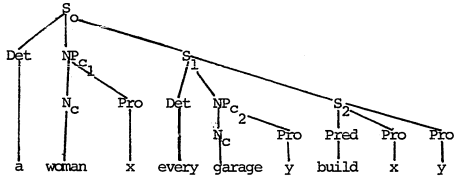
Semantically, 'Q_i has higher scope over Q_j' means that S_{i+1} (which contains Q_j) will be interpreted as an instance for every member of the set designated by Q_i. As an example, consider the following sentence:

(2) A woman built every garage.

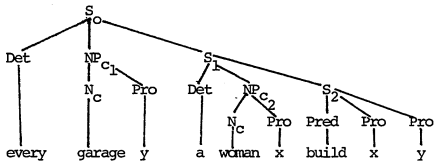
If the quantified noun phrase *every garage* is given higher scope than *a woman*, then the open sentence *a woman built y* applies to each member in the set sepcified by *every garage* in the interpretation, and there can be as many women as there are garages. In on the other hand, the quantified noun phrase *every garage* is read with lower scope than *a woman*, then it will be contained in the open sentence *x built every garage* which is interpreted for each member of the set *a woman* (in this case just one member). Each time the open sentence applies in the latter reading the set of garages is referred to as a group. Because on this reading there is only one member in the set of women, the open sentence applies once giving us one set of garages.

The acutal deep structures for the two scope readings of sentence (2) take the following form in KG (tense is not represented in these diagrams).[1]

(3)



(4)



Phrase marker (3) underlies sentence (2) on the wide scope reading of *a woman*. Phrase marker (4) underlies the narrow scope reading of *a woman* in sentence (2). The semantics of KG gives a definition of truth to phrase markers (3) and (4) as follows. We interpret the highest quantifier and its open sentence first.[2] The reading of (2) represented by phrase marker (3) is true in an arbitrary interpretation i just in case for the triple (a, NP_{C_1}, S_1), conditions (a) and (b) both hold,

(a) NP_C is interpreted as a non-empty set, B.

(b) S is true in i for at least one member of B.

and for the triple (every, NP_{C_2}, S_2) condition (a) above holds as well as condition (c)

(c) S is true in i of each member of B.

If either or both conditions (b) and (c) fail, sentence (2) is false in i on that reading. In all other cases the reading is assigned a third value zero. To assign a truth value to the second reading we interpret the triple (every, NP_{C_2}, S_2) of phrase marker (4) first to determine whether condition (a) and (c) both hold for it in some interpretation i. Then we determine the truth value of the triple (a, NP_{C_2}, S_2) according to conditions (a) and (b) above. In order for sentence (2) to be assigned the value true on some interpretation it must be case that the two conditions defined above for

each quantifier hold in reference to both quantified noun phrases.

Not all ambiguities involving quantifiers are the result of scope changes. There are many other factors which can affect the semantic interpretation of quantified sentences. Although the major concern of the present study is the problem of defining the linguistic parameters which contribute to the determination of scope assignment, it will aid our investigation if we examine other kinds of ambiguity in quantified sentences and attempt to establish the criteria which distinguish them from those causing scope ambiguities.

Section 2: The Syntax and Semantics of Group Quantification

In KG, scope relationships are characterized syntactically by the relative structural arrangement of the quantified noun phrases in the underlying tree.[3] The quantified NP interpreted with highest scope is the one which asymmetrically commands the others at the deep level. Suppose a surface structure contained two quantified noun phrases. Using asymmetric command relationships we are able to represent two interpretations of its quantificational semantics, but no more. Given two surface quantifiers, Q_x and Q_y either Q_x would asymmetrically command Q_y in the underlying structure, or Q_y would asymmetrically command Q_x; each configuration expressing a different reading of the sentence. Relative structural arrangements yield exactly n factorial meaning representations given n quantifiers at the surface.

If a sentence has two quantifiers, and is actually three ways ambiguous with respect to its quantificational semantics, the structural relationships of KG offer no way of representing one of the possible meanings. Consider, for example, the following sentence:

(5) All the comrades sang a victory song.

Sentence (5) has three distinct readings. The most salient reading seems to

to be one which portrays the comrades singing together a particular victory song. Therefore, there is one song and one singing event. If the victory song referred to on this reading happened to be written, say, as a fugue for four voices, then of no individual comrade could it be claimed that she sang a victory song, for she would only have sung part of it. A second reading is one in which the comrades sing one particular song, but not as a group. Here, there is one song, but there may be as many singing events as there are comrades. On the third reading, not only are the singing events possibly distinct, but there may be a different song for every comrade, as well. Let us summarize the three readings of sentence (5).

(i) one object / one event

(ii) one object / possibly many events

(iii) possibly many objects / possibly many events

Our semantic rules of quantifier interpretation as defined above permit us to express only two of the three readings, (ii) and (iii), for we have no way of stating that the quantified NP, *all the comrades*, is to be interpreted as a group predicated of a single event.[4] When the truth conditions are applied to the structural configuration (all, NP_c, S), a true interpretation results just in case S is true independently for every member of the set specified by NP_c. More specifically, if the name of every member of NP_c were substituted for the proper pro-name in S, the result would represent a true state of affairs. But, as we have explained earlier, when the predicate expresses a single event, it may not be the case that the substitution of any name in NP_c would satisfy the open sentence. The syntactic and semantic rules of KG must be expanded to allow for a group interpretation of a quantified noun phrase.

To begin, let us consider what syntactic changes will be necessary in order to accomodate the group reading. First we must expand the basic

vocabulary from one to two denumerable sets of pro-names. The original formulation contained one such set, specified as: x',y',x",y" ...(Keenan, 1972:p.454). These are pro-names representing individuals. The new class of pro-names will represent groups and are specified as: X',Y',X",Y" ... Next we expand the set of predicates to include three classes: those subcategorized for individual arguments, those subcategorized for group arguments, and those subcategorized for both.

The changes to be made in the semantics relate essentially to the interpreting function f_i. First we expand the definition of an interpretation i of L from a six-tuple to a seven-tuple by adding the power set over the set of discourse names N_i in i, P_{N_i}. Then we define f_i for both the group pro-names in P_{u_i} and the group discourse names in P_{N_i}. Next we define the extension of NP's made up of a noun plus a group pro-name.

With respect to each atomic predicate symbol P of degree m (degree referring to the fixed number of arguments a predicate may have) f_i tells us which m-tuples over the universe of discourse u_i can be in the extension of the predicate. Where formerly our m-tuples were specified over the universe of discourse, we expand the semantics to allow their specification over the power set P_{u_i}.

With respect to atomic sentences f_i defines the set of truth conditions which determine the facts of presupposition in the language. We must expand the definition of truth to include truth conditions for sentences expressing group quantification. Any natural language quantified NP denoting an amount greater than one is capable of being interpreted as a group noun phrase (with the exception of the distributive universal, *each*). Because KG has only defined the semantics of universal and natural number quantifiers in this class for the individual reading, I will restrict my analyses to open sentences quantified by one of these two types. The definition of truth

for the group universal is most simple. Consider a sentence like (6) below on a group interpretation of *every girl scout*, where building the fire is considered a joint effort.

(6) Every girl scout built the fire.

The sentence is true just in case there is a group of individuals that built the fire such that its members comprise all the girl scouts. It is false if a group so defined did not built the fire and zero valued otherwise. Notice that to determine the truth value of such a sentence one need not know if anyone else participated in the act.

The conditions for a true interpretation are fairly similar for natural numbers, but the conditions for a false interpretation are enlarged. There are three ways a sentence like (7) could fail to be true.

(7) Three men finished the beer.

It could be assigned a false interpretation if 1) the three men didn't actually finish the beer, 2) not all three of the people who finished the beer were men - one might have been a woman, or 3) the number of men in the group that finished the beer was not exactly three, that is, say, if (8) below were really the case.

(8) Two men finished the beer.

We now proceed to a formalization of the group syntax and semantics.

New Syntax and Semantics for a Group Interpretation[5]

Syntax:

For each natural number m, we have arbitrarily many predicates of degree m. Each such predicate P is subcategorized as $P_{\alpha_1\alpha_2\cdots\alpha_n}$ where each α_j is in the symbol set {I, G, I/G}.

e.g.: P_I, P_G, $P_{I/G}$

Categories: I = individual pro-names, x',y',x",y" ....

G = group pro-names, X',Y',X",Y" .....

Semantics:

An interpretation i of L is a seven-tuple $(u_i, N_i, L_i, P_{N_i}, PN_i, \{t,f,z\}, f_i)$. u_i is any nonempty set, called the universe of discourse of the interpretation i. N_i is a set of symbols called discourse names having the same cardinality as u_i and having no symbols in common with the basic vocabulary of L. L_i is the set of sentences obtained by adding N_i as a new category symbol to L and allowing them to occur in the pro-name positions of atomic sentences. P_{N_i} is the power set over N_i. PN_i is an arbitrary subset of the proper names of L. {t,f,z} is a set of three truth values, read as *true, false,* and *zero* respectively.[6] f_i is any function which meets, in addition to the original 12 conditions in Keenan (1972), the following conditions:

(1) For each group pro-name X, $f_i(X)$ is a member of P_{u_i}.

(2) For each group discourse name G, $f_i(G)$ is a member of P_{u_i} such that

(a) for all H, H' in P_{N_i}, $f_i(H) = f_i(H')$ iff H and H' name the same set, and

(b) for each $A \in P_{u_i}$ there is a G in P_{N_i} such that $f_i(G) = A$.

(3) For each group common noun phrase:

(a) $f_i(N,X) = Ext_i(N)$

(b) $f_i(NP,S,Y) = f_i(NP) \cap \{f_i(G): f_i\ S^X_G = t\}$

(4) For each atomic predicate symbol P of degree m,

$f_i(P_{\alpha_1\alpha_2 \cdots \alpha_m}) \subseteq A_1 \times A_2 \times \ldots \times A_m$ where

(a) $A_j = u_i$ if $\alpha_j = I$

(b) $A_j = P_{u_i}$ if $\alpha_j = G$

(c) $A_j = u_i \cup P_{u_i}$ if $\alpha_j = I/G$

(5) For each group universally quantified sentence (every, NP, S) where NP is understood to be a group common noun phrase in X:

f_i(every, NP, S) = t iff there is a G such that

(a) $f_i(G) \neq \Lambda$

(b) for all a ε u_i, f_i(a is a NP) = t iff f_i(a) ε f_i(G)

(c) $f_i(S^X_G)$ = t

f_i(every, NP, S) = f iff

(a) and (b) above hold

(c) $f_i(S^X_G)$ = f

f_i(every, NP, S) = z otherwise

(6) For each group natural number quantified sentence (R, NP, S) where R is understood to represent a natural number and NP is understood to be a group common noun phrase in X:

f_i(R, NP, S) = t iff there is a G such that

(a) $f_i(\overline{\overline{G}})$ = R

(b) for all a ε f_i(G), f_i(a is a NP) = t

(c) $f_i(S^X_G)$ = t

f_i(R, NP, S) = f iff one of the following three conditions obtains:

(i) (a) and (b) as above

(c) $f_i(S^X_G)$ = f

(ii) (a) as above

(b) for some a ε f_i(G), f_i(a is a NP) = f

(c) as above

(iii) (a) $f_i(\overline{\overline{G}})$ = m, (m $\neq$ R)

(b) and (c) as above

f_i(R, NP, S) = z otherwise

In the syntactic derivation the group and individual readings will be distinguished only by the types of pro-names which occur. Otherwise, the

underlying trees are the same for each. It is from this difference in pro-name occurrence that the different semantic interpretations are obtained.

The ambiguities which manifest themselves in sentences permitting a group reading, such as (5) above, are not always the same in each instance. The differences arise from three factors:

(i) The number of quantified noun phrases in a given sentence.

(ii) The type of quantifier occurring in each noun phrase position.

(iii) The nature of the verb.

According to an analysis put forth by Bennett (1972:58ff), the maximum number of readings a sentence containing two quantifiers can receive in terms of its quantificational semantics is seven. This will be the case with any verb which permits both a group and an individual reading of its subject and some object noun phrase. *Visit* is such a verb. People can visit in a group or individually. Likewise, they can visit a group or individuals. Sentence (9) permits the seven possible readings.

(9) Three landlords visited five tenants.

Either quantified noun phrase can be given a group or individual interpretation, and either one may receive wide scope assignment. Therefore the sentence can have the following readings:[7]

(1) (three, landlord, X) (three, tenant, Y) (X visit Y)

3 landlords, 1 visit, 3 tenants

$\{L_1\ L_2\ L_3\} \longrightarrow \{T_1\ T_2\ T_3\}$

A group of three landlords makes a single visit to a group of three tenants.

(2) (three, landlord, X) (three, tenant, y) (X visit y)

3 landlords, 3 visits, 3 tenants

$\{L_1\ L_2\ L_3\} \Rightarrow T_1, T_2, T_3$

A group of three landlords visits three (different) tenants, one at a time.

(3) (three, tenant, y) (three, landlord, X) (X visit y)

9 landlords, 3 visits, 3 tenants

$\{L_1\ L_2\ L_3\} \longrightarrow T_1$

$\{L_4\ L_5\ L_6\} \longrightarrow T_2$

$\{L_7\ L_8\ L_9\} \longrightarrow T_3$

Three (different) groups of three landlords each visit one of three tenants.

(4) (three, landlord, x) (three, tenant, Y) (x visit Y)

3 landlords, 3 visits, 9 tenants

$L_1 \longrightarrow \{T_1\ T_2\ T_3\}$

$L_2 \longrightarrow \{T_4\ T_5\ T_6\}$

$L_3 \longrightarrow \{T_7\ T_8\ T_9\}$

Three separate landlords each visit a (different) group of three tenants.

(5) (three, tenant, Y) (three, landlord, x) (x visit Y)

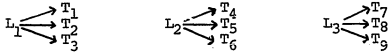
3 landlords, 3 visits, 3 tenants

$L_1, L_2, L_3 \Rightarrow \{T_1\ T_2\ T_3\}$

Three (different) landlords visit separately one group of three tenants.

(6) (three, landlord, x) (three, tenant, y) (x visit y)

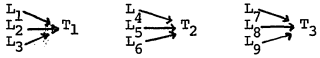
3 landlords, 9 visits, 9 tenants



Three separate landlords each visit three (different) tenants, one at a time.

(7) (three, tenant, y) (three, landlord, x) (x visit y)

9 landlords, 9 visits, 5 tenants



Three (different) landlords a piece individually visit each of three separate tenants.

The last two readings, numbers (6) and (7), represent the readings traditionally given by standard logic and also by the semantics of KG before the addition of the group semantics. They result from a reversal in scope order of two individually interpreted quantifiers. The semantics we have just discussed illustrate that the first half of Reichenbach's claim concerning the absence of semantic change when two identical quantifiers are reversed is invalid for natural language quantifiers.

It is obvious that to get a total of seven readings, both quantified noun phrases in the sentence being considered must be plural. If only one of the noun phrases is plural, the sentence will be at most three ways ambiguous with respect to its quantificational semantics, as can be seen in sentences (10) and (11) below.

(10) a. A doctor visited three patients.

b. Three patients visited a doctor.

A combination of any two plural quantified noun phrases will give the seven readings. The interacting quantifiers may be natural numbers or any of the vague natural language quantifiers like *many, several, a few,* etc. Sentence (11) permits the same range of interpretations as sentence (9).

(11) Several landlords visited many tenants.

One class of plural quantifiers is an exception to this generalizations: the class of universals. Because these quantifiers refer to the entire set of objects specified in the domain of discourse by the common noun, they cannot be interpreted as selecting possibly different subsets on each instantiation. Compare the following sentences as to their permissible number of readings.

(12) a. Two cats stalked three birds.

b. Two cats stalked all the birds.

Whereas in (12a) the set of birds stalked can be different for each cat, the sets must be identical in (12b). An interpretation where a non-universal plural quantifier which is interpreted individually is assigned wider scope over a group reading of a universal becomes logically equivalent to an interpretation in which the same universal is assigned wider scope, for

(two, cat, x) (every, bird, Y) (x stalk Y) $\equiv$ (every, bird, Y) (two, cat, x) (x stalk Y)

If the universal in (12b) receives narrow scope assignment and an individual interpretation, the cats must necessarily stalk the same set of birds. But, this reading is not equivalent to one where the scope assignment is reversed.

(two, cat, x) (every, bird, y) (x stalk y) $\not\equiv$ (every, bird, y) (two, cat, x) (x stalk y)

When both quantified noun phrases contain universal quantifiers, the number of non-equivalent readings possible drops to four; for in all cases, a reversal of the order of the quantifiers in the syntax has no semantic import.

There are many problems with an analysis which attributes seven readings

to sentence (9). As stated earlier, the properties of the verb help determine the number of possible readings. Ideally, each verb will be classified in the lexicon as to the types of pro-names permissible in argument positions. However, we are far from understanding all the complexities which govern the interaction of a given predicate with its arguments. Whether or not a verb permits certain quantificational semantics depends on many factors, several of which may be pragmatic in nature. Some of the predicted readings may never actually occur. This may be due to the fact that the verb is subcategorized for one or another type of argument, so that certain semantic readings will never be ascribed to it. Or, the unwanted readings, after having been assigned to the sentence by the semantics, can be filtered out by the pragmatic component because our knowledge of the world informs us that these readings are implausible. We can make a tentative classification of possible verb types and attempt to predict their semantics.

a) Certain verbs require individual subjects: *remember, breathe, sleep, dream, die, give birth, be red, be round, be dark,* etc.

b) Certain verbs require group subjects: *swarm, queue up, dwindle, congregate, mob, riot, be in a row, look alike, be a motley crew,* etc.

c) Certain verbs permit either group or individual subjects: *paint, watch, build, sing, lift, bury, move, be heavy, be attractive, be noisy,* etc.

c') Some verbs in this class require different syntactic frames for group and individual subjects: *meet, mix, kiss, embrace, marry, collide, thin, fill, share, be similar, gather, fit together,* etc.

d) Certain verbs require group objects: *sum, count, total, scatter, break up, disperse, compare,* etc.

e) Certain verbs require individual objects: *hit, kiss, shake hands with, touch, dust, clean, drink, swallow,* etc.

f) Certain verbs permit either group or individual objects: *talk to, see, watch, admire, hear, lock up, carry, transport, invite, sing, bury, play with, discover*, etc.

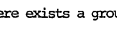
g) Certain verbs affect the existence of the referent of their objects: *build, bake, cook, compose, write, make, pick (a flower), dig, destroy, burn, cut up, eat, drink, swallow, devour*, etc. Such verbs do not permit readings in which the subject NPs receive both narrow scope assignment and an individual interpretation. Therefore, we cannot attribute to a sentence like (13) the interpretations paraphrased in (14) and (15). These readings are anomolous.

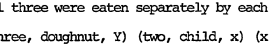
(13) Two children ate three doughnuts.

(14)*There exists a group of three doughnuts which is such that all three were eaten separately by each of two children.
(three, doughnut, Y) (two, child, x) (x eat Y)

(15)*Three doughnuts are such that each of them was eaten separately by each of two children.
(three, doughnut, y) (two, child, x) (x eat y)

These paraphrases are represented by the following diagrams:

(14') 

(15') 

Only five of the seven predicted readings are possible for sentences containing this type of verb. However, we must note that there is individual variation among speakers as to which verbs require the restriction stated in (g).

Some of the possible readings may be ruled out on pragmatic grounds. For

example, the verb-object relations in (16a) and (b) require the sentences to be used under different sets of circumstances.

(16) a. Three men ate two pies.

b. Three men ate two olives.

While sentence (16a) could be used to describe three men functioning as a group (i.e., sharing the pies), it would be very odd to attribute this interpretation to the subject noun phrase in (16b). Consequently, three of the seven possible readings of (16b) will be marked as strange or improbable by the pragmatics.

The major problem to be dealt with by those advocating seven distinct readings for sentences like (9) above is the fact that such sentences may permit more than seven readings.[8] Consider sentence (9) repeated again below.

(17) Three landlords visited three tenants.

The group landlord-individual tenant reading given as (2) in the seven readings above would still be considered true if the following situation were the case.

(a) landlord_1 and landlord_2 visited tenant_1.

(b) landlord_1 and landlord_3 visited tenant_2.

(c) all three landlords visited tenant_3.

That the group can be partitioned in many different ways and still give a true interpretation to a group reading is even more apparent in the following sentence.

(18) Four women carried the two sofas up six flights of stairs.

They could have divided up the task in any number of ways and a group reading of the sentence would still be an accurate description of the situation. Three of the women may have carried one and all four, the other, or they might have been divided into two and two, or they might have had relay teams so that no single woman carried any sofa up a total of six

flights. It is obvious that the groups can be partitioned into any possible combination in a true interpretation. The group reading is vague and the semantics should reflect this fact. The open sentence is considered satisfied when the group as a whole, and not the individual members of it, is in the extension of the predicate.

Section 3: Justification of Group Semantics

It might occur to one that since the group reading is vague as to the permissible partitions to the extent that it can be partitioned into unit sets, then it seems unnecessary to have both a group and individual reading.[9] The individual instantiation of quantifiers that occurs in predicate calculus can easily be subsumed under the group reading. The group reading permits all possible combinations of its members on a true interpretation. Such an approach would account for many of the problems associated with the group/individual dichotomy, most especially that of defining what constitutes an event, for this concept seems to be central to an understanding of the group semantics. The difficulties involved in making this notion precise become apparent from a consideration of sentence (19) below. The sentence is given three readings in a semantics containing both group and individual quantification.

(19) Three rabbits washed a rock.

The three readings are spelled out as follows:

(a) They all could have washed a different rock.

(three, rabbit, x) (a, rock, y) (x wash y)

(b) They could have all washed the same rock at different times.

(a, rock, y) (three, rabbit, x) (x wash y)

(c) They could have all washed the same rock together.

(three, rabbit, X) (a, rock, y) (X wash y)

The problem is one of ascertaining how far apart the washings must be on the (b) reading for them to be considered separate events so as to be distinguished from the (c) reading. If the three rabbits are sitting and watching each other take turns washing a rock, should this be considered an individual reading, for after all, the rabbits are in a group? Wouldn't it make more sense to treat this situation logically in the same way as one would treat a group partition of the rabbits washing in turns of two and one, a previously acknowledged division of the group reading? Is there a logically well-motivated reason for assigning one logic to the 2-1 partition, and another to the 1-1-1 partition?

It might be argued that a distinction should be maintained between individual and group semantics on the grounds that certain verbs have restrictions prohibiting one or another reading in one of their argument positions. Consider the following sentence:

(20) Twenty-five people filled the bathroom.

There is a reading of the sentence where it can be considered true if the filling is done by two groups of 10 and 15, or five groups of five. But certainly it can't be considered true if it is done by a series of twenty-five individuals, one at a time. Therefore, no matter how the group reading of (20) is partitioned, it cannot be partitioned into unit sets. An even better case can be made with sentence (21) below.

(21) Francine's six children look alike.

Sentence (21) can only be true if the group is not partitioned at all. All the children must be in a look alike relation with each of the others. In contrast, sentence (22) requires that the plural noun phrase necessarily be partitioned into individuals.

(22) All sound sleepers dream a lot.

It seems odd to require of a semantics, given only one reading of the plural, that the truth conditions be stated so as to render a sentence true on some partitions but false on others. Though sentences of this type present strong evidence for a dichotomy between the group and individual reading, they do not offer conclusive evidence. Opponents of a dichotomy can maintain that purely pragmatic factors rule out certain partitions in the case of a particular verb.

There is, however, a semantically well-motivated reason for maintaining the distinction between group and individual readings. No matter to what extent the partitions of a group reading render it semantically similar to a related individual reading, the truth conditions for the two must remain distinct. One very important criterion separates the semantics of the group reading from the semantics of the individual reading. On the group reading, regardless of the type of partition, the predicate need not be true of every member of the set. What must be the case is that the group, as a well-defined unit, be in the extension of the predicate. However, the individual reading is true if and only if every member of the set is in the extension of the predicate. Consider the two readings of the following sentence.

(23) Seven of my friends painted the mural.

Ignoring the difficult problem of defining what constitutes an individual painting event, we can observe the above mentioned difference in the characterization of its truth conditions for the two types of semantics. Sentence (23) is true on the group reading if one of the friends happens not to have painted at all, but perhaps was responsible for buying the paints and mixing the colors. The individual reading admits of no exceptions. All seven friends must have contributed to the actual painting. Because of this very distinct difference in the semantics of the group and individual readings, the two must be kept separate.

Notice, however, that the group semantics of symmetric predicates requires special treatment, for, in general, these predicates do not admit of exceptions either, as (24) illustrates.

(24) All of the pieces fit together.

Sentence (24) is false if one or more pieces don't participate in the fitting relation. The truth conditions for these predicates must specify some type of total involvement condition.[10]

Section 4: Justification of the Wide/Narrow Scope Distinction

In line with the suggestion discussed earlier for a reduction in the number of readings made possible by the group/individual dichotomy, several semanticists have suggested reducing the number of distinct readings produced through scope variation by eliminating the wide/narrow scope distinction in the semantics (Stenning [1975] and J. Katz [personal conversations]). Just as a group reading is vague to the extent that it can be partitioned into something akin to an individual reading, so certain relative scope orderings entail the reversed quantifier ordering. Consider the example given earlier:

(25) Three rabbits washed a rock.

We have already observed that the reading is vague with respect to a group reading of the subject noun phrase: they may wash a rock simultaneously or in various combinations. A similar vagueness is found on one of the scope orderings. A standard logical analysis would assign two readings to (25) paraphrased by (26) and (27).

(26) Three rabbits are such that each one washed a (different) rock.

(27) There exists a rock which is such that each of three rabbits washed it.

The paraphrase given in (27) implies a unique referent of the noun phrase *a rock*. This follows from the fact that *a rock* is assigned wide scope in

the semantics on that reading. In paraphrase (26) the referent of *a rock* may be different for each rabbit. This follows from the narrow scope reading of *a rock*. But they are not necessarily different rocks and herein lies the vagueness referred to earlier. The sentence would be true on this reading if all the rabbits happened to wash the same rock. It follows that the narrow scope reading of *a rock* is implied by the wide scope reading of *a rock*. Therefore, why should sentence (25) be considered ambiguous, and not just vague? If the sentence was assigned only one scope ordering, the weaker reading which is vague enough to be implied by the other ordering, then all possible combinations of rabbits and rocks would become available to the semantic interpretation. Can we find a principled reason for keeping the two scope readings disjoint? Is there any semantic factor which can be used to individuate the two scope orderings? Keenan (1974) discussed one important semantic difference between a wide and narrow scope reading of some quantified noun phrase Q_1 in relation to another Q_2. It relates to what Keenan has termed "the functional principle." When Q_1 is assigned lower scope than Q_2, then the choice of its referent may be a function of the referent of Q_2. However, when Q_1 has wider scope assignment than Q_2, its choice of referent must be determinable independently of the meaning or reference of Q_2. When we look back to our earlier example, sentence (25), if *a rock* is read with narrow scope, then its semantic determination may depend on the choice of rabbit. To identify the rock(s) being referred to by the sentence it may be first necessary to identify the set of rabbits in question. When *a rock* is read with wider scope, its identity must be stable independently of the choice of rabbit. And in the semantics the referent of rabbits may now be a function of the referent of rock. The independent motivation for adhering to a relative scope semantics is found in the semantic conditions used for determining the identity of a referent.

Section 5: The Semantics of Specificity

One additional factor which affects the semantic behavior of quantifiers remains to be investigated. Notice that the following sentence is ambiguous, although it contains only one quantifier.

(28) Melinda wants to buy a motorcycle.

It can be continued in either of two ways, reflecting the two possible interpretations.

(29) She will buy it tomorrow.

(30) She will buy one tomorrow.

The ambiguity manifest in sentence (28) centers on the indefinite noun phrase. If it is interpreted as naming a unique referent, then sentence (29) is an appropriate continuation, but not sentence (30). However, if the indefinite is construed as defining a class of objects, any member of which can satisfy the instantiation, then sentence (30), rather than sentence (29), is the appropriate response. If Melinda has a particular object in mind in sentence (28), the interpretation given to the indefinite is referred to as *specific*. If her intentions are to acquire a certain *type* of object, the interpretation given to the indefinite is referred to as *non-specific*.[11] Certain inferences follow on a specific reading which are invalid on a non-specific reading. On a specific reading of (28) we can infer the existence of the object referred to by the indefinite noun phrase. On this reading sentence (31) will be true.

(31) There is a particular motorcycle which Melinda wants to buy.

No existence claims follow from the non-specific reading; therefore, (31) is not a valid inference from (28) on this reading. Instead we can paraphrase the non-specific reading as:

(32) Melinda wants there to be a motorcycle that she can buy.

Ambiguities with reference to specificity occur independently of the

relative quantifier scope ambiguities discussed earlier. These ambiguities can occur in sentences containing only one quantifier. A definition of the environments which give rise to ambiguities involving specificity has been the subject of many studies,[12] perhaps the most extensive treatment being that of J.D. Fodor (1970).

Fodor argues convincingly that specificity is appropriately represented in the grammar through a variation in scope of the operator representing the indefinite. The non-specific reading arises when an indefinitely quantified noun phrase occurs inside what is called an opaque context. An opaque context is one which gives rise to invalid argumentation when certain inference rules, namely, existential generalization and substitution of identicals, are applied to noun phrases occurring inside the context. A class of predicates including *believe, want* and *intend*, and many operators, such as negation and modals, are among the factors which can create opaque contexts for indefinites.[13] Fodor demonstrates that a feature analysis whereby the noun phrase in question is marked [+specific] or [-specific], or any other n-ary mechanism, is inadequate to capture all the possible readings a sentence may convey. The ambiguities in question do not result from the ambiguity of the indefinite noun phrase, nor of the context, but stem from the semantic relationship between the noun phrase and the remainder of the sentence. Therefore, a type of logical representation where the indefinite is represented by an existential quantifier and its scope in relation to the other elements in the sentence is used to indicate specificity offers the most adequate formal analysis and permits the inference rules to apply correctly.

In most cases the existential quantifier is an adequate approximation of the semantics of the indefinite and through its scope variation we can arrive at the proper semantic interpretation of the ambiguities associated

with specificity. Because when the existential quantifier occurs outside the opaque context in the logical representation, existential generalization is assumed to be valid, it follows that on the specific reading, the use of the existential quantifier entails that something of the kind described by the noun phrase exists. This is not always the case. The following sentence is ambiguous with respect to specificity, even though no referent of the indefinite exists, and the sentence could be true on either reading.

(33) Alberta believes that a dragon ate her petunias.

Whether or not dragons exist, Alberta may believe they do and (33) is ambiguous as to whether Alberta maintains a belief about a particular dragon or about some unspecified dragon. We could paraphrase the specific reading by:

(34) There is a particular dragon that Alberta believes ate her petunias.

which could be true without the ontological reality of dragons; for example, she could intend Puff, the Magic Dragon. The ambiguities concerning specificity appear to be independent of existence entailments. The distinguishing factor which separates the two readings is that of individuation. The specific reading of (33) ascribes a property to both Alberta and a dragon. It states that a relation of belief to have eaten the petunias holds between the two. The non-specific reading ascribes a property to Alberta. It does not attribute any property to a dragon.[14]

Since the use of the existential to represent the indefinite leads to incorrect entailments for many sentences, Fodor suggests that its use be dropped. Sentences containing indefinites should be represented in a manner which is neutral with respect to existence entailments. She proposes a new existence-neutral operator (Sx) to replace the use of the existential quantifier in defining scope relations between and indefinite and the remainder of the sentence. The semantic rules of interpretation which result

in the correct entailments and which permit the proper inferences to be made remain to be specified for this new operator. Though Fodor does not actually formalize the semantics for (Sx), from her discussions one can conclude that it would be similar to the semantics normally given to the traditional existential, except that existence entailments would somehow be eliminated.

However, one need not establish a new specificity operator to eliminate existence entailments from the semantics. Marcus (1962) and later Orenstein (1972) demonstrate that existence entailments do not obligatorily follow from the use of ($\exists$ x). Orenstein refers to this symbol as the particular quantifier to avoid the misleading name 'existential'. He traces the history of the particular quantifier from Frege to Quine and points out that ($\exists$ x) has traditionally been given at least two different readings, one an existential reading and one a substitutional reading. The existential reading can be paraphrased by 'there exists an x such that S'. The substitutional reading avoids mention of existence, and is paraphrased by 'it is sometimes true that S' or better still, 'for at least one substitution instance of x, S is true'. A substitutional reading of the particular quantifier is ontologically neutral, making it an ideal semantics for the specific/non-specific distinction. On an existential reading of the particular quantifier, the variable in question would be said to range over a domain of ontologically existing objects referred to as the value of that variable. On the substitutional reading, we are concerned with the substituends of the variables which are linguistic objects, that is, the names of the things referred to. When the substitution involves noun phrases, the substituends will be individual constants. Translating the substitutional reading into the semantics of specificity, a sentence is true on the specific reading if there is at least one substitution instance of the variable representing

the indefinite noun phrase. On the non-specific reading it is not necessarily the case that the variable will be instantiated.

There is some confusion in the linguistic literature concerning which class of sentences defines a specific reading and which defines a non-specific reading, as well as what semantic properties should be ascribed to each class. Karttunen (1968) attempts such a classification. He distinguishes the specific and non-specific readings linguistically by whether or not they establish discourse referents. The specific reading is capable of being talked about at a later point in the discourse by using a personal pronoun or definite description, i.e., a discourse referent. The non-specific reading does not permit such later references. Karttunen illustrates the linguistic difference with the following examples:

(35) a. She has a car. It is blue.

b. She doesn't have a car. *It is blue.

A car in (35a) is read as specific and can be referred to by a personal pronoun. The same noun phrase is non-specific in (35b), hence the inappropriateness of the continuation. After defining the linguistic differences in the two readings, Karttunen then attempts to determine the semantic criteria which distinguish the indefinites that establish discourse referents from those that do not. At first he posits existence as the defining semantic criterion, but like Fodor, he quickly recognizes the inadequacy of ontological existence as a requirement for the specific reading, for the linguistic distinction obtains with non-existent entities.

(36) a. I saw a unicorn. It had a gold mane.

b. I didn't see a unicorn. *It had a gold mane.

However, after examining additional examples, Karttunen decides that more subtle defining characteristics are necessary. He observes that in non-opaque contexts, an indefinite is subject to ambiguous interpretations.

The following affirmative, declarative (and non-opaque) sentence can be read in two different ways.

(37) I talked with a logician.

It may be the case that the speaker has a certain referent in mind, say Carnap, and is using the indefinite noun phrase as a description of that individual. Or the indefinite noun phrase in (37) could be used to indicate the type of person talked to. The identity of the person is unimportant. In fact, the speaker may not know anything about the person, except that she is a logician. However, whether or not the identity of the logician is known matters little on this reading, for it is the speaker's intent in using the phrase and not her knowledge, that distinguishes the two readings of (37). If the speaker uses the indefinite noun phrase as a way of naming an individual, the reading is one which Karttunen considers to be the correct specific reading. If she uses the indefinite to indicate a type of individual, then the reading is a non-specific one, according to Karttunen. The interesting thing is that both readings of (37) establish a discourse referent, so that the linguistic criteria no longer divide the uses of the indefinite into the same two classes as do the semantic criteria. Karttunen, himself, acknowledges this fact: "it becomes clear that the notion of 'discourse referent' as we have used it, is not all the same as 'the individual which the speaker has in mind.'" (p.8). The specific and non-specific readings in the revised sense seem to correspond to Donnellan's (1966) referential/attributive distinction for definite noun phrases.[13] Although the indefinites do not refer in the unique way reference is normally defined for definite descriptions, I will use Donnellan's terms to characterize the ambiguities of (37).

Because the referential readings select a particular individual, Karttunen believes they are best represented by logical formulae containing

constants. He assigns the following representation to the referential (specific, for him) reading of (37). [p.8].

(38) t(I,c) . l(c)

'I talked with c and c is a logician.'

For the attributive or non-specific reading of (37) Karttunen chooses the indefinite operator (ηx) defined by Reichenbach (1947) and assigns the sentence formula (39).

(39) t (I, (ηx) l(x))

'I talked with some x such that x is a logician.'

According to the new defining criteria specified by the logic of (38) and (39), non-specific indefinites fall into two types, those that establish discourse referents and those that do not. What determines this linguistic property is not the specificity of the noun phrase, but whether the noun phrase, as Karttunen contends (p.8), "appears in a clause which is understood to be a true statement, that is, not flagged by a modal or certain non-factive verbs." It seems that what Karttunen is saying is that noun phrases which are logically represented inside an opaque context do not establish discourse referents, while those outside do.

Since the linguistic criteria appear to correlate to the opaque and transparant reading of a sentence, it seems odd that Karttunen and many others after him (Partee (1972), Stenning (1975) and Katz (personal conversations)) wish to define the specific/non-specific ambiguity of indefinites as one involving a referential/attributive distinction. Partee, after taking this position, admits (p.439, footnote 4) that there are grounds for regarding the referential/attributive distinction as a pragmatic one, rather than one specified syntactically and semantically, since the distinction depends on the speaker's intentions.

It is my contention that there are two distinctions to be made for indefinite noun phrases; one is a specific/non-specific distinction, and the other is the referential/attributive one. The former division is defined according to the semantic properties outlined by Fodor (1971) and corresponds to the opaque and transparent reading of a sentence. The latter division, as will become evident, is completely independent of specificity and involves pragmatic rather than semantic factors. Hence it need not be represented in the grammar. Specific noun phrases may be intended as either referential or attributive. Non-specific noun phrases can only be intended in the attributive sense. Referential indefinites, therefore, can only be specific noun phrases because, like specifics, they require linguistic existence. On the other hand, attributive indefinites can sometimes be specific and sometimes be non-specific for sometimes they require linguistic existence and sometimes they don't. In an appendix Karttunen acknowledges that a sentence of the following form may be three ways ambiguous, therefore necessitating what he calls two variants of specificity. (1968: p.13 ff)

(40) The casting director is looking for a handsome blond.

We can paraphrase (40) in three ways:

(41) a. There is a particular individual who happens to be a handsome blond that the casting director is looking for.

b. There is a handsome blond, some ideal type, that the casting director is looking for.

c. The casting director is looking for any man who is handsome and blond.

The paraphrases of (41) would correspond to the following logical analyses of the indefinite, formulated with constants and the particular quantifier.

(42) a. The casting director is looking for c and c is a handsome

blond.

b. (∃ handsome blond x) (The casting director is looking for x)

c. The casting director wants (∃handsome blond x) (she find x)

With respect to specificity, the (a) and (b) readings described in (41) and (42) are both specific readings and can be responded to by:

(43) She found him in North Dakota.

The (c) reading is non-specific and (43) is not an appropriate continuation for it. One could respond to the (c) reading by:

(44) She found one in North Dakota.

The referential/attributive dichotomy divides the three readings in a different manner. The (a) reading is referential while the (b) and (c) readings are attributive. The attributive, but not the referential, readings can be continued by (45), since they refer to a type of individual, rather than a particular one.

(45) But no handsome blond men exist.

The referential/attributive dichotomy is a pragmatic one. There is no need to represent it in the syntax. The specific/non-specific dichotomy is a semantic one which can be distinguished by both syntactic and semantic correlates. When the indefinite is given a specific interpretation it requires the same set of truth conditions whether the speaker intends a referential use or an attributive use. There must be at least one substitution instance for the sentence to be true. The semantic interpretation will not reflect the speaker's intent; therefore, neither should the syntax. Formulas (42a) and (b) will collapse into one syntactic representation in the grammar, that of (42b). The referential/attributive distinction can be referred to as speaker's reference, a pragmatic notion. The specific/non-specific division of indefinites concerns semantic reference in terms of linguistic existence and as such must be distinguished in a logically based

syntax.

There are many languages which have two forms for the indefinite, each requiring a different semantics. In Russian this is the case for the indefinite pronouns, and it can be shown that the two forms correspond to a notion of specificity defined on the opaque/transparent semantic dichotomy, and not to one defined on the referential/attributive distinction. The data come from Dahl (1970). The indefinites in Russian carry either a *-to* or *-nibud'* suffix. The *-nibud'* suffix corresponds to the non-specific reading of an indefinite. It usually cannot appear in simple declarative sentences. The environments in which it is found include imperatives, questions, future tenses, negatives, interrogatives and conditionals among others.

(46) a. Ona xočet vyjti zamuž za kogo-to.

'She wants to marry someone (specific)'

b. Ona xočet vyjti zamuž za kogo-nibud'.

'She wants to marry someone (non-specific)'

A declarative sentence which is ambiguous between a referential and attributive sense does not permit two pronoun forms. It can only have a *to*-pronoun.

(47) Kto-to ne poët.

'Someone isn't singing'

Sentence (47) has two interpretations. It can mean "a particular person whom I can name if I care to isn't singing" or "one of the people isn't singing, I'm not sure who." Though this ambiguity corresponds to what Karttunen has labeled a specificity ambiguity in:

(48) I talked to a logician.

it does not receive two linguistic manifestations in Russian. According to Dahl's data, the *nibud'*-pronoun can only be used in sentences where there is a reading which does not require at least one instantiation in a true

interpretation. The Russian data support a syntactic representation of specificity defined on opacity correlates in the semantics.

Section 6: Scope and Specificity

Now that we have defined what syntactic and semantic properties specify the class of specific and non-specific readings, there remains to be clarified one additional confusion concerning these sentences. We have demonstrated that there are two types of distinctions which contribute to the interpretation of indefinites: they can be ambiguous with respect to semantic reference (specificity) or to speaker's reference (referential/ attributive differences). There is a third factor which can affect the interpretation of an indefinite noun phrase, and this factor is completely independent of the other two. However, in the linguistic literature there has been a tendency to confuse this factor with specificity regardless of which definition the author uses for it. The factor we are referring to is one of the relative scope differences obtaining between the indefinite noun phrase and another quantified NP. The scope variation which plays a role in specificity is an interaction between the particular quantifier and an opaque context. These contexts can have an affect on the existence entailments of a substituent. Such entailments are what distinguish the specific from the non-specific readings. When an indefinite noun phrase interacts with another quantified noun phrase, questions of linguistic existence are never raised. The indefinite must receive a specific interpretation no matter how many other quantifiers it interacts with. What changes in the semantics of the indefinite noun phrase is the *number* of instances required for the sentence to be true. With specificity the concern is whether or not *any* instance is required for a true interpretation. Whenever the indefinite interacts with another quantifier, at least one

instantiation of a substituend is necessary for a true interpretation of the wide scope reading of the indefinite, and possibly many instantiations as necessary for the narrow scope reading to be true (the number depends on the other quantifier).

Karttunen, quite clearly, is one of those who is confused about these semantic distinctions. In Karttunen (1968) the following discourse is given as an example of one which exhibits a specific/non-specific ambiguity. (p.6)

(49) Harvey courts a girl at every convention. She always comes to the banquet with him.

He equates the specificity distinctions with the speaker intending a particular girl (wide scope reading of the indefinite) or no girl in particular (narrow scope reading of the indefinite). But this is a false characterization of the narrow scope reading. Certainly the speaker cannot intend no girl in particular if Harvey courts a different one each year (unless, of course, the speaker intends an attributive sense of the indefinite; but this sense is possible on the wide scope reading as well). The speaker has the girls as well identified on this reading as she does on the wide scope reading. It's just that there are more of them, a particular girl for each year.

In Karttunen (1971), he shows the same confusion. He claims (p.13) that the indefinite in the following discourse can only receive a specific interpretation.

(50) Most boys in this town are in love with a go-go dancer. Mary doesn't like her at all.

Because (50) can only receive a wide scope interpretation of the indefinite, Karttunen contends that the narrow scope reading, which he equates with a non-specific reading, fails to establish a discourse referent. This fact

is in keeping with his earlier observations of non-specifics. But the indefinite can establish a discourse referent on a narrow scope reading. The following discourse unambiguously assigns the indefinite inside scope when the two indexed NP's are considered coreferential.

(51) Most boys in this town are in love with a go-go dancer$_i$.
Mary doesn't like them$_i$ at all.

Because relative quantifier scope interactions are independent of specificity, it should be possible to find a sentence which exhibits both kinds of ambiguities and consequently is four ways ambiguous. Such sentences do exist. Sentence (52) is four ways ambiguous.

(52) Everyone believes that a witch blighted their mares.

There are four possible ways of interpreting the indefinite noun phrase. *A witch* may be read with wide scope or narrow scope, as specific or non-specific. Each of the four combinations of the two dichotomies gives a different reading. If the indefinite is read with narrow scope, everyone holds the belief about the witch who blighted their own mare. They may not know that anyone else had a mare that was blighted; or if they do know, they may have no opinion as to whether the same witch was responsible for all the blighting. On the narrow scope reading of the indefinite, there is a witch for each person's belief, possibly different in each case. The narrow scope reading may be read as specific or non-specific. That is, each person may have the belief about a particular witch for which an instantiation exists, or they might just think that the only type of 'person' who could have committed such a horrendous act was a witch.

On the wide scope reading of *a witch*, there is one individual of whom they hold a common belief. That is, everyone believes that one witch was responsible for all the blighting. If the indefinite is specific, then the witch who did the blighting is identifiable in some way. It must be

possible to instantiate the variable being bound. But they might not know any witches and believe that the type of person was a witch, but that whichever witch it was, the same one blighted everyone's mares, perhaps because of the particular type of blighting that was done. This interpretation where the indefinite is read as a non-specific with wide scope corresponds to what Geach terms *intensional identity* (1972: pp.146ff). That there are four interpretations of (52) can be shown by the fact that there are four distinct continuations of the sentence.

(53) a. *wide scope / non-specific*

If they ever find out who she is they'll try to catch her.

b. *narrow scope / non-specific*

If they ever find out who they are, they'll try to catch them.

c. *wide scope / specific*

They know who she is and they're trying to catch her.

d. *narrow scope / specific*

They know who they are and they're trying to catch them.

The interesting fact about sentence (52) is that all four readings cannot be represented through scope variation of the operators. A linear arrangement of the operators allows us no way of representing one of the readings, that of (53a). This reading is, to my mind, the most salient one for sentence (52). It requires, for a wide scope reading of the indefinite, that the particular quantifier be ordered outside the scope of the universal. The universal does not interact with the opaque context so must also be represented outside of it. However, if the indefinite is to be given a non-specific interpretation, the particular quantifier must occur inside the opaque context. There is no possible linear representation that orders the particular quantifier outside the universal and inside the

opaque context. We conclude this chapter with the observation that a single linear arrangement of operators to represent semantic factors that are independent of one another will be inadequate to the task. A similar point was made in another connection by Hintikka (1974). Some non-linear arrangement of the operators must be devised (and branching quantifiers won't do) to permit specificity to be represented independently of relative quantifier scope interactions, so that with sentences like (52) all possible interpretations can be assigned a representation.

Footnotes

1. An explicit account of the syntax and semantics for quantified sentences as well as for the other sentence types is found in Keenan (1972). Keenan Grammar has no Q-node as represented in diagram 1. In his model [Det - NPc] as shown in (3) and (4) are equivalent to the Q-node of (1).

2. We are considering here the interpretation of individual sentences rather that the interpretation of a whole language. However, our analysis could easily be extended to an interpretation of the whole language.

3. Relative structural configurations are also used to represent scope semantics in other systems, specifically, first order predicate calculus, generative semantics and Montague grammar. Neither the standard theory, nor the extended standard theory has, as yet, given any explicit formulation of the representation and interpretation to be assigned to various scope ambiguities.

4. Group readings were first discussed in the linguistic literature by McCawley (1968).

5. I am greatly indebted to Ed Keenan for help in formalizing the group syntax and semantics.

6. The definition of an interpretation i just given is exactly that found in Keenan (1972:pp.445) with the exception of the specifications of P_{N_i} which I have added.

7. The figures given below represent the maximum number of objects and events on a given interpretation whenever vagueness is possible. There are seven actual readings for sentence (9) rather than eight as one would predict from the number of formal combinations because two of the possible combinations are logically equivalent. Relative scope order is semantically irrevalent when both quantifiers receive a group interpretation. Reading (1) is equivalent to (i) below.

   (i) (five, tenant, Y) (three, landlord, X) (X visit Y)

8. This problem was first pointed out to me by Osten Dahl. Dahl himself discusses it in Dahl (1973a).

9. This possibility was suggested to me by Chiahua Pan.

10. For a detailed discussion of the semantics of symmetric predicates see Langendoen (forthcoming).

11. The terms *specific* and *non-specific* were first introduced by Baker (1966).

12. Other works concerned with this issue are Baker (1966), Bach (1968), Dean (1968), Karttunen (1968,1971) and Partee (1972).

13. Negation functions as an opeque operator for indefinite noun phrases only. Fodor (1970) has shown that opacity must be defined separately for definite and indefinite noun phrases. Failure of existential generalization is what distinguishes the opaque reading of indefinites from the transparent one. However, it is the lack of substitutivity of identicals which distinguishes the semantics of opaque definites from that of the transparent ones. Negation affects existential generalization only. It does not affect the substitutivity of identicals.

14. For a more detailed analysis of the factors involved in individuation see Fodor (1970, Chapter 2).

Chapter III

Quantified Noun Phrases Which Interact as Clause Mates

Section 1: Introduction

Linguists speak of two configurations at the surface level for which quantifier scope relations can be defined: (1) The two quantified NP's under consideration may be clause mates in the same surface S (that is, NP's that share clause membership, see Postal (1971:p.67)), or (2) the two quantified NP's in question may occur in different surface S's, one embedded within the other (two quantified NP's that occur in different conjuncts do not enter into scope relationships with each other). In this chapter we examine only the first class of quantifier interactions in an attempt to delimit the factors that are relevant to a determination of the possible and preferred scope readings. The current linguistic treatments are reviewed and their inadequacies presented. We observe that, for the most part, linguists follow the views of traditional logicians and explain scope variation within a simple sentence on the basis of the relative order of the quantifiers: the one that is 'leftmost' in the surface structure is interpreted with wider scope. It is my contention that in natural language order has little to do with the determination of quantifier scope. Many examples are given from English and other languages in which scope assignment in simple sentences is opposite that predicted by a left-right order hypothesis. Instead the inherent characteristics of the individual quantifiers and their grammatical function within the clause are shown to be the factors relevant to quantifier scope assignment. Evidence to support this claim is based on data collected from a large number of languages.

One difficulty encountered in obtaining reliable responses in all languages is the lack of clear intuitions on the precise interpretation of

sentences involving scope variation. In addition, there seemed to be a fair amount of dialect variation in this area. A method is developed using a ranking scale to ascertain a relative degree of ambiguity. Though there is individual variation, it is a matter of making all judgments one degree higher or lower on the scale. The results then are expressed in terms of relative position on the scale of ambiguity.

Section 2: Predictions made by Generative Semantics and Interpretive Semantics

Lakoff, respresenting generative semantics, gives his definitive position on quantifier interpretation in Lakoff (1971), in which he iterates several times his belief that order alone accounts for scope differences within a clause. In fact, he expresses this belief in the form of a derivational constraint, which he suggests operates universally for all languages. There are two parts to the constraint, the second of which pertains to quantifiers within a single S. Lakoff explains the constraint as follows:

> If Q_1 commands Q_2 in surface structure but Q_2 doesn't command Q_1, then Q_1 commands Q_2 in semantic representation. If, on the other hand, Q_1 and Q_2 command each other in surface structure, then the leftmost quantifier commands the rightmost one in semantic representation. If constraints 1 and 2 are reflections in grammar of perceptual strategies, then they would of course be prime candidates for syntactic universals [p.243].

To summarize briefly, when quantifiers occur in different clauses at surface level, the one in the highest clause gets interpreted with widest scope; when both quantifiers are in the same clause, it is the leftmost one that is given largest scope by the semantics.[1]

Lakoff's examples involve changes in order due to the application of the passive transformation. In the following set of sentences, he claims that each one is unambiguous and that the two are not synonymous:

(1) Many men read few books.

(2) Few books are read by many men.

In semantic interpretation the quantifier with highest scope would correspond to the one that is leftmost. All the speakers I have questioned find such sentences ambiguous, although they give each one a preferred reading. But a preferred reading must be accounted for as much as an unambiguous reading. It is necessary to investigate whether order alone can predict such preferences.

Lakoff rules out the possibility that grammatical function might have any effect on the determination of highest scope. He states, after discussing several examples:

> It is important to note that the fact that one of the two quantifiers is in subject position in the sentences we have discussed so far is simply an accident of the data we happened to have looked at. The difference in the interpretation of quantifiers has nothing whatever to do with the fact that in these examples one quantifier is inside the VP while the other is outside the VP. Only the left right order within the clause matters [p.241].

He goes on to give two examples in which the two quantified NP's occur as objects, with their order reversed in the second sentence. He states emphatically that both sentences are unambiguous and differ in meaning exactly in that it is the leftmost quantifier in each sentence that is interpreted with highest scope, a difference I have difficulty perceiving. The following two sentences are used to illustrate his point:

(3) John talked to few girls about many problems.

(4) John talked about many problems to few girls.

But he chooses to use in his examples quantifiers that are difficult to interpret in their own right, so that the reader is unsure what the exact interpretation of either sentence is. All his examples contain *few* and *many* as the two quantifiers that interact. Both of these are quantifiers that express relative size; thus, the precision needed in interpretation to perceive the subtle distinctions caused by a change in scope is lacking owing to the vagueness associated with these quantifiers. Once they are substituted by natural numbers, the reader can be more certain what meaning changes occur, if any. Consider:

(5) John talked to three girls about a problem.

(6) John talked about a problem to three girls.

Sentences (5) and (6) do not differ in meaning with regard to scope. If they can be construed at all as ambiguous, they are ambiguous in the same way. However, I and every informant questioned perceive the two of them as unambiguous and synonymous. In both sentences *a problem* has highest scope, and it is the same problem that is told to the three girls in both sentences.[2] Such sentences constitute counterexamples to Lakoff's theory.

Let us examine the interpretivist treatment before proceeding with more extensive counterexamples. Jackendoff's position is representative of the interpretivist framework in which logical relations in a sentence are not expressed in the deep structure but are interpreted by the semantics directly from the derived structure. (See Chomsky, 1971.) Like Lakoff, Jackendoff defines the scope of a quantifier as that part of a sentence commanded by it and to the right of it. These relations are determined at the surface level by means of a MODAL PROJECTION RULE, stated as follows:

> Given a lexical item A whose semantic representation contains a modal operator M. If an NP is within the scope of A, it is optionally *dependent on* M in the modal structure, that is subject to C_m [where 'C_m' means *dependent on* M]. If an NP is outside the scope of M, it is not dependent on M [1972:p.293].

He then identifies three categories of scope - the third of which pertains to quantifiers. Type III scope 'consists of all material commanded by and to the right of the lexical item containing the operator [p.292].'

Unlike Lakoff, Jackendoff does not claim that all quantifiers on the left within a clause have highest scope. He only argues that ambiguities are possible when an NP occurs to the right of a quantifier. He does not limit the type of NP that can occur on the right, not does he give examples of such ambiguities using proper names or definite descriptions. All his examples contain other quantified NP's or NP's introduced by the indefinite article, which he does not consider a quantifier. In essence, it seems that all he is claiming is that ambiguities are possible when two quantifiers occur within the same clause, hardly a novel claim. He still ignores the difficult problem of predicting which reading will be preferred.

Sentences that Lakoff judges unambiguous Jackendoff argues are ambiguous, judgments in accord with the preliminary data I have collected. But to other sentences that informants found equally ambiguous, Jackendoff assigns a single interpretation. He cites the following pair:

(7) {Some / All / Five} of the boys told me a story.

(8) A story was told to me by {some / all / five} of the boys.

Lakoff would claim that the pair is unambiguous and that each sentence differs in meaning. Jackendoff, on the other hand, claims that (7) is ambiguous, but (8) is not. This judgment of (8) accords with his theory, since the indefinite article, which introduces the NP on the left, is not considered a quantifier. My data find (7) and (8) equally ambiguous but give them each a preferred reading. This ambiguity of (8) would constitute a counterexample to Jackendoff's hypothesis - for the only quantifier he recognizes in the sentence occurs to the right of the other NP, yet an ambiguity results. In working with the interpretation of logical elements, a linguist must present more empirical evidence. Whole theories are built around a subjective interpretation of some sentences when those very interpretations are greatly disputed.

Section 3: The Inherent Properties of Quantifiers

Let us turn our attention to additional counterexamples in which the quantifier on the right has highest scope. It seems that the type of quantifier used makes a difference. This fact is rarely considered by linguists, although Quine (1960) and Vendler (1967) have examined it from a logical perspective. The quantifiers *each* and *every* always tend to have highest scope no matter where they occur in a sentence. This is more certain with *each*. In the following sentences *each* and *every* not only occur to the right of the second NP, but they occur in a prepositional phrase dependent on it. Yet the preferred (if not the only) reading is the one in which *each* or *every* has widest scope:

(9) I saw a picture of each child.

(10) She knows a solution to every problem.

(11) Ethel has a dress for every occasion.

When *all* is substituted for *each* and *every*, the preferred reading is

one giving the indefinite highest scope, though the sentences are very ambiguous:

(12) I saw a picture of all the children.

(13) She knows a solution to all problems.

(14) Ethel has a dress for all occasions.

There seems to be a hierarchy of quantifiers that tend to have highest scope regardless of the environment. At the top are the universal quantifiers with distributive properties. Then it seems to depend on the size of the set specified. The larger the set defined by the quantifier, the higher it will be in the hierarchy and the greater its inclination toward highest scope when interacting with other quantifiers. The indefinite article and *some* followed by a singular NP are apparent exceptions to this generalization and have not been included in the hierarchy. These quantifiers, which will be referred to by the cover term Q_{sg}, seem to occur very high on the hierarchy, preceded only by *each* and *every*. However, the decision to assign them to that position is not yet supported by conclusive evidence; hence their exclusion from the list. Table 1 indicates a tentative ordering of the most common quantifiers that quantify over plural sets (Q_{pl}).[3]

TABLE 1

Greatest inherent tendency
toward highest scope

each

every

all

most

many

several

same (+ NP_{pl})

a few

Least inherent tendency
toward highest scope

The following sentences illustrate the proposed hierarchy:

(15) Joan gave a few handouts to *some* pedestrians.

(16) Joan gave a few handouts to *several* pedestrians.

(17) Joan gave a few handouts to *many* pedestrians.

(18) Joan gave a few handouts to *all* the pedestrians.

(19) Joan gave a few handouts to *every* pedestrian.

In sentence (15), it seems as if the total number of handouts is a few and each pedestrian received one. As the quantifiers get larger, the tendency is for one to interpret the sentences as if each pedestrian received more than one. With sentences (18) and (19), it becomes certain at once that each pedestrian received a few.

Section 4: Grammatical Relations as a Parameter of Quantifier Scope

The inherent properties of the quantifiers are not the sole determinants of relative scope. The grammatical function of the quantified NP

in question has much to do with it. Here again, a hierarchy can be established. It goes from subject to indirect object to preposition object to direct object. It makes a difference whether the subject occupies that position at both the deep and surface levels. An NP that is subject at both levels will be highest in the hierarchy. Following it will be NP's that are either deep or surface subject (following a passive transformation) but not both. All these will tend to have higher scope over the same quantifier in the indirect object or preposition object, which, in turn, have higher scope over the same quantifier occurring in the direct object. In the last three cases, the objects occupy the same grammatical positions at both the deep and surface levels. Table 2 specifies the hierarchy of grammatical relations (where '>' means greater tendency toward higher scope).

TABLE 2

deep and surface subject > deep subject/surface subject > preposition object > indirect object > direct object

This hierarchy is very similar to the type of ranking Postal has done in connection with work on the function of the transformational cycle.[4] He has stated that order is irrelvant in defining transformations. Grammatical relations, not word order, is the information needed to formulate the rules. This seems to be the case in assigning quantifier scope as well. The difference between his ranking and this one is the fact that the prepositional, indirect and direct objects are reversed in his hierarchy. It is also the case that a deep structure term that has been reassigned to a nonterm status at the surface level is included in the ranking. (TERM indicates deep structure NP's that bear grammatical relations.)

Keenan (1972) establishes a similar order of the grammatical positions with greatest accessibility to relativization. It basically follows the same order as Postal's and places the direct object before the indirect and preposition objects. In his hierarchy the following progression obtains: subject > direct object > indirect object > objects of prepositions > possessives > objects of comparative particles.

Section 5: Levels of Scope Interpretation

I will now outline a system to refer to degrees of ambiguity. This study defines five levels of ambiguity, referred to by number. A limited set of quantifiers is used in the examples, since attention is focused on differences not related to the individual properties of the quantifiers themselves. Each sentence contains an existentially quantified NP introduced by the indefinite article if the language in question has one. The second quantifier it interacts with is a Q_{pl}, usually a universal or the quantifier *some* followed by a semantically plural noun phrase.

There seems to be an ordered progression in the judgments of ambiguity, ranging from completely unambiguous with a wide scope (ws) reading of the Q_{pl} on one end to completely unambiguous with a wide scope (ws) reading of the Q_{sg} on the other. (See Table 3.)

TABLE 3 Scale of Ambiguity Judgments

Level 1 -	unambiguous:	wide scope Q_{sg} only
Level 2 -	ambiguous:	wide scope Q_{sg} preferred
Level 3 -	ambiguous:	no preferred reading
Level 4 -	ambiguous:	wide scope Q_{pl} preferred
Level 5 -	unambiguous:	wide scope Q_{pl} only

When informants are uncertain about the interpretation of a sentence, it is always a hesitation between two contiguous levels. For example, if informants are not sure whether a sentence is ambiguous or not, they will claim that if it is, it most definitely has a preferred reading. Thus, they might waver between Levels 1 and 2, or Levels 4 and 5. However, no informants were confused between Levels 1 and 5, and no two informants in the same language give judments more than two levels away. When there are differences between speakers, they are likely to extend over more than one example: One informant will place all the sentences given at a higher level than another informant. Some people tend to permit more logical ambiguities throughout the language than others, and it has been my experience that people with linguistic training fall in the former category.

Section 6: Evidence from English to Support the Grammatical Relations Hierarchy

Now let us look at some evidence to support the claim that subjects take precedence over direct objects in scope assignments. The judgments given the following sentences are my own. Any disagreement should not disrupt the pattern, just move it up or down on the scale. While each of the following sentences contains the same two quantified NP's - one quantified by *every* and the other by the indefinite article, the deep and surface grammatical positions of the NP's vary within them:

(22) Every girl took a chemistry course.

Level 5 - ws Q_{pl}, only

(23) A chemistry course was taken by every girl.

Level 4 - ws Q_{pl}, preferred

(24) Every chemistry course was taken by a girl.

Level 4 - ws Q_{pl}, preferred

(25) A girl took every chemistry course.

Level 2 - ws Q_{sg}, preferred

In (22), the universal is in both the deep and the surface subject: in (23), in just the deep subject; in (24), in just the subject; and in (25), in neither the deep nor the surface subject - but in the object at both levels. The interpretations descend the ranking scale as the universally quantified NP changes from subject to object position. Clearly, order is not a contributing factor to the changes in interpretation. Examples (22) and (24) have the same surface order of quantifiers, but only (24) is ambiguous and permits reading in which the rightmost quantifier, Q_{sg}, has highest scope. Again, the quantifiers in (23) and (25) have the same surface order, but (23) has a preferred interpretation giving Q_{pl} highest scope, while (25) has a preferred interpretation which assigns Q_{sg} highest scope. Finally, (23) and (24) have opposite quantifier ordering but identical preferred and permitted readings.

Next, I will give examples to show that the indirect object position takes precedence over the direct object position. Here the order of the quantifiers is the same but their grammatical functions change:

(26) I told every child a story.

Level 4 - ws Q_{pl}, preferred

(27) I told every story to a child.

Level 2 - ws Q_{sg}, preferred

Reversing the order of the quantifiers in each of these sentences has little effect on its interpretation:

(26') I told a story to every child.

Level 4 - ws Q_{pl}, preferred

(27') I told a child every story.

Level 2 - ws Q_{sg}, preferred

Both (26) and (26') have a preferred reading in which a possibly different story is told to each child - a ws Q_{pl} reading. In both cases it is the indirect object, every child, that has highest scope. The preferred readings in (27) and (27') are the same: ws Q_{sg} interpretations. Here the indefinite article occurs with the indirect object rather than with the direct object as in (26) and (26'). Thus, it is the indirect object, again, that receives higher scope on the preferred reading. We find that in all four sentences, though we have reversed the order of the quantifiers and interchanged their grammatical functions the indirect object takes precedence over the direct object throughout.

The following pairs of sentences illustrate that a similar precedence relation obtains between the preposition object and the direct object:

(28) I had many conversations with a friend.

Level 1 - ws Q_{sg}, only

(29) I had a conversation with many friends.

Level 3 - ambiguous

(30) Freddy hit many balls with a bat.

Level 1 - ws Q_{sg}, only

(31) Freddy hit a ball with many bats.

Level 3 - ambiguous

In both pairs, when the Q_{sg} occurs in the preposition object [(28) and (30)], it must necessarily receive higher scope, even though it is rightmost in the sentence. However, when this quantifier occurs in the direct object and the Q_{pl} is in the preposition object [(29) and (31)], the sentences become very ambiguous, and on one reading the Q_{sg}, which is leftmost in the sentence, is assigned lower scope.

Now we must demonstrate that preposition objects take precedence over indirect objects. In the following pair of sentences it is clear that the quantified noun phrase inside the prepositional phrase is the one that receives wide scope on the preferred reading. The two sentences exhibit a definite reversal in scope assignment.

(32) a. Joan told someone the story at every intersection.

Level 4 - ws Q_{pl}, preferred

b. Joan told everyone the story at an intersection.

Level 2 - ws Q_{sg}, preferred

In sentence (32a) it is a different person for each intersection, while in (32b) there is only one intersection, on the preferred readings.

The situation with the preposition objects is actually more complex than we have represented it. Although the preposition objects are classed on the grammatical relations hierarchy as a unified set, they exhibit many differences among themselves in terms of scope. To do justice to the preposition objects one should classify them according to their semantic function, for this seems to determine their behavior with respect to quantifiers cope. Keenan (1974) has observed that quantifiers in the possessor position are likely to have wider scope than the quantified head noun phrase.

(33) a. Every branch of a tree was trimmed.

b. A representative of every union signed the petition.

In (33a) we seem to be speaking of one tree, but in (33b) we are speaking of many representatives. In both cases the noun phrase inside the possessor phrase is assigned wider scope. The preposition object has higher scope than the head even when the head is the subject.

Gabbay and Moravcsik (1974) give similar findings for other prepositional phrases which are in construction with a head noun phrase. The preferred reading in most cases gives the quantifier inside the prepositional

phrase wider scope.

(34) a. Some entrance to every freeway is poorly constructed.

b. Every market in some major city was temporarily closed.

These scope readings can be predicted using Keenan's (1974) functional principle, referred to in Chapter 2, above. It argues that the identity of one noun phrase may be stated as a function of another, and that the second noun phrase, referred to as the argument, will then usually receive wider scope. This follows because the identity of the argument must be independent of any noun phrase inside the function. When a quantified NP is assigned wide scope, its identity must also be ascertainable independently of the quantified noun phrases it ranges over. If a prepositional phrase occurs in construction with a noun phrase, the object of the preposition functions as the argument which is independently identified, while the noun phrase is inside the function symbol.

A prepositional phrase that is not in construction with a noun phrase does not normally take precedence over the subject in terms of scope assignment. This is the case when the prepositional phrase functions as an adverb.

(35) a. A waitress put some flowers on every table.

Level 2 - ws Q_{sg}, preferred

b. Every waitress put some flowers on a table.

Level 4 - ws Q_{pl}, preferred

In both the (a) and (b) sentences the subject receives wide scope on the preferred reading.

Section 7: Data from Other Languages

The hierarchies of inherent characteristics and grammatical functions seem to work for other languages as well as English, so they are candidates

for language universals. On the other hand, the hypothesis that relative order determines scope can be invalidated by numerous counterexamples from the same languages, so it must be discounted as a universal possibility.

Two sets of data were collected to determine the universal vadidity of the proposed hierarchies. From the first set of data we observe that subjects do indeed take precedence over direct and indirect objects. The data also support the inherent properties hierarchy. The second collection of data gives evidence that the position of indirect object preecedes direct object on the grammatical relations hierarchy in languages other than English.

In the first investigation, thirteen languages were examined besides English. They were, in the Indo-European family, Hindi, Greek, Polish, Persian, Spanish, and Portuguese; two Semitic languages: Hebrew and Arabic; two African languages: Yoruba and Chiluba; and Tagalog, Japanese, and Turkish. They represent a variety of surface words orders. Nine of the languages have no indefinite article; they are Chiluba, Yoruba, Arabic, Hebrew, Turkish, Hindi, Polish, Tagalog, and Japanese. Four of the languages have a single indefinite article: they are Greek, English, Spanish and Portuguese. One language, Persian has two indefinite articles - *yek*, an unstressed form of the numeral 'one' that precedes the noun, and a suffix, *-i*.

Informants were asked to translate the following six sentences into their native languages:

(36) John made some (a few) girls a cake.

(37) John made all the girls a cake.

(38) John made each girl a cake.

(39) Some (a few) girls made a cake.

(40) All the girls made a cake.

(41) Each girl made a cake.

The first three sentences have the Q_{pl} in the indirect object position: the last three place it in the subject position. In all six sentences Q_{sg} occurs in the direct object position.[5] After giving the translations, informants were asked whether any changes in word order were possible, and if so, what effect they had on the meaning of the sentence. The responses to the latter question, constituting some of the most interesting data collected, are presented in a later section.

In order to ascertain how they interpreted the sentences, informants were asked whether the girls in each sentence acted or were acted upon as a group or individually. They were asked, as well, whether the other reading was equally possible, or possible at all. The responses were quite similar across languages and are presented in Table 4 and in Figures 1, 2, 3, and 4.

Table 4 shows the results for individual languages. Definite patterns can be perceived. Every language investigated had universal quantifiers equivalent to both *each* and *all*. There were never any differences in the way the universal quantifier with distributive properties was perceived. It always had wider scope, and no other reading was permitted. This was the case whether the distributive universal was in subject or indirect object position.

TABLE 4 Ambiguity Level for Quantifiers in Different Languages

	Indirect object			Subject		
	Some	All	Each	Some	All	Each
Level 1 ws Q_{sg}, only	Greek English Spanish Portuguese Persian Turkish Chiluba Yoruba Hindi Japanese Tagalog Hebrew Arabic Polish	Portuguese Persian-*yek* Chiluba Yoruba Hindi		English Persian Yoruba Chiluba Polish		
Level 2 ws Q_{sg}, preferred		Greek English Spanish Persian-*i* Hebrew Arabic Polish		Greek Spanish Portuguese Japanese Arabic Tagalog Turkish Hindi	Chiluba Hebrew Arabic Hindi	
Level 3 Ambiguous		Japanese Tagalog Turkish		Hebrew	Greek English Spanish Portuguese Persian Japanese Yoruba Turkish Polish	
Level 4 ws Q_{pl}, preferred					Tagalog	
Level 5 ws Q_{pl}, only			Polish Tagalog Greek English Spanish Portuguese Persian Turkish Chiluba Yoruba Hindi Japanese Hebrew Arabic			Polish Tagalog Greek English Spanish Portuguese Persian Turkish Chiluba Yoruba Hindi Japanese Hebrew Arabic

Comparing the quantifiers *some* (or *a few*) and *all* in any one language, one can observe a definite tendency to interpret *some girls* with narrow scope more often than *all the girls*. The latter phrase permits many more ambiguous (Level 3) scope interpretations, while a sentence containing *some* is interpreted only once in this way. With *some*, the readings normally refer to a particular cake that the girls relate to as a group.[6] The one exception occurred In Hebrew, in which the informants felt that either interpretation was equally possible when the quantifier *some* occurred in subject position. It is interesting that in all the languages examined informants chose the same response when *some* occurred in an indirect object position. It is always a Level 1 ambiguity rating that informants perceive; that is, the interpretation giving Q_{sg} higher scope is the only interpretation permitted for such a sentence.

It is obvious that these data support the ranking of *each* before *all* and *some* in the hierarchy of inherent quantifier properties. *Each* is the only one of the three that is consistently interpreted as having higher scope no matter what other parameters are present in the sentence. The data also support the conclusion that *some* is less distributive than *all*. This can easily be seen by looking at Figure 1. Figure 1 presents the distribution over the five possible interpretations of the combined subject

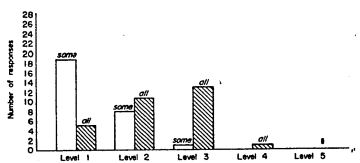


Figure 1. Some *versus* all – *total responses for both subject and indirect object.*

and indirect object responses for *some* and *all* – a total of 26 responses for

each quantifier. The largest number of responses for *some* occurs at Level 1, the level at which it can be interpreted only as having lower scope. The greatest concentration of responses for *all* are clustered around the center of the scale, where scope interpretation is perceived as ambiguous. As the levels of interpretation progress from a Level 1 interpretation to a Level 5 interpretation, the number of responses for *all* increases while the number for *some* decreases.

The data also support the hierarchy established for grammatical relations. Quantifiers in this sampling have a greater tendency to higher scope in a subject position than in an indirect object position. Figures 2, 3 and 4 present the results in support of this hypothesis. Figure 2 gives combined responses for *some* and *all*, while Figures 3 and 4 indicate the responses for the individual quantifiers. Note that the data for *each* are not included in these graphs, since grammatical category made no difference in the interpretation of sentences containing this quantifier. The responses for the indirect object position, as shown in Figure 2, peak at the first level of interpretation and then taper off. The reverse is true of the subject position, which is lower at the first level and then increases as the levels permit greater ambiguity. When the data are separated as to individual quantifiers, subject responses in both cases have heaviest concentration in the direction of a Level 5 interpretation, but indirect object responses, in comparison, are heavier at the Level 1 interpretation end of the graph. These data are depicted in Figures 3 and 4.

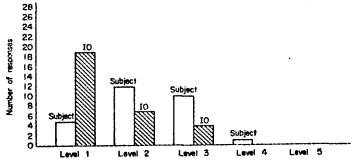


Figure 2. *Subject versus indirect object*—*total responses for both* some *and* all.

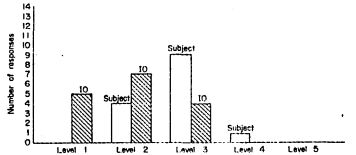


Figure 3. All-*subject versus* all-*indirect object*.

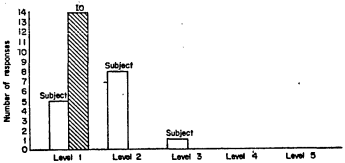


Figure 4. Some-*subject versus* some-*indirect object*.

The evidence from the languages examined supports my hypothesis that the parameters of relative scope assignment, where two quantifiers are concerned, are the inherent properties of the quantifiers themselves and the grammatical function of the noun phrases that contain them. I will now show evidence from these same languages that left-right ordering cannot be a parameter of scope assignment for quantifiers.

In Japanese, word order is relatively free, although some patterns are more marked than others. As I understand it, virtually any noun can be topicalized and brought to the front of the sentence.[7] The following sentences show first the unmarked order and then two marked versions, first with indirect object topicalization and then with direct object topicalization. Listed below each sentence is the ambiguity level elicited from the informant.

(42) a. Taro-wa nisann'n-no onnanoko-ni keiki-o tsukuri-mashita.
Taro a few-girl-for cake made
Level 1 ws Q_{sg}, only

b. Nissanin-no onnanoko-ni Taro-wa keiki-o tsukuri-mashita.
a few-girl-for Taro cake made
Level 4 - ws Q_{pl}, preferred

c. Keiki-o Taro-wa nisannin-no onnanoko-ni tsukuri-mashita.
cake Taro a few-girl-for made
Level 1 ws Q_{sg}, only

Examples (42a) and (42b) have the same relative left-right ordering of quantifiers, yet the interpretations are very different. In (42a), the unmarked version, though the noun phrase 'cake' is rightmost in the sentence it is assigned higher scope on the only reading the sentence permits. In (42b), focus is shifted to the indirect object, which has been topicalized, and now this noun phrase has higher scope on the preferred

reading. Again I must stress that the relative ordering of the quantifiers is the same in both sentences. It was not a change in relative order that reversed the scope assignment, but a change in the focus of attention. Sentence (42c) does have an opposite quantifier ordering from (42a). But the interpretation level remains constant. Here we are focusing on the direct object, but since it already had higher scope in the unmarked version, nothing changes.

Arabic and Hebrew offer even more striking counterexamples. In these languages topicalization is performed by placing the noun at the end of the sentence. And it is topicalization, not left-right ordering, that takes precedence in determining scope relations. In these examples the (a) sentences are the unmarked versions and the (b) sentences have been topicalized:

(43) Arabic

a. Khabaz Hanna feteer li kol il binaat.
baked John cake for all the girls
Level 2 - ws Q_{sg}, preferred

b. Khabaz Hanna li kol li binaat feteer.
baked John for all the girls cake
Level 1 - ws Q_{sg}, only

(44) Hebrew

a. Afa Jon ooga le kol ha banot.
baked John cake for all the girls
Level 2- ws Q_{sg}, preferred

b. Afa Jon le kol ha banot ooga.
baked John for all the girls cake
Level 1- ws Q_{sg}, only

Topicalization has the effect of putting the direct object, 'cake', to

the right of the indirect object. However, the informants in both languages commented that placing 'cake', in sentence-final position made it much stronger for a wide scope Q_{sg} interpretation.

Topicalization operates the same way in Polish in that the topicalized noun phrase is shifted to the end of the sentence. Here, too, we find counterexamples to the left - right order hypothesis. When a quantified noun phrase has been topicalized and is to the right of the second quantifier, it is more likely to be assigned higher scope than when it appears to the left. The (b) sentences give the topicalized versions:

(45) a. Jan upiekł tort dla wszystkich dziewczyn.
John baked cake for all girls
Level 2 - ws Q_{sg}, preferred

b. Jan upiekł dla wszystkich dziewczyn tort.
John baked for all girls cake
Level 1 - ws Q_{sg}, only

(46) a. Wszystkie dziewczyny upiekły tort.
all girls baked cake
Level 3 - ambiguous

b. Upiekły tort wszystkie dziewczyny.
baked cake all girls
Level 4 - ws Q_{pl}, preferred

Persian offers a similar phenomenon. Here the informants stated that although the direct object must always directly precede the verb, the indirect object could easily move to a sentence-final position, where it receives greater focus. As would be expected, it is also more likely in that position to be given higher scope. Again the (a) sentence represents the unmarked version:

(47) a. Asghar baraie hamme doxhtar keki posht.
Asghar for all girls cake-a made

Level 2 - ws Q_{sg}, preferred

b. Asghar keki poxht baraie hamme doxhtarha.

Asghar cake-a made for all girls

Level 4 - ws Q_{pl}, preferred

In Greek,[8] as in English, the direct and indirect objects can be interchanged, reversing the order of the two quantifiers and there is no change in meaning. When the quantifier occurring in the indirect object is 'some', the direct object in both cases is given higher scope:

(48) a. Giannos ekaine ena kaiki gai kapia koritsia.

John made a cake for some girls

Level 1 - ws Q_{sg}, only

b. Giannos ekaine gai kapia koritsia ena kaiki.

John made for some girls a cake

Level 1 - ws Q_{sg}, only

The normal word order in Hindi places the indirect object before the direct object. But it is the latter noun that is assigned highest scope when the indirect object is quantified by 'a few':

(49) Ram ne kaiee ladkion ke liye mithaiee banaiee.

Ram a few girls for cake made

Level i - ws Q_{sg}, only

Both the Greek and Hindi responses are predicted by the hierarchy established earlier, which assigns a low rank to the quantifiers *some* and *a few* in their chances of receiving higher scope.

The Malayo-Polynesian languages usually permit a sentence order in which the subject (sometimes referred to as the topic) is in sentence-final position. Tagalog is one such language. It is interesting that the same relative ordering occurs when the two quantifiers are in the direct indirect object positions as when they are in the subject object positions; yet there

is a difference in ambiguity level. In both cases the existentially quantified direct object occurs to the left. When the universal 'all' is in the indirect object position, the sentence is judged very ambiguous, with either scope ordering acceptable. However, when the same quantifier is in the subject position the informant assigned it a preferred reading giving Q_{pl} wide scope:

(50) a. Gumawa ng keik para sa lahat ng mga babae si Jose.
made cake for all of (pl) girl Jose
Level 3 - ambiguous

b. Gumawa ng keik ang lahat ng mga babe.
made cake all of (pl) girl
Level 4 - ws Q_{pl}, preferred

Tagalog is the only one of the languages examined that gave a sentence equivalent to (50b) a Level 4 interpretation. Yet it is the only language in which the subject (containing the universal) occurs after the direct object. This judgment is exactly opposite that predicted by a theory based on relative ordering. But the facts are accounted for by the interaction of the two hierarchies previously outlined: one ranking individual quantifiers by their inherent tendency toward higher scope, the other ranking the grammatical positions in order of their receptiveness to wider scope assignment.

Turkish word order is relatively free. Every sentence elicited from the informant was capable of being transformed at the surface level into another surface order. But in no case did a change in linear order result in a change in interpretation. I will cite a few typical examples:

(51) a. Birkaç kiz pasta yaptı.
a few girl cake-made
Level 2 - ws Q_{sg}, preferred

b. Pasta yaptı birkaç kız

cake made a few girl

Level 2 - ws Q_{sg}, preferred

(52) a. Ahmet bütün kızlara pasta yaptı.

Ahmet all girls-for cake made

Level 3 - ambiguous

b. Bütün kızlara pasta yaptı Ahment.

all girls-for cake made Ahmet

Level 3 - ambiguous

c. Pasta yaptı Ahmet bütün kızlara.

cake made Ahmet all girls-for

Level 3 - ambiguous

The final evidence I offer comes from Yoruba. In this language, clefting occurs through the permutation of a noun phrase to the beginning of the sentence, followed by the particle *ni*. Since this is not topicalization as I define it, there is not focusing of attention to cause a change in interpretation. The reversal of the left right order of quantifiers does not alter the scope assignemnt:

(53) a. Femi se iṣ-akara fun gbogbo awọn obinrin.

Femi cooked loaf-bread for all (pl) girl

Level 1 - ws Q_{sg}, only

b. Fun gbogbo awọn obinrin ni Femi se iṣu-akara.

for all (pl) girl Femi cooked loaf-bread

Level 1 - ws Q_{sg}, only

Our second collection of data, intended to substantiate our hypothesis that indirect objects universally receive high scope assignment over direct objects, involved seven languages. These were Arabic, Hebrew, Polish, Hindi, Irish Gaelic, Japanese and Vietnamese. Four of the languages have

SOV word order: Hindi and Japanese. Irish Gaelic is a VSO language. Informants were given the following two sentences to translate into their native languages. Each sentence contains two interacting quantified noun phrases, one in the indirect object position and one in the direct object position. In one sentence the universal quantifies the indirect object and in the other it quantifies the direct object.

(54) a. Martha told every child a story.

b. Martha told a child every story.

Informants were asked whether sentence (54a) was best interpreted referring to one story or to many stories, and whether sentence (54b) most likely referred to one child or many children. They were then asked if the other reading was equally possible or possible at all. In all cases the indirect object was given higher scope assignment than the direct object, regardless of which of the two quantifiers occurred in the indirect object position.

(55) Polish

a. Jan pržečzytoχ każdemu dziečku bajkę.

Jan read every child story.

Level 5 - ws Q_{pl}, only

b. Jan pržečzytoχ dziečku każdą jojkę.

Jan read child every story.

Level 1 - ws Q_{sg}, only

(56) Arabic

a. Muna rawat qissa li kuli ṭufl.

Muna read story to every child.

Level 5 - ws Q_{pl}, only

b. Muna rawat kul qissa li ṭufl.

Muna read every story to child.

Level 1 - ws Q_{sg}, only

(57) Hebrew

a. Jon kore lexol yeled sipur.

Jon read to every child story.

Level 5 - ws Q_{pl}, only

b. Jon kore le yeled kol sipor.

Jon read to child every story.

Level 1 - ws Q_{sg}, only

(58) Vietnamese

a. Tâm kể mỗi đứa-nhỏ một câu-chuyện.

Tam tell each child one story.

Level 5 - ws Q_{pl}, only

b. Tâm kể mỗi câu-chuyện cho một đứa-nhỏ.

Tam tell each story to one child.

Level 2 - ws Q_{sg}, preferred

(59) Hindi

a. Ramne har ek bacche-ko kahāni sunāī

Ram every child story told.

Level 4 - ws Q_{pl}, preferred

b. Ramne bacche-ko har ek kahāni sunāī

Ram child every story told.

Level 1 - ws Q_{sg}, preferred

(60) Japanese

a. Taro-wa hitori-hitorino ko-ni ohanashi-o shimashita.

Taro every child-to story told.

Level 5 - ws Q_{pl}, only

b. Taro-wa kodomo-ni zembu-no hanashi-o shimashita.

Taro child-to every story told.

Level 1 - ws Q_{sg}, only

(61) Irish Gaelic

a. D'inis Seán scéal do gach-aon phaiste.

Told Sean story for each child.

Level 5 - ws Q_{pl}, only

b. D'inis Seán gach-aon scéal do phaiste.

Told Sean each story for child.

Level 1 - ws Q_{sg}, only

Section 8: Grammatical Function and Sentential Position

From the data given above we can conclude that another sentential element belongs in the hierarchy of grammatical positions, this being the category of topic. One might question whether this is a legitimate grammatical category, since in English there is no designated way of referring to the topic. But many languages do have a specific grammatical category for the topic. Some have argued that the sentential element usually considered the subject in Malayo-Polynesian languages is actually a topic. I will revise the hierarchy presented earlier to include the topic position slightly ahead of the subject position. This decision is justified on the basis of the fact that in Japanese and Iranian topicalization of the 'girls' noun phrase causes it to be given higher scope on the preferred reading [cf. (42n) and (47b)]. The same nouns in subject position do not give a Level 4 rating, but only a Level 2 or a Level 3. (See Table 4.) The revised list appears in Table 5.

TABLE 5 Revised Hierarchy of Grammatical Functions

1. topic
2. deep and surface subject
3. deep subject/surface subject
4. preposition object
5. indirect object
6. direct object

One might speculate as to why the topic and subject are at the top of the hierarchy. In all the languages examined, focus was accomplished by moving an element to either the front or the end of the sentence. In most languages these are also positions for the subject. Exceptions are the Semitic languages, but in at least Hebrew and Arabic this is changing in the colloquial language. It seems to me that the explanation of why these two categories have greatest tendency to higher scope lies in the fact that they occur in very salient positions in the sentential string. Sentences are uttered as ordered series of elements and, thus, are subject to what is known as the serial position effect. It has long been known in psychology that in an ordered set of items those at the beginning and at the end capture the most attention and are retained the longest. This is due to what is called the primacy and recency effect. Languages use those positions to convey the most important information in the sentence. This is why the element with higher scope will most likely be found at either end of the sentence. English normally utilizes the S-initial position to convey important information. Thus, the noun phrase with higher scope can usually be found at the front of the sentence. This is why to date linguists, who have built their theories around data in English

alone have posited left right order as the determining factor in assigning scope. One need only look at a variety of languages to see the leftmost position is just a vehicle to convey the important GRAMMATICAL information.

This chapter has delineated three major points: different quantifiers have differing probabilities of acquiring wider scope; relative linear ordering of clause mates at the surface level is not a parameter of quantifier scope; and grammatical functions, both those at the deep and those at the surface levels, are among the relevant factors that determine the possible scope interpretations.

Footnotes

1. Though he admits to dialect variation in the interpretation of sentences in which quantifiers interact, he represents data for his dialect alone. Without the use of rigorous psycholinguistic testing measures, this is the only approach a linguist can take. However, Lakoff claims that his dialect represents that of the majority of English speakers, a claim he makes no attempt to substantiate. In fact, in questioning a large number of both linguistically and nonlinguistically trained speakers, I have found none who share his dialect.

2. It is not specified whether the girls are in a group or not, but this has nothing to do with the scope of the quantifiers. It is a question of whether the set of girls is interpreted by the semantics as one set or as the individual members of it. Either way, the quantifier NP, *a problem*, distributes over *three girls* in the interpretation. This problem was dealt with in chapter two.

3. It must be noted that the quantifiers on this list are only the unstressed variants. It is probably the case that another hierarchy could be established for stressed quantifiers, or one showing the interaction between stressed and unstressed occurrences.

4. These ideas were presented by Postal in a lecture entitled "Grammatical Relations in Generative Grammar" at Queens College of the City University of New York on April 5, 1973.

5. In languages without an indefinite article, existentially quantified noun phrases are unmarked for number. A more accurate notation for Q_{sg} in these languages would be Q_u. However, for simplicity this designation is kept. The Q_{pl}'s in every language are followed by a semantically plural noun phrase whether the language indicates number syntactically on nouns or not. Semantically plural nouns are implied by the meaning of the Q_{pl}'s.

6. In languages without an indefinite article, the number of cake is unspecified. This remains so whether the set of girls is interpreted with wide scope or with narrow scope.

7. The notion of 'topic' used here is a very informal one. It is not used in the sense of 'old information,' although it may serve this function in some of the languages. What we mean here by 'topic' is the element of the sentence on which attention is focused. No attempt is made to define the semantic import of this process of focusing attention.

8. The dialect of Greek used is that spoken on the island of Chios.

Chapter IV

Quantified Noun Phrases Which Interact in an Asymmetric Command Relation

Section 1: The Need for Both Deep and Surface Command in Defining Quantifier Scope

The second configuration in which we find quantifiers interacting is a sentence exhibiting asymmetric command relations at the surface level. The surface structure of the sentence contains at least two S nodes, with one embedded within the other. One quantifier occurs in the matrix S and the other appears in the embedded S. In reference to such configurations, current linguistic theories predict that the quantifier in the higher S will receive higher scope assignment.

This view is again most precisely articulated by Lakoff and Jackendoff in their respective formalizations of the constraint which holds between surface logical operators interacting in an asymmetric command relation and their semantic interpretations. Lakoff claims that if a logical operator L_1 commands (i.e., gets higher scope assignment over) another, L_2 in the semantic representation, then L_1 must either precede or command L_2 at the surface level. The grammar should block derivations in which this constraint fails to hold (1971: p.246). We have already shown that precedence is inadequate for capturing generalizations concerning quantifier scope relations (see chapter 3). We will now show that the concept of surface command is equally inadequate.

Like Lakoff, Jackendoff determines scope assignment from the surface arrangements of logical operators. He defines the scope of logical operators such as quantifiers as that material commanded by or to the right of the logical operator. He qualifies the dependency relation, however, by asserting that an NP within the scope of a logical operator is only

optionally dependent on it - according to the degree of preference (d_m) which he does not specifically define. Jackendoff's prediction is vacuous when two quantifiers interact, for one quantified NP will always fall within the surface scope of the other; so a sentence containing two quantifiers is always potentially ambiguous to some degree in his theory. Notice that if it is unambiguous, he could claim that the degree d_m is 0. Jackendoff's prediction concerning command relations is too weak to be disproved; Lakoff's constraint, on the other hand, is far too strong and can be falsified by numerous counterexamples. The notion that asymmetric command alone, uninfluenced by other factors, can determine scope assignment is too simplistic to account for the complexities of quantifier scope interaction. To demonstrate that this is the case, the following discussiion examines in depth one type of asymmetric command relation in which we find two quantifiers interacting, sentences where the embedded S has the form of a complement.

In the following pairs of sentences, the surface structure command relationship is inadequate to predict scope assignment.

(1) a. I persuaded a foreign student to enroll in every course.

b. I expected a foreign student to enroll in every course.

(2) a. A senator is anxious to speak at every rally.

b. A senator is likely to speak at every rally.

(3) a. An interesting conversationalist expects to be invited to every party.

b. An interesting conversationalist seems to be invited to every party.

(4) a. A cake is ready for anyone to ice.

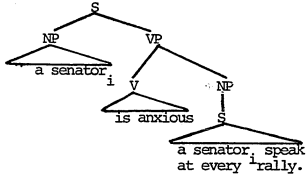
b. A cake is easy for anyone to ice.

In each pair, a standard theory analysis assigns the same surface

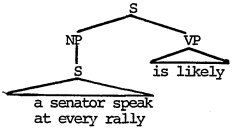
structural description to the (a) and (b) sentences. Thus, in both, word order and command relations are identical. In all eight sentences one quantifier occurs in the matrix S and the other in the subordinate S. But the (a) sentences in all the pairs have a different preferred scope interpretation from the (b) sentences. In the (a) class, the quantifier in the higher S is assigned wider scope on the most likely reading, as the derivational constraint predicts. However, in the (b) examples there is a noticeable change in interpretation. The quantifier in the lower S and occurring rightmost in the tree receives wider scope assignment on the preferred reading. Neither surface relationship, command nor precedence, can account for the preferred readings of the (b) sentences.

In the standard theory (cf. Rosenbaum (1967)) the (a) and (b) sentences have very different derivational histories. The (a) sentences are all said to have undergone equi NP deletion whereby a noun phrase in the embedded S at the level of deep structure has been deleted under identity with a noun phrase in the matrix S. The (b) sentences are examples of raising. Here the quantified NP which occurs in the matrix S in the surface structure has been raised to that position from the place it occupies in the complement of the underlying structure. Therefore the (a) and (b) sentences have quite different deep structure descriptions in the standard theory. Phrase markers (5) and (6) illustrate the differences.

5) D.S. (2a)



6) D. S. (2b)



The distinctions brought out in the standard theory between the (a) and (b) deep structures provide us with a way of explaining the differences in scope interpretation. Using the standard theory model we note that a command relationship does control the assignment of higher scope, but it is a command relationship which is defined at both the deep and surface levels, and not one defined from the surface alone, as had previously been postulated. Thus in the (a) sentences the existentially quantified noun phrase receives higher scope on the preferred reading because it commands asymmetrically at both levels. The indefinite noun phrase in the (b) sentences is in the higher S at the surface level only, accounting in part for why it is assigned lower scope.

A theory which posits syntactic differences in the deep structure for the (a) and (b) sentences is able to account for the differences in interpretation. Without such distinctions, we are at a loss for any obvious explanation of facts, for the (a) and (b) pairs appear to be identical at the surface except for the predicate choice. One might suggest marking the predicate in the lexicon as preferring certain readings but this would be an ad hoc alternative unless some unifying semantic criterion is found which distinguishes the "high scope assignment" predicates from the "low scope assignment" ones. So far, I have not been able to isolate such a semantic property, although one could conceivably be found and shown to work consistently.

Section 2: Accounting for Quantifier Scope in Complement Constructions

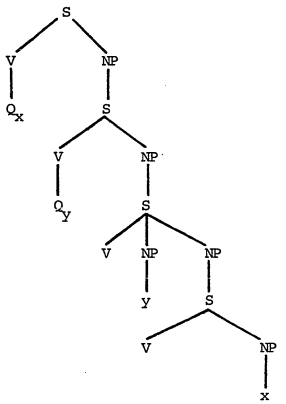
What are the implications which follow from the facts just discussed? One might suggest that all the current theories be revised so as to incorporate information on deep structure syntactic command relations into the mechanism used to predict scope assignment. However, we will see that this

will not be so simple for both the extended standard theory and generative semantics.

A. Difficulties Within Generative Semantics

Let us first examine the difficulties which would be encountered in a generative semantics approach which tried to incorporate information on underlying command relations into its derivational constraints. Generative semantics expresses the semantic relationship between two logical operators by a command relationship in the underlying structure. Logical operators, such as quantifiers, are not represented at this level inside the sentential string where they would appear at the surface. Instead they occur as higher predicates, where one logical operator may command another. However, this is not the command relationship to which I have been referring. The asymmetric command necessary to predict relative quantifier scope is a relationship which holds between the noun phrase positions into which the quantifiers will be lowered, regardless of the command dependencies of the higher predicates. Phrase Marker (7) illustrates a generative semantics underlying structure. It is the positions of the two noun phrases that immediately dominate the x and y variables which play a role in determining scope interpretation.

(7)



A derivational constraint for quantifier scope will have to match the asymmetric command of the quantifiers as higher predicates in the underlying structure with both asymmetric command in the surface and the underlying command relationship of the noun phrase positions into which the quantifiers will be incorporated.

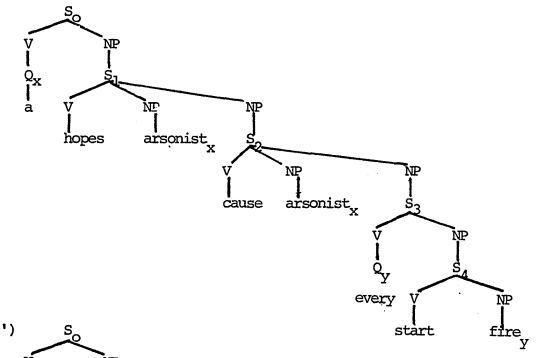
We will see that such a constraint is not statable in the generative semantics model as now formulated. The deep structure command differences exhibited within the standard theory in the (a) and (b) sentences above are often destroyed in a generative semantics underlying structure due to lexical decomposition. The result is that many times raising predicates and deletion predicates place the noun phrases into identical command relationships. Consider sentences (8) and (9):

(8) An arsonist hopes to start every fire.

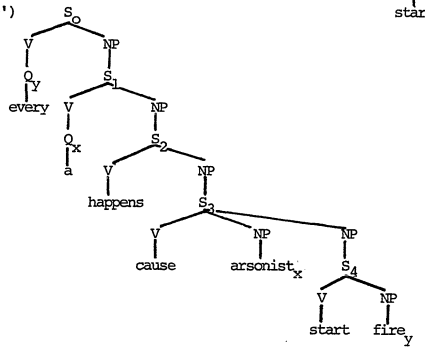
(9) An arsonist happens to start every fire.

Clearly the two sentences have different preferred scope readings. A standard theory account of the two would assign the noun phrases which bear quantification to different underlying S's in (8) and to the same underlying S in (9). This would not be the case in generative semantics as phrase markers (8') and (9') indicate.

(8')



(9')



Whereas in a standard theory deep structure of sentence (9), the NP's, *arsonist* and *fire*, are clause mates; in a generative semantics underlying structure of (9) [cf. phrase marker (9')] *arsonist* commands *fire*, a situation analogous to that found in the underlying structure of (8) [cf. phrase marker (8')]. It is not until predicate raising has taken place that the two noun phrases in (9') become clause mates. It is at this point in the derivation that the specification of their position in the tree is important for the derivational constraint. Until this point the grammar has no way of determining which relative ordering of the two quantifiers in the underlying structure specifies the preferred reading, different for each sentence. The derivational constraint is unable to account for the fact that the quantifier *every* hangs from S_3 in the underlying structure representing the preferred reading of (8) and that it hangs from S_0 in the underlying structure representing the preferred reading of (9). Neither the command relationship of the NP's at the surface level, nor that found in the semantic representation will supply the needed structural information; for the same asymmetric command situation exists at both levels in generative semantics in the two sentences under consideration.

Newmeyer (1974) has given independent evidence to demonstrate that predicate raising is a precyclic rule and that from this it follows that one can define a syntactic level in a generative semantics underlying structure which occurs at the end of the application of the precyclic rules and before the application of the cycle. Such a level is needed in generative semantics to determine quantifier scope as well.

B. Difficulties Within the Extended Standard Theory

The extended standard theory will also have difficulty incorporating information on deep structure command into its framework of semantic

interpretation. Chomsky has stated that the interpretation of the logical properties of a sentence is to be made from the surface alone. The examples cited in (1) to (4) would seem to argue against his position. However both deletion and movement have been reformulated in the extended theory. Traces now record movement operations and deletion has been replaced by an anaphoric interpretation of deltas. The surface structure can now code the command dependencies represented in the deep structure. Because deep structure information has become available at the surface level, the extended standard theory should be able to revise the formula used to interpret scope so that it will correctly predict the scope differences exhibited in sentences (1) to (4).

Yet other recent revisions in the extended theory preclude such a simple restatement of the interpretation mechanism. Several linguists working within this framework have questioned the presumed structural identity of the (a) and (b) sentences at the surface level and the structural differences at the deep level. Mainly, they have challenged the assumption that the (b) sentences of (1) to (4) are derived in every case by a raising transformation. The very existence of a raising transformation in certain contexts has been rejected by Chomsky (1973). Lasnik and Fiengo (1974) have argued for a deletion-type deep structure rather than a raising-type deep structure for certain other predicates. Bresnan (1971) has maintained that the movement that occurs with certain predicates is not raising from an embedded S to a matrix S, but rather movement from an object position to a subject position within the same S. Notice that for my explanation of the scope differences exhibited in (1) to (4) to be viable, it is necessary that the grammatical model assign similar surface structures but different underlying structures to each pair of sentences.

Because doubts have been raised as to whether the (b) sentences result

from raising, we must examine the arguments which lead to a rejection of a raising analysis to ascertain if they are valid. For if they are, we must then seek some alternative explanation for why the (b) sentences are normally interpreted differently from the (a) sentences.

Section 3: A Re-examination of the Linguistic Motivation for Raising

Three raising contexts have been defined. They are:

1) Raising into Subject of an embedded subject (S to S raising). This occurs with verbs like *happen, seem, appear, chanced, prove* and *turn out*; and with certain adjectives like *certain, able, likely,* and *bound*. Examples of this transformational process are given by the sentences (2b) and (3b) above.

2) Raising into Object of an embedded subject (S to O raising). This transformation was defined to apply to predicates of the following sort: *expect, want, prefer, consider, intend,* and *cause*. An example using one of these predicates following a raising operation is (1b) above.

3) Raising into Subject of an embedded object (O to S raising). This process is often called *Tough*-movement or simply object raising. More recently it has been referred to as non-subject raising. O to S raising predicates are adjectives of the following sort: *easy, hard, tough, difficult, simple,* and *expensive*. An example of a sentence which has undergone O to S raising is (4b) above.

Of the three types of raising, the one which has remained undisputed since the analysis defined by the *Aspects* model is S to S raising. No arguments have come forth claiming that the matrix subject which appears at the surface level with raising predicates originates in the matrix subject position in the underlying structure. Therefore the deep structures of the raising predicates remain distinct from those of their deletion counterparts

in all the current literature discussing these predicates. Moreover, the surface structures which are derived from the two classes of predicates look very similar. Although Emonds (1972) and other working within a structure preserving framework (cf. Bowers (1972)) have argued that the embedded S originates in the object rather than in the subject position as it did in Rosenbaum's analysis, in these more recent analyses, the noun phrase which becomes the surface matrix subject still originates in the embedded sentence and is raised up. There seems to be no syntactic evidence to suggest that S to S raising should be redefined as equi NP deletion. Among the several reasons given for the justification of raising, two major arguments stand out. First, constituents which are subcategorized for a very restricted distribution can occur as the surface subject of raising predicates, but not of deletion predicates. To introduce these NPs as deep structure subjects of the raising predicates would add undue complexity to the grammar. Such NPs are phrases which normally occur as subjects of idioms and the lexical item *there*. In the case of *there*, even if the objection of the complexity of selectional restricitions could be overcome, independent arguments exist which demonstrate the need to introduce *there* transformationally rather than directly into the base. We find the selectional differences manifesting themselves in sentences such as those of (10) which contain raising predicates and (11) which contain deletion predicates.

(10) a. There seems to be a lot we can do for Cuba.

b. The shit is likely to hit the fan.

(11) a. *There expects to be a lot we can do for Cuba.

b. *The shit is anxious to hit the fan.

A second major argument supporting a raising analysis stems from the

fact that either an active or passive embedded subject may be raised into the matrix subject position. Even so, the meaning of the two forms remains equivalent as long as the meaning of the complement has held constant under passivization. We can find a sharp contrast to this in S to S deletion predicates where the meaning is noticeably different if deletion has occured with the passive subject rather than the active one. Sentences (12) and (13) illustrate the comparison between the raising and the deletion paradigms.

(12) a. Everyone seems to admire the Duke of Buccleuch.=
b. The Duke of Buccleuch seems to be admired by everyone.

(13) a. Everyone is anxious to admire the Duke of Buccleuch.≠
b. The Duke of Buccleuch is anxious to be admired by everyone.

Many other arguments in favor of a raising analysis for this class of S to S predicates can be found in Postal (1974: pp.369-374).

Because the surface structure of S to S deletion and raising predicates are quite similar, yet they consistantly give rise to very different quantifier scope interpretations, a theory which assigns logical representations to surface structure strings only will not be able to account for the differences. From this follows an invalidation of Chomsky's (1973) claim that all logical relations can be interpreted from the surface phrase marker and that the only semantic information provided by the underlying phrase marker is that of thematic relations. The structural differences illustrated by the underlying syntactic configurations provide a ready explanation for the differences in scope interpretation. Only a theory of semantic interpretation which utilizes syntactic information afforded by both the deep and surface trees in assigning logical representations can

can account for the data, necessitating an extension of all the current theories attempting to represent logical interpretations.

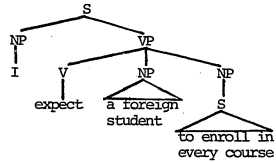
Turning to the second class of raising predicates - those that trigger S to O raising, no one to my knowledge has claimed that these raising predicates have equivalent deep structures to corresponding deletion predicates. Such a claim would amount to an assertion that at deep structure the S to O raising predicates are three place rather than two place, or conversely, that the corresponding deletion predicates are two place rather than three place predicates. There is strong syntactic evidence against such claims and it has been detailed in many places (cf. Rosenbaum (1967); R. Lakoff (1968); and Huddleston (1971)).

With this class of raising predicates little argumentation has been put forth to challenge our position that there are different deep structures which can account for, in a systematic way, the meaning differences exhibited between S to O deletion and raising predicates. However, though it is necessary for our explanation to have established the existence of two different underlying configurations, it is not sufficient evidence to illustrate that our explanation is the only viable one. We must also demonstrate that the two classes of S to O predicates have identical surface configurations, thus precluding the possibility of obtaining the correct semantics from the surface structure alone.

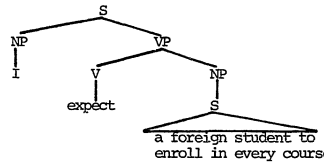
There is currently in the linguistic literature much debate as to what the correct surface structures of the S to O two place predicates are. As we noted above, the commonly held position has been to argue that the embedded subject is raised by some transformational operation to become a surface object of a higher S. This view is still being defended, perhaps with greatest articulation by Postal (1974). However, other linguists, most

notably Chomsky (1973), assert that raising has not in fact taken place and that the underlying embedded subject remains in that position in the surface phrase marker as well. The two competing surface configurations are illustrated in (14) and (15) below.

14) Raising SS:

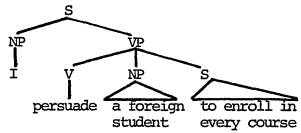


15) Non-Raising SS:



The raising surface structure shown in (14) will exhibit identical quantifier command relationships as in the surface structures of corresponding three place predicates.

16) 3-place predicate SS:



But, on the other hand, the non-raising surface structure is of quite a different form. Thus one adhering to a non-raising analysis for S to O two place predicates will be provided with a surface structure explanation as to why the two classes of predicates differ in their preferred scope assignment: the cases where the object indefinite gets higher scope are those where it is located in a higher surface S.

However, those espousing a S to O raising analysis also have an

explanation at hand - namely, the same explanation which is to be used to account for all the instances of deletion vs. raising scope differences. They would explain the differences using the deep structure command relations as a basis for scope interpretation. They would have the advantage of proposing a unified explanation for the unexpected scope interpretation in all three types of raising. Those linguists who would maintain that the surface structure could account for the scope differences between the S to O two place and three place predicates will be unable to extend their explanation to the other cases; for as we have shown above and will further illustrate below, the S to S raising and deletion, as well as the O to S raising and deletion predicates, have identical surface structures in all the essential parameters which one might employ to account for scope differences.

Therefore, because in our view the evidence which has been advanced to support either analysis of S to O two place predicates is not convincing enough to admit a choice between the two positions, and because championing one analysis over the other is not a necessary condition for our claims concerning quantifier scope interpretation to be correct, and last of all, because the arguments supporting each of the analyses have already been lucidly spelled out by Postal (1974) and Chomsky (1973), we will not repeat these arguments here.

Section 4: *Tough*-Movement versus *Tough*-Deletion

The strongest and most frequent proposals for a similar treatment of corresponding deletion and raising predicates whereby they would both be derived from the same type of underlying structures, occurs in the case of O to S raising or *tough*-movement. Several linguists have argued that O to S raising is actually O to S deletion (cf. Lightfoot (1974) and Lasnik & Fiengo (1974)). The claims they are making for the *tough* predicates

in relation to their deletion counterparts is exactly opposite to the claim Chomsky is proposing for the S to O two place predicates in relation to their three place counterparts. Whereas what Chomsky is asserting is that the two place predicates differ at *both* the deep and surface structure levels from the three place ones, Lightfoot and Lasnik & Fiengo are claiming that the two classes of O to S predicates have identical deep *and* surface structures. Under their analyses the sentences containing predicates like *easy* would be derived from the same configurations as those underlying predicates like *ready*. Both would be treated as cases of object deletion. A sentence like (17b) below would be the source for the surface sentence (17a).

(17) a. Taffy is tough for Polly to pull.

b. Taffy is tough for Polly to pull taffy.

Arguments against a deletion analysis of these predicates have been made in several places including Postal & Ross (1973), Berman (1973, 1974) and Berman & Szamosi (1972). Since the explanation we have proposed to account for the quantifier scope variation depends crucially on a distinction being made between the deep structures of deletion and raising predicates in all three cases, it is essential that we justify a raising analysis of the O to S predicates. Therefore we will review the arguments on both sides and attempt to justify a raising type of deep structure.

Basically, advocates of a deletion analysis would deny the transformational relationship between sentences (18a and b) whereas they have been traditionally described as deriving from the same underlying structure.

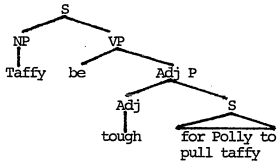
(18) a. Taffy is tough for Polly to pull.

b. It is tough for Polly to pull taffy.

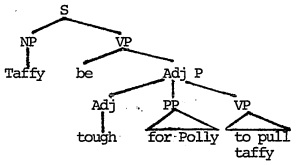
However, the two deletion treatments we are considering differ in one

fundamental respect in the underlying structures they assign to the sentences of (18). Lightfoot would still maintain the traditional view that the complement following the *tough* predicates is an S in the underlying structure. Lasnik & Fiengo, building on syntactic arguments first proposed by Bresnan (1971), claim that the complement is dominated simply by a VP node and that as a result, the underlying structure contains no embedded S. As a result, the *for* phrase must originate in the matrix VP rather than in the complement. (19) and (20) below represent the deep structures for sentence (18a), and (21) and (22) are those underlying sentence (18b).

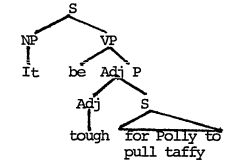
19) Lightfoot D.S. of (18a)



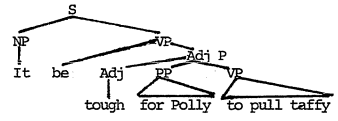
20) Lasnik & Fiengo D.S. of (18b)



21) Lightfoot D.S. of (18b)



22) Lasnik & Fiengo D.S. of (18b)



Of course, I hope to demonstrate that the underlying complement is an embedded S. Furthermore, I will illustrate that the same preferred readings arise with *tough* predicates when there is no justification for claiming that the *for* phrase originates in the matrix VP.

A. Arguments Against Lightfoot's Deletion Analysis

First I will examine the position outlined by Lightfoot, since his reanalysis is not as radical as that put forth by Lasnik & Fiengo. The motivation for Lightfoot's position stems from his observation that there are predicates which sometimes behave as movement predicates and other times behave syntactically as deletion predicates. Using the predicate *silly* as an illustration, he compares the following sets of sentences (his 7 to 17).

(23) a. John's eagerness to please

b. *John's easiness to please

c. *John's silliness to please

(24) a. John is eager for me to come.

b. *John is easy for me to come.

c. *John is silly for me to come.

(25) a. *John is eager for me to touch.

b. John is easy for me to touch.

c. *John is silly for me to touch.

(26) a. John is eager to please people.

b. *John is easy to please people.

c. John is silly to please people.

(27) a. ?The dirt is eager to come off.

b. *The dirt is easy to come off.

c. ?The dirt is silly to come off.

(28) a. *The dirt is eager to see.

b. The dirt is easy to see.

c. *The dirt is silly to see.

(29) a. What John is eager for is that Trudeau will win.

b. *What John is easy for is that Trudeau will win.

c. *What John is silly for is that he went to the party.

(30) a. Everyone is eager to ignore me. ≠ I am eager to be ignored by everyone.

b. Everyone is certain to ignore me. = I am certain to be ignored by everyone.

c. Everyone is silly to ignore me. ≠ I am silly to to be ignored by everyone.

(31) a. The cat is eager to wash itself.

b. *The cat is easy to wash itself.

c. The cat is silly to wash itself.

(32) a. *To please Rodney is eager.

b. To please Rodney is easy.

c. To please Rodney is silly.

(33) a. There is certain to be a snake lying there.

b. *There is silly to be a snake lying there.

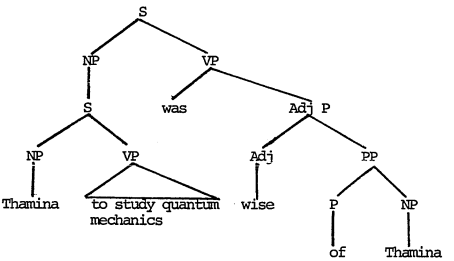
Lightfoot argues that since the criteria presented in (23) to (33), normally used to distinguish between *easy* and *eager* deep structures, do not generalize to other adjectives such as *silly*, we may raise questions as to the validity of the underlying distinctions. He defines the notion of "indeterminacy in syntax." His claim is that since some predicates such as *silly* are indeterminate as to which deep structure analysis they should be given the choice being between and *eager*-type deletion configuration or an *easy*-type raising configuration - there is no justifiable syntactic reason to maintain the two distinct deep structures (p.16). On the basis of the syntactic evidence presented in (23) to (33) Lightfoot concludes that there is no structural difference between *easy* and *eager* complementation.

Let us examine the validity of the arguments leading to this conclusion. First, Lightfoot claims that the structure presented in the examples are the syntactic evidence used to segregate predicates into one category or the other, and necessarily every predicate must fall into one of the two possibilities - an *eager*-type deep structure or an *easy*-type deep structure. If the syntactic criteria established to motivate the different deep structures fail to be applicable to some class of predicates, leaving us at a loss as to how to classify them, our only move is to reject the original distinction as untenable.

Lightfoot has not considered the possibility that there might be a third type of deep structure, unlike either the *easy* or *eager* underlying trees, and this third type of structure would not be subjected to the same syntactic criteria to motivate its form. Such a possibility is in fact the case. Hornby (1954) has noted that *silly* belongs to a traditionally recognized class of predicates that designate personality characteristics. From this fact we can conclude that *silly* and other predicates in the class must be subcategorized as being predicated only of [+ animate] nouns.

Rosenbaum and Langendoen (1964) have suggested a likely deep structure analysis of this class of adjectives (which includes *silly, wise, thoughtful, thoughtless, stupid, nice, pleasant, kind* and *gracious*). The deep structure has the following form:

34)



If Equi NP deletion does not apply to (34) we would derive:

35) For $\left\{\begin{matrix}\text{Thamina}\\ \text{her}\end{matrix}\right\}$ to study q. m. was wise of $\left\{\begin{matrix}\text{her}\\ \text{Thamina}\end{matrix}\right\}$.

After the application of Equi we would get:

(36) To study quantum mechanics was wise of Thamina.

Expraposition on this structure yields:

(37) It was wise of Thamina to study quantum mechanics

and It-replacement gives us:

(38) Thamina was wise to study quantum mechanics.

It should follow from a deletion analysis for adjectives like *silly* that scope relations with quantifiers would behave as they do with others deletion adjectives and give the indefinite higher scope in sentences like those under consideration. And this is precisely the case.

(39) A senator is silly to speak at every rally.

Sentence (39) has a preferred reading where for any senator we choose, it is the case that she is silly to speak at every rally. Our hypothesis that deep structure syntactic command relations govern scope interpretations is strengthened by the correct prediction it makes for yet another class of

deletion predicates.

We see then that Lightfoot's first error was to assume that there could only be two possible underlying configurations for adjectives taking complements. Given the fact that there exist three different deep structures, is there any natural explanation for the distribution of the data in examples (23) to (33)? If we examine the data case by case, not only will we observe that the various grammaticality judgements are completely predictable from other facts than the ones considered by Lightfoot, but it will also become obvious that these structures are not the syntactic tests which are to be used to separate raising predicates from deletion predicates. Rather the grammaticality judgements result from a host of other facts which are completely unrelated to the distinctions of deletion vs. raising.

Consider first example (23) showing that *eager* can nominalize, while *easy* and *silly* cannot. Though the facts of nominalization are not understood, it is certainly not the case that ability to nominalize corresponds even weakly to ability to take a deep structure concrete subject. Some well known deletion predicates don't nominalize, for example **awfulness*, and **deliciousness*. On the other hand, many raising predicates do, for example *certainty, likelihood*.

The ungrammaticality of sentence (24b), *John is easy for me to come*, has an obvious explanation. The embedded complement **for me to come John* is not well-formed, for it violates the selection restrictions on the object of *come*. Therefore we expect the raised sentence to be ungrammatical.

Many of the remaining deviant sentences can be explained by looking at the raising or deletion requirements of each predicate. *Eager* is specified for an identity holding between the matrix *subject* and the complement

subject, if deletion is to occur. The identity cannot be maintained with a complement object. This restriction explains the deviance of (25a) *John is eager for me to touch.* In the case of *silly*, the identity is required between the *object* of the matrix *of* phrase and the *subject* of the embedded S in the underlying structure. Using this grammatical fact we can rule out (24c) *John is silly for me to come* and (25c) *John is silly for me to touch.* In the case of *easy*, only an embedded *object* can be raised into the matrix subject position. If one tries to raise an embedded subject, the result will be an ungrammatical sentence. Hence we explain the deviance of (26b) **John is easy to please people*, (27b) **The dirt is easy to come off*, and (28b) **The cat is easy to wash itself.* Sentence (29b) **What John is easy for is for Trudeau to win* is ungrammatical simply because the matrix surface subject, *John*, never occurred at all in the underlying complement. No NP was raised, so the sentence before pseudo-clefting is ungrammatical. It is hardly a surprise then that pseudo-clefting in this case produces a deviant sentence.

Eager must have an animate subject at both the deep and surface levels; *silly* requires an animate object of the matrix *of* phrase in the underlying structure which can optionally be moved into the subject position at the surface. Using these restrictions we can rule out the following:

(27) a. *The dirt is eager to come off.

c. *The dirt is silly to come off.

(28) a. *The dirt is eager to see.

c. *The dirt is silly to see.

(32) a. *To please Rodney is eager.

(33) b. *There is silly to be a snake lying there.

As with nominalizations I cannot explain the conditions under which

pseudo-clefting can occur. But its permissibility cannot be equated with the ability of predicates to undergo deletion, for many deletion predicates do not permit a pseudo-clefting construction.

(40) *What Katherine is too intelligent for is to be taken in by a man like Carl.

One set of examples remains to be accounted for, namely, those of number (30). Certainly we would not expect synonymy under passivization with subject deletion predicates, for the logical subject of the matrix verb will not be the same in both cases. Thus the noun phrase which has the agentive role is different in the active and passive versions. On the other hand with the subject raising predicates we would expect the meaning to remain constant with a passivized complement, if the two versions of the complement are synonymous, for none of the case relations would have changed within the sentence. In the case of *silly*, I must disagree with Lightfoot's judgements of grammaticality. I find the passivized version of (30c) an ungrammatical sentence.

(30) c. *I am silly to be ignored by everyone.

The complement following *silly* must be something within the control of the person of whom the property of being *silly* is ascribed. This explains the requirement that the identity which holds must be with the deep structure *subject* of the complement.

There is an additional criticism of Lightfoot's position. On examination one finds an inconsistency in his own reasoning. Having observed that there is no neat division of predicates into those which behave in certain syntactic ways and those which don't, he attempts to explain the indeterminacy by denying any syntactic distinction at all in the types of predicates. Rather, he asserts that they all derive from structurally

similar phrase markers if they occur with a concrete subject at the surface. But by denying underlying structural differences, he can in no way explain the indeterminacy he has set out to account for. If all three predicates occur in similar types of deep structures, they should behave the same with regard to his alleged syntactic tests, leaving him with no explanation whatsoever of the indeterminacy he claims exists. Though he delineates some inconsistent facts, his solution precludes any insightful explanation.

B. Traditional Arguments in Support of *Tough*-Movement

Before presenting Lasnik and Fiengo's arguments in support of a deletion analysis of *tough* predicates, let us review the syntactic facts which led linguists originally to hypothesize an object raising transformation.[1] The main support for a raising analysis derives from the fact that the selection restrictions on the *tough* class of predicates are very narrowly defined when the predicate is not followed by a complement. Only a small set of noun phrases can function as the subject of these predicates in simple sentences. However, when the predicates are followed by a complement virtually any noun phrase may occur as subject, as long as it can be interpreted as object of the complement verb. Sentences (41) and (42) illustrate the difference.

(41) a. *Justice is difficult.

b. *Scott's hair is simple.

(42) a. Justice is difficult to administer.

b. Scott's hair is simple to run your fingers through.

If the subjects in both configurations are generated in the base, two types of selection restrictions would be required: one for the adjective when it occurs alone and one for when it is followed by a complement.

In addition to a simple noun phrase these adjectives can occur with a reduced sentence as their subjects, or the pronoun *it* if the sentence

has been extraposed.

(43) a. To administer justice is difficult

b. It is difficult to administer justice.

(44) a. To run your fingers through Scott's hair is simple.

b. It is simple to run your fingers through Scott's hair.

A theory espousing a deletion analysis to account for simple NP's as subjects of *tough* constructions would have to posit two deep structure configurations in which *tough* adjectives may occur. Such an analysis is possible; however, it misses several important generalizations. First, the sentences of (43) and (44) are synonymous with the sentences of (42). This generalization is naturally captured by an analysis which derives all three versions of the sentence from a single deep structure. The alternative deletion analysis would appear to complicate the grammar by requiring a mechanism to account for the fact that the synonymy between the two types of sentences is non-accidental, but results every time two such deep structures contain identical lexical items.

Second, a deletion analysis would be at a loss to explain why the only NP's which can occur as subject of the adjective plus complement constructions, as in (42), are those which occur as objects of the complements verb when the complement is the underlying subject of the sentence, as in (43) and (44). If the NP subjects in (42) are analyzed as underlying subjects, then the fact that the same selection restrictions hold for both deep structure configurations again appears accidental.

Idioms provide additional evidence for a movement analysis. There are certain nouns which only occur as objects in fixed expressions. Two of these are *headway* and *appearances* in: *make headway* and *maintain appearances*. Though neither noun can occur as the subject of a *tough* adjective appearing

alone, they can function as the subject if the adjective has a complement the remainder of the idiom. Examples (45) and (46) illustrate these facts.[2]

(45) a. *Headway may be difficult.

b. *Appearances are good.

(46) a. Headway may be difficult to make under such conditions of stress.

b. Appearances are good to maintain for your family's sake.

In other idioms the object NP's are interpreted in a non-literal sense. They keep the non-literal interpretation when they become subjects of *tough* adjectives, as a movement analysis predicts.

(47) The ice is hard to break at formal receptions.

(48) The hatchet will be difficult to bury after what you just said.

A deletion analysis will have great difficulty explaining how such subjects can be generated independently in the base, with no apparent connection to the remainder of the idiom.

Deletion predicates do not exhibit the above mentioned properties. With respect to selectional restrictions, a deletion predicate selects the same set of noun phrases as its subject whether or not it is followed by a complement.

(49) a. My hair is too dry.

b. My hair is too dry to shampoo every night.

(50) a. Max is eager.

b. Max is eager to feed all the birds.

But as was indicated above, this is not true of raising predicates.

(51) a. *The bookshelf is easy

b. The bookshelf is easy to carry.

Idiom behavior also differs with deletion predicates. Idiom fragments

cannot occur as subjects of deletion predicates while the remainder of the idiom is located in the complement. *Tough* predicates have no such restriction, and this is the case with the ther movement predicates as well.

(52) a. The shit seems to have hit the fan.

b. *The shit expects to have hit the fan.

(53) a. The hatchet can be hard to bury.

b. *The hatchet can be ready to bury.

When *tough* predicates are placed in a deletion configuration, as happens when they are joined with *too* or *enough*, they lose the ability to isolate parts of idioms. This illustrates that it is not an inherent semantic property of the predicate which determines its behavior with idioms, but rather the syntactic configuration in which it appears.

(54) a. *The ice is too hard to break at formal receptions.

b. *Headway is difficult enough to make under conditions of stress.

C. Arguments Against Lasnik and Fiengo's Deletion Analysis

Turning to the arguments given to justify a deletion analysis, Lasnik and Fiengo make two claims concerning sentences like (55):

(55) Taffy is tough for Polly to pull.

1. The rule which derives (55) from its underlying structure is a *deletion* rule, not a *movement* rule. From this it follows that the surface subject is also the deep subject.

2. The complement following *tough* predicates is a VP comp, not an S comp, at both the deep and surface levels. Therefore, in the underlying structure the *for* phrase occurs only once, as a prepositional phrase of the higher verb.

To justify the former claim - that the rule is a deletion rule - they give three main arguments. The strongest of these centers around the fact

that the surface subject of *tough* predicates can sometimes be interpreted with agentive force. Such is the case when a *tough* construction permits the progressive aspect, an intentional adverb or an imperative form; for these are indications that the subject controls the action of the verb. That *Suzanna* in (56) can have an agentive interpretation is shown by the existance of the forms in (57).

(56) Suzanna is easy to please.

(57) a. Suzanna is being easy to please.

b. Suzanna is intentionally easy to please.

c. Be easy to please.

L & F note correctly that neither the progressive aspect nor an intentional adverb can occur with the normal paraphrases of (56):

(58) a. *It is being easy to please Suzanna.

b. *To please Suzanna is being easy.

(59) a. *It is intentionally easy to please Suzanna.

b. *To please Suzanna is intentionally easy.

Under a movement analysis (57a) and the sentences of (58), and (57b) and the sentences of (59) are said to derive from the same underlying structures. L & F remark that adherents of a movement analysis will have difficulty generating the sentences of (57) while blocking the sentences of (58) and (59) without resorting to an ad hoc mechanism.

However, one thing L & F do not observe is that the agentive tests illustrated in (57) are not very productive. There only seem to be a few expressions containing *tough* predicates that can express a property over which the subject may have control. The most obvious are *easy to please* and *hard to get*, but even these are rejected in forms such as (57) by some speakers. There may be a few additional expressions which can be

used with an agentive subject, but the list is small. These fixed expressions therefore function as idioms, and the complete phrase would be listed in the lexicon as a single item requiring a [+animate] subject. The interpretation would assign an agentive role to the subject of the idiomatic expressions. In the normal usage of *tough* predicates the agentive role is taken by the object of the *for* phrase. The following sentences are typical examples of the type of *tough* constructions under consideration.

(60) a. *Ellen is being easy to remember.

b. *Frank is intentionally difficult for Frieda to appreciate.

c. *Be impossible to imagine.

Though these sentences have animate subjects at the surface, none can occur with the progressive aspect, the imperative or an intentional adverb. This is exactly what one would expect when the surface subject does not function as an agent. There is no justification to postulate a source for the sentences of (60) in which the surface subject is also the deep subject. In fact one could explain the idiomatic reading of *tough* constructions by permitting a second derivation for them. The sentences which do not permit the agentive subject reading would derive from only one underlying configuration, that containing a sentential subject.

L & F, themselves, state in an appendix to their paper that *tough* constructions, in the relevant sense, "describe an entity in terms of an action on or change of state of that entity" (p.560). The entity to which they refer in the quote is the object of the *for*-phrase. They are careful to differentiate what can be called a [+agentive] usage of the *for*-phrase from a [+benefactive] usage; the latter, they claim, is not

the relevant sense of the *tough* predicates. In the examples below, only (61a) in which *Lois* functions as an agent, is the type of *tough* construction relevant to the discussion.

(61) a. It will be tough for Lois to both work and go to night school.

b. It will be tough for Lois (on Lois) for her husband to lose his job.

In its normal usage a *tough* predicate requires that a concrete surface subject be interpreted as [+patient]. But *tough* constructions seem to be undergoing an historical change in that they permit concrete surface subjects to function as agents in a limited set of cases. As a result the grammar of English now contains an additional deep structure subcategorization for these predicates. The second subcategorization reflects the new [+agentive] interpretation of the subject which is still idiomatic.

The change which is occurring in the possible interpretations of *tough* constructions has historical parallels in other predicates.[3] Several verbs in English have required the addition of new subcategorizations to reflect new semantic interpretations which they permit. *Need* and *want* are two such predicates. In an earlier predicates. In an earlier period of English the two verbs took only impersonal subjects of the following sort.[4]

(62) a. There needs no such apology.

b. There wants a collection of dying speeches.

Later the verbs became transitive requiring concrete subjects:

(63) a. Jack needs a hair cut.

b. Martha wants to meet the govenor.

More recently a new subcategorization has been added which allows the underlying object of the complement verb to appear as the surface subject. Though

the complement verb takes the gerundive form, it is understood with a passive meaning.

(64) a. Her socks need mending.

b. The floor wants washing.

Additional examples are found with *promise* and *threaten*. Normally these verbs require an animate agent as subject. However, in a limited number of cases, these verbs may have inanimate subjects which cannot be interpreted in an agentive sense.

(65) a. That window threatens to break.

b. The weather promises to be sunny.

The examples in (65) indicate idiomatic uses of the verbs. This may represent a stage through which a predicate passes in the process of adding new subcategorizations or selection restrictions. The *tough* constructions are also passing through an idiomatic stage as they begin to add new subcategorizational frames. But, in claiming that there is only one deep structure frame for sentences like (56) which have two interpretations, L & F have no way of indicating that such a change is underway.

The second argument for a deletion analysis concerns indefinite NP's. As Postal (1971) pointed out, indefinite NP forms moved into the surface subject position of *tough* constructions cannot be interpreted as [+specific].[5] L & F use this restriction as support for a deletion type deep structure. The fact that true indefinites cannot occur as surface subjects of *tough* predicates, but can occur in other *tough* configurations is accounted for easily with a deletion analysis. They claim that an independent restriction that "indefinites cannot be the deep subjects of predicates denoting characteristics" [p.545] will explain the ungrammaticality shown in (66).

(66) a. *A bunch of bananas was easy to eat.

b. *An uncle of mine is difficult to visit

However, the deep structure constraint which they claim is operating to block (66) does not appear to be a valid constraint. There are many sentences which ascribe a characteristic of a true indefinite NP, where the indefinite form is clearly the underlying subject.

(67) a. A girl friend of mine is eager to see all the World Series games.

b. An old school friend expects us to visit her every Christmas.

c. Some woman swims in the Charles every day.[6]

It seems that what L & F mean by "denoting a characteristic" is the predication of some generic generalization. To say that indefinites cannot be deep subjects of generic expressions misses the point. If the predicate expresses a generic quality, then naturally an indefinite form occurring as subject of that expression will be interpreted as a generic. This has nothing to do with deep structure restrictions, as such a prediction follows from an examination of the surface alone. The question to be raised concerning *tough* predicates is why they always require an indefinite form occurring in the subject to be interpreted as part of a generic expression (see footnote 5). A deletion analysis will give us little insight into an explanation; for notice that true indefinites can occur as underlying subjects of generics if they have been moved out of that position at the surface level, as example (68) illustrates:

(68) Christmas gifts are always delivered by a red suited man.

The third and final argument for the deletion analysis is based on the syntax of the verb *try*. Lasnik and Fiengo claim that a movement analysis will have difficulty generating sentences like (69) from an underlying source like (70) or (71).

(69) John tries to be easy to please.

(70) *John tries (for) to please John to be easy.

(71) *John tries for it to please John to be easy.

Since tough movement is an optional rule, there is no way to guarantee that it would have applied in order to supply the proper structural description for the equi NP deletion rule required by the verb *try*. If tough movement does not occur, only deviant sentences would result.

L & F assert that a deletion analysis, coupled with a description of the complement as a VP rather than an S, can easily generate sentence (69). The source for it is represented in (72) where the second occurrence of John is deleted under identity with the subject of *try*.

(72) John tries to be easy to please John.

Thus the structural description of (72) contains two VP's, one being the complement of *try* and the second being the complement of *easy*. By postulating VP complements for *try*, L & F avoid the necessity of requiring a *like subject constraint* usually associated with the syntax of *try*, and the many problems which accompany it.[7] However, they will have difficulty generating all the acceptable sentences containing *try*. Though L & F go to great lengths to deny it [p.553], large numbers of passive constructions can occur as complements of *try*. The following sentences are acceptable to such a large number of speakers, that they must be accounted for by the grammar.[8]

(73) a. Matthew tries to be liked by everybody.

b. Harry always tries to be told what to do next.

c. John tried to be examined by the doctor. (cited by Bowers:1972)

d. Joe tried to be chosen for the part. (cited by Berman:1974)

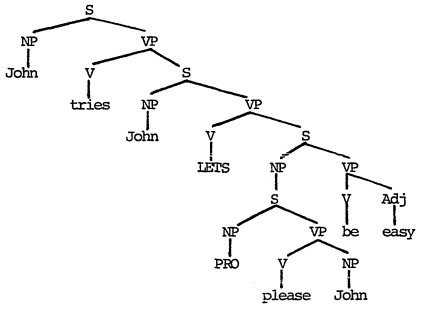
Notice also that the passive can occur after object deletion predicates,

a fact which L & F deny as well [p.549]. Sentences likes (74) below cannot be generated by L & F's grammar since the complement is always a verb phrase. There would be no mechanism to change the verb morphology from active to passive or to transform the logical object into a grammatical subject.

(74) Will you try to be ready to be examined by the doctor at 3:00.

Lasnik and Fiengo state that Perlmutter's (1968) treatment of the verb *try* offers a workable alternative derivation for sentences like (72). This is not the case. Perlmutter requires that the *like subject constraint* which is necessary for the verb *try* operate at the deep structure level, not at an intermediate point in the derivation where the equi NP deletion will occur. To account for sentences like (73), he must posit an intermediate abstract verb which has a subject identical to the matrix subject. His deep structure for (72) would have the following from (unnecessary details omitted).

(72')



The structure represented in (72') meets the necessary condition for *try* that the deep subjects of the matrix and highest complement be identical. However, the real requirement for sentence (72) is that the *object* of the most deeply embedded S be identical to the matrix subject at the deep structure level. Sentence (75a) where the like subject constraint is met, but where the most deeply embedded object is not identical to the matrix subject, is ungrammatical. It's source in Perlmutter's analysis is a sentence like (75b).

(75) a. *John tries (for it) to be easy to please Sally.

b. John tries John LETS it (to) be easy to please Sally.

The deep structure *like subject constraint* will not capture this generalization, while a constraint articulated at the point where the deletion takes place will.[9]

The verb *try* presents no additional problems for a movement analysis. The same mechanism needed to generate *try* constructions with passive complements (in fact with any derived complement verb phrase) would be used to generate *try* constructions with *tough* predicate complements. A treatment along the lines of Lakoff's (1970) positive absolute exception analysis would be one possible solution to the requirement that equi must apply.

The greatest drawback to the deletion analysis presented by Lasnik and Fiengo is the fact that their deletion rule will not work. It overgenerates. The rule of object deletion they have proposed is restated in (76).

(76) X NP_i U [AP / NP] W NP_i Y] Z

1 2 3 4 5 6 7 ⟹

1 2 3 4 Ø 6 7

The rule is so general that it will permit the derivation of many ungrammatical sentences. L & F, themselves, note several deviant sentences generated by their rule, but argue that two of Chomsky's (1971) conditions on transformations will block these ungrammatical derivations. The Tensed-S Condition will apply to block ungrammatical sentences like (77) [their (83)] and the Specified Subject Condition will reject (78) [their (84a)].

(77) *This rock is too heavy for us to try to claim that we picked up.

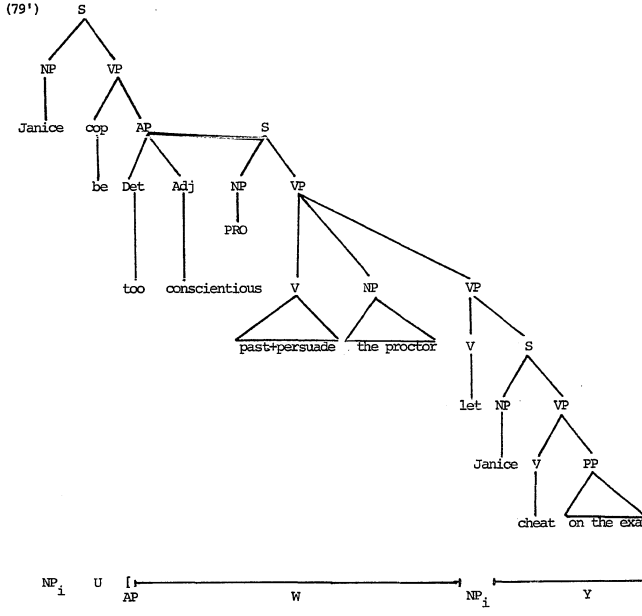
(78) *George is too obscure for there to be a book about.

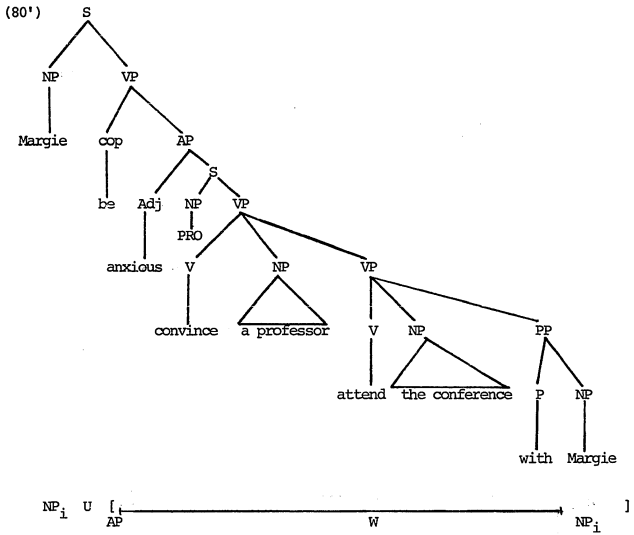
There are other deviant sentences which result from the application of (66), where no conditions operate to exclude them. The rule is formulated in such a way that it will delete any identical NP embedded in an Adjective Phrase if the controller of deletion is in the superordinate clause, as long as neither of Chomsky's conditions are applicable to the sentence.

Sentences (79) and (80) below would be assigned deep structures (79') and (80') by L & F. As the tress show, verbs like *persuade* and *convince* are followed by VP complements rather than S complements in their theory. Below each tree is indicated the schematization which serves as the input to Rule Schema (76).

(79) Janice is too conscientious to have persuaded the proctor to let her cheat on the exam.

(80) Margie is anxious to convince a professor to attend the conference with her.





Phrase markers (79') and (80') both meet the structural description required by Rule (76). The rule will apply and will delete the second occurrence of NP_i in both trees. The following ungrammatical sentences result:

(79'') *Janice is too conscientious to have persuaded the proctor to let ___ cheat on the exam.

(80'') *Margie is anxious to convince a professor to attend the conference with ___.

Notice that even though a specified subject intervenes between the controller of deletion and the deletion site, Chomsky's Specified Subject Condition will not block the application of Rule (76), since the specified subject is also controlled by the NP which triggers the deletion. Therefore, there is no known interpretive device which will filter out (79'') and (80'').

D. Arguments Against a VP Complement Analysis

The second claim advanced by Lasnik and Fiengo concerning the *tough* class of predicates (and all predicates occurring in an object deletion configuration) is that the complement following such predicates is a verb phrase, not a sentence. Their evidence against a sentential complement is presented in three specific arguments.

1. Certain movement transformations which require sentential inputs are not applicable to the complements of object deletion predicates. VP complementation would account for this.

2. The *for*-phrase which occurs with an object deletion predicate is movable, one sign that it must originate in the matrix S.

3. *Tough* predicates are ambiguous between a true "tough" sense and a completely different sense. Dual subcategorization of the complement form (S comp vs. VP comp) permits us to distinguish structurally between the two senses. Let us examine in detail their su-port for the three arguments.

To justify the first claim, they cite three movement transformations which rearrange constituents within an S: Passive, There-insertion and Dative Shift. Object Raising (or deletion) cannot occur if the complement has undergone one of these transformation, as witnessed by the ungrammaticality of the following sentences:

(81) a. *Sam is tough to be misunderstood by.

b. *Meg is impossible for there to be a book about.

c. *?Paula was tough to give criticism.

Lasnik and Fiengo account for the absence of sentences like those in (81) by postulating an underlying VP comp. VP complementation would not satisfy the structural description required as input to the three transformation, they argue, and the transformations would be prevented from applying. Thus they attempt to provide a unified explanation for three seemingly disparate facts.

However, the three facts do not lend themselves to a single explanation. For example, by positing a VP complement, L & F will not prevent the Dative Shift transformation from applying. The cycle does not operate on a VP node. Thus, at the point when the cycle reaches the matrix S node, the NP's located inside the VP comp will still be accessible as input to the Dative Shift transformation. The transformation will operate to permute the two NP's resulting in what some consider to be ungrammatical sentences.[10] A VP comp offers no solution in this case.

To block sentences like (81c) syntactically, one could simply add a condition to the rule of object raising (deletion). It would prevent the rule from applying if an NP immediately preceded or followed the affected constituent. However, the restriction would be better stated as a perceptual filter utilizing the grammatical relations of the constituents

under consideration. Such a principle has already been articulated in Langendoen, Kalish-Landon and Dore (1974). It is formulated as a series of perceptual mapping rules which state, among other things, that if a derivation generates a string which is ambiguous just in that some grammatical relation is assigned more than one function, the string is judged unacceptable. A sentence like (81c) in which an object is moved after Dative Shift has applied is considered deviant because the surface subject may be perceived grammatically as either an underlying direct or indirect object. This perceptual constraint is superior to a syntactic condition on the rule of Data Shift in that it is formulated as a language universal whereas the condition alluded to above would be restricted to a specific rule in the grammar of a particular language.

One would expect that a VP comp would prevent transformations that involve subjects from applying to that structure. But again, because there is no cycle on the VP node, the new configuration they posit will not block the application of Passive or There-insertion. In the interpretevist framework adhered to by L & F, the structural description of the transformations is defined on the linear arrangement of the essential elements rather than on the basis of their grammatical function such as *subject of* or *object of*. Therefore any string consisting of the sequence NP V NP will fit the structural description for a transformation like Passive. The precise statement of Passive and There-insertion varies from linguist to linguist, however Fiengo (1974) defines his rules (eg. Passive) beginning with an essential variable. Using the following structural descriptions for Passive and There-insertion,[11] the underlying trees proposed by L & F for *tough* will quite easily fit the input structure.

(82) Passive

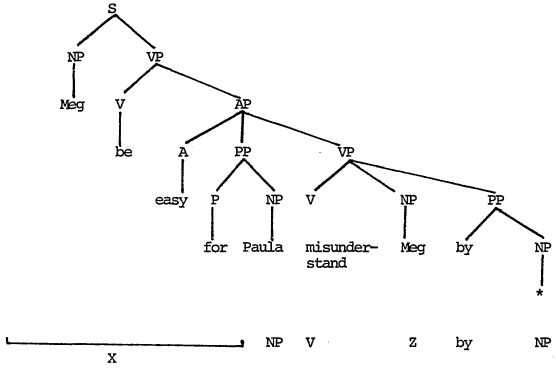
SD: X NP Y V Z by NP W

(93) There-insertion

SD: X NP Y be Z

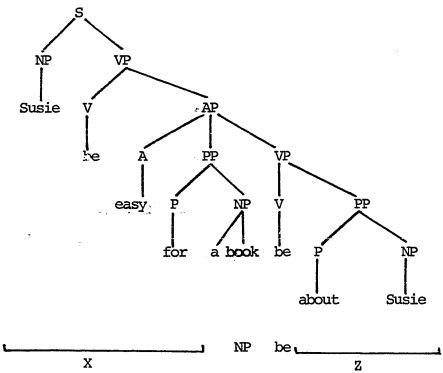
The following deep structures which in there essential features are those proposed by L & F, can function as input to the rules given in (82) and (83).

(84) Passive



(84') *Meg is easy to be misunderstood by Paula.

(85) There-insertion



(85') *Susie is easy for there to be a book about.

One obvious suggestion to avoid such undesirable consequences is to omit the essential variable occurring in the sentence initial positon, replacing it with the finite list of elements which may precede the left-most NP. However, this alternative would violate the Principle of Minimal Factors (Chomsky, 1973) which stipulates that only those constituents that are crucially involved in the operation of a rule may be specified in the rule schema. That is, an element must be one affected by the rule or be the controller of the affected element in order to be represented in the rule. As the alternative of listing is not available to L & F, their structural analysis is just as problematic as the one they purport to replace. Just as with the dative case their solution here proves to be no solution at all.

There are empirical reasons for rejecting a VP complement as a way of blocking the application of the three transformation. First, it is not the case that Passive is always prohibited in sentences like (81a). The following sentences have been judged acceptable by a large number of speakers.

(86) a. Such flattery is easy to be fooled by. (cited by Chomsky, 1964)

b. These tragedies are not difficult to be moved by.

c. Such trivia is hard to be bothered by.

d. His rhetoric is easy to be confused by.

e. John is not hard to be tricked by.

f. A loan shark is easy to be taken in by.

g. Their evidence was difficult to be convinced by.

h. A snowball is easy to be hurt by.

i. This door would be difficult for the piano to be brought in through.

j. Mary is easy to be confused with.

k. The net was simple for the ball to be hit under.

l. Beer like that is not easy to be had outside Germany.

If Lasnik and Fiengo were to devise some ad hoc mechanism to prevent Passive and There-insertion from applying to their underlying VP complements, they would be at a loss to explain the existence of the sentences in (86). Though I am not able to provide a complete explanation for why the majority of passive complements are ungrammatical, perhaps a closer examination of the type of sentence which allows Passive and Object Raising will give us insight into what factors interact to permit Object Raising from some Passives but not others. We first observe that three

types of objects may be affected by the application of Object Raising to a Passive complement.

I. The object which is moved was not involved in the rule of Passive. Sentences falling into this category are of the type found in (86i-k). The object which has been raised here is the object of a preposition and therefore is not one of the elements transformed by the Passive rule.

II. The object which is moved is the underlying subject which has become object of the *by*-phrase at the time the rule operates. Sentences exhibiting this interaction of Passive and Object Raising are represented in (86a-h). The element permuted originated as a subject before the application of Passive, but is a prepositional object when it is raised.

III. The object which is moved is the underlying object, but at the time of the raising rule, it must be considered to be a derived subject. Only one example was located of this type of interaction, that of (86l), although such sentences were very common in an earlier stage of English.

The occurrence of object raising from a passive comp is rare, no matter what the nature of the constituent to be moved. Even so, we can define certain parameters which permit the rule to operate more freely. Most noteworthy, an object of a *by*-phrase (Type II Raising) is best raised if it is non-agentive. It appears that the passive verb is more acceptable if it is understood as a state rather than as an action. If possible, the past participle of the complement verb will be understood with adjectival force. This tendency can be readily observed by comparing (86b) containing

a non-agentive raised constituent to the ungrammatical (87) which is the same in all respects, except that the raised constituent is agentive, thus forcing a non-stative interpretation of the participle.

(87) *Allied Van Lines is not difficult to be moved by.

Of the three types of Object Raising from Passive, the least common is the third type defined where the underlying object is the element permuted. This movement is almost non-existent today. It is possible to find examples of the first type where the raised element is an object not involved in the Passive rule, but such sentences are more often ungrammatical than grammatical. The most usual case of raising to occur from a passive complement is the second type involving the object of the *by*-phrase. This was not always the case. It is interesting to note that as recently as 35 years ago, we can observe that passives were quite acceptable after *tough* predicates, but the raising that occurred seems to have been the third type which moved the underlying object. Jespersen (1940,V:272) states that the subject of adjectives like *easy* fill two semantic functions. They may serve as the object of the embedded infinitive:

(88) He is easy to deceive.

or as the subject of a passive infinitive:

(89) He is easy to be deceived.

though he notes that the passive infinitive is much less common in his time than it had been. Many examples of the occurrence of passive complements in English literature are cited. To mention a few:

(90) a. But why the doctor should ..... is a matter not so easy to be accounted for. (Fielding: *Tom Jones*, 1749)

b. Things were hard to be distinguished. (Stevenson: *The Merry Men*, 1887)

c. Money was so hard to be got there.
This is not easy to be obtained. (Stella: *Journal of Stella*, 1768)

d. Margaret was old, and blind, and easy to be imposed upon. (Lamb: *Rosamond Gray*, 1798)

Let us now examine the syntax of the Object Raising transformation to see if we can determine the present form of the rule with regard to the interaction with Passive that was noted above and then attempt to define the historical development which the rule underwent. It may be assumed that the rule of Object Raising is the same rule as that of Object Fronting which occurs as a subrule of Passive. Similar restrictions obtain for both operations. Notice that the so-called middle verbs in English which will not permit a Passive transformation (Lees, 1960), do not allow their objects to be fronted by a raising operation. Included in this category are the verbs *have*, *want*, *resemble*, *cost*, *fit*, *weigh*, *suit* and *lack*. When sentences containing these verbs in their complements undergo Object Raising, they result in ungrammatical sentences, as (91a-d) illustrate.

(91) a. *A lot of money is easy for clothes to cost these days.

b. *A pepperoni pizza is not difficult to want.

c. *Their parents are easy for children to resemble.

d. *350 lbs. is tough to weigh. (In the middle sense of *weigh*)

The rule of Object Fronting may apply to a *tough*-sentence on any cycle, moving an object to the initial position of that cyclic S. If the object is moved to an initial position within the same S, the object fronting is the subrule of the Passive rule. If the object is moved to the head of a superordinate S, then the procedure has effected an object

raising transformation.

Historically, we can see that *tough* constructions have undergone a change in the occurrence of passive voice in their complements. Sentences with the underlying object raised were extremely common, while sentences containing a permuted agent were given no mention by Jespersen. It is difficult to account for the movement of an underlying object by means of an Object Raising rule. Object Raising must occur on the superordinate cycle. Passive takes place on a subordinate cycle. It has transformed the underlying object into a derived subject when the derivation reaches the point at which Object Raising is applicable. The complement no longer meets the structural description necessary to accomplish raising of the underlying object. It appears that in the historical period that accepted such passive *tough* constructions, both Subject and Object Raising were permitted to apply to *tough* complements, just as Subject and Object deletion were (and still are) permitted to apply to the complements of parallel deletion predicates. In fact, Jespersen does not distinguish between these two types of predicates when describing the behavior of sentences which permit an objective interpretation of their matrix surface subjects. We may note one important difference in the syntax of the deletion and movement predicares. The deletion predicates permit the transformational operation to apply to both derived and underlying subjects. However, the movement predicates only permitted Subject Raising if the subject was derived, insuring that the raised constituent was only interpreted as object of the complement verb. The ambiguity shown in (92a) which can arise with deletion predicates given a complement in the active voice, could never occur with movement predicates. An ambiguity cannot arise if the complement verb is passive as (92b) illustrates.

(92) a. The chicken is ready Δ to eat Δ.

b. The chicken is ready Δ to be eaten.

We can observe other parallels in the behavior of current deletion predicates and the movement predicates of an earlier period. Like the earlier movement predicates, the deletion counterparts do not allow to their surface subjects an interpretation of passive agent. The only deletion that can take place in a passive complement is that of the derived subject, never of the underlying subject. However, like the earlier movement predicates (see [90d] above) prepositional objects can be deleted after passive. The sentences of (93) illustrate this contrast.

(93) a. *Fred is ready for the chicken to be eaten by.

b. The bag is ready for the garbage to be put into.

In the present period of English, movement predicates have distinguished themselves further from deletion predicates. In no case is Subject Raising permitted at present. We can speculate as to why the restricted occurrence of this transformation has dropped. In every case in which a derived subject could be raised, another derivation existed where the same constituent could be raised as an object of an active voice verb, and the two derivations, without fail, resulted in synonymous sentences. The reasons, therefore, for the disappearence of Subject Raising after *tough* predicates are twofold: 1) The transformation was complicated to state since it could only apply in a restricted number of cases; and 2) the grammar contained a simpler derivational procedure for generating the desired meaning representation. It is the interaction of these two phenomena that has caused the grammar to change. Notice, also, that on analogy with the disappearence of sentences like (89) above, other types of Object Raising after Passive have become rare because here

too there exists an active counterpart to express the same meaning. However, a new type of raising has begun to appear after Passive; the raising of the *by*-phrase object. We can attempt to offer an explanation for this phenomenon. With such passive sentences there exists no active counterpart to express the requisite meaning, for we cannot derive:

(94) *John is not hard to trick Mary.

As the tough predicates distinguish their syntax further from that of the deletion predicates, the ability to add new transformational processes increases. Deletion predicates do have an active form similar to (94) and therefore do not require a transformation which deletes the *by*-phrase object.

Lasnik and Fiengo wish to treat the rarity of passive complements and the absense of *there* complements in *tough* constructions as the result of the same syntactic fact - that the underlying trees contain a VP complement. Although Jespersen cites many instances of passive complements, he gives no examples of tough complements which have undergone *There*-insertion. Such sentences seem to have always been prohibited in English. A unitary treatment of these two phenomena cannot account for the historical fact that only *there* complements were absent in the earlier period. Their explanation of the synchronic data will give us no insight into how the language has changed. In fact if one considers language structure dynamically, evolving gradually from one stage to another, then their description of modern English simply cannot be correct. It is not feasible that at the stage in the language when both Passive and *There*-insertion are prohibited in certain complements, that the underlying structure of these sentences should suddenly develop VP comps, but at the stage where just

There-insertion is prohibited, the explanation is based on other factors.

Berman and Szamosi (1972) offer a different explanation for the absense of object movement with *tough* complements containing *there* in subject position. They suggest that in the structural description of the rule of Object Raising, the embedded subject is unspecified, having already been deleted by an obligatory rule of equi under identity with the object of the matrix *for*-phrase. Since *there* could never occur as object of a matrix prepositional phrase, the occurrence of *there* in the complement subject position will never get deleted. Thus complements containing *there* subjects would not meet the structural description of the Object Raising rule.

Their explanation is similar to one offered by Chomsky (1973) in his analysis of *tough* constructions. However, in Chomsky's treatment the embedded subject is generated as a PRO form whose features are interpreted from the higher *for*-phrase. Here again an embedded *there* subject is prevented from occurring. Both Chomsky and the Berman & Szamosi explanations are problematic as will become evident below. Although I have no completely satisfactory explanation for the absence of Object Raising when *There*-insertion has occurred, the explanation may involve restrictions on extracting from the complement elements which occur after the verb *to be*. This would account for the ungrammaticality of the following sentences as well as those like (72b) above:

(95) a. *Our new secretary will be hard for Frank to be.

b. *His parents' home is difficult for Elmer to be a mature adult in.

Yet the restriction is more general. The very environments which permit *There*-insertion do not allow Object Raising. The structural

descriptions of the two transformations are in complementary distribution. Independent of the occurrence of *there*, objects cannot be raised out of those contexts which meet the structural description of the *There*-insertion rule. Therefore, the sentences of (96) are grammatical while those of (97), which are examples of raising from a context which accepts *There*-insertion, are not.

(96) a. There is a stranger in the kitchen.

b. There stood a lamp beside the table.

c. There are some police officers looking for illegally parked cars.

(97) a. *The kitchen is difficult for a stranger to be in.

b. *The table is hard for a lamp to stand beside.[12]

c. *Illegally parked cars are a pleasure for some police officers to be looking for.

This opposition may explain why Object Raising is so rare out of passive complements. Passive morphology has the effect of rendering a string amenable to the structural description of *There*-insertion. But if a predicate adjective follows *be* in the structural description, *There*-insertion is in most cases blocked. Again we notice that where *There*-insertion is unacceptable, Object Raising may occur:

(98) a. People are nice to older women.

b. *There are people nice to older women.

c. Older women are easy for people to be nice to.

This fact offers some explanation of why Object Raising from passive complements seems more acceptable if the past participle can be interpreted adjectivally, forcing a non-agentive reading of the *by*-phrase object.

Now let us turn to Lasnik and Fiengo's second argument in support of

a VP complement. It is based on the claim that the *for*-phrase in constructions where *tough* movement (deletion) has occurred must originate in the matrix S. They argue further that there is no justification for positing an identical NP as the underlying subject of the complement. Their argumentation goes as follows:

A *for*-phrase which is the syntactic subject of an infinitival complement is not free to topicalize into the initial or final position of the sentence as the following paradigm illustrates: [Their examples (23a-c]

(99) a. I want very much for Mt. Vesuvius to erupt.

b. *For Mt. Vesuvius, I want very much to erupt.

c. *I want very much to erupt, for Mt. Vesuvius.

Therefore, a *for*-phrase that moves freely must not have originated as the subject of the complement. *For*-phrases that occur in sentences where object movement (deletion) has taken place are free to topicalize, illustrated by the grammaticality of the following sentences: [Their examples (72a-c]

(100) a. John is easy for Bill to please.

b. John is easy to please, for Bill.

c. For Bill, John is easy to please.

Notice that their claims concerning a moveable *for*-phrase in and of themselves do not argue against a derivation containing an underlying complement subject which has been deleted by an obligatory equi rule. They assert only that the *for*-phrase which appears at the surface must originate in the matrix S. But even this claim can be shown to be invalid. There are many instances of *tough* movement where the *for*-phrase is not free to topicalize at the surface level and where there is no justification

for claiming that it originates in the matrix S. Whenever the object of the *for*-phrase is inanimate, the phrase is not free to move, as the sentences of (102) and (103) illustrate:

(101) a. This substance will be hard for the acid to dissolve.

b. The material is not easy for my scissors to cut.

c. This wall will be difficult for the whole can of paint to cover.

d. Onions are simple for the blender to dice.

(102) a. *For the acid, this substance will be hard to dissolve.

b. *For my scissors, the material is not easy to cut.

c. *For the whole can of paint, this wall will be difficult to cover.

d. *For the blender, onions are simple to dice.

(103) a. *This substance will be hard to dissolve, for the acid.

b. *The material is not easy to cut, for my scissors.

c. *This wall will be difficult to cover, for the whole can of paint.

d. *Onions are simple to dice, for the blender.

There is another test for matrix origin of the *for*-phrase. A *for*-phrase that has originated in the underlying matrix verb phrase can be separated from the complement verb at the surface level. In most *tough* sentences this is the case. The complement phrase may occur as the surface subject while the *for*-phrase remains an adjunct to the *tough* predicate.

(104) a. To please John is easy for Bill.

b. To pull taffy is tough for Polly.

c. To admire the Sultan of Swat is easy for the Duke of Buccleuch.

The sentences of (101), however, cannot be transformed into this surface configuration, further evidence that there is no *for*-phrase in the underlying matrix of such sentences.

(105) a. *To dissolve this substance will be hard for the acid.

b. *To cut the material is not easy for my scissors.

c. *To cover this wall will be difficult for the whole can of paint.

d. *To dice onions is simple for the blender.

The existence of such sentences as these argues against the claims made by Berman and Szamosi (1972) and Chomsky (1973) as well concerning the derivation of all *tough*-movement sentences (see above). The implications which follow from a rejection of their proposals will be taken up in a later section.

With regard to L & F's position (and to a similar position taken by Bresnan, 1971) the facts above offer one more piece of evidence that the complement of *tough* predicates cannot take the form of a verb phrase in the underlying structure.

A second motivation for positing only a matrix *for*-phrase is taken from Bresnan (1971). She observes that Object Raising sentences containing two *for*-phrases are ungrammatical.

(106) a. *Karate would be good for Mary for her to learn.

b. Karate would be good for Mary to learn.

Lasnik and Fiengo in their Appendix A reaffirm this observation. It is certainly true that of the sentences in (106), only (106b) containing one *for*-phrase is grammatical. However, it is just assumed that this *for*-phrase originates in the underlying matrix VP. Notice that the following sentence, which has both two *for*-phrases and the application of Object Raising, is grammatical.

(107) For Mary, karate would be good for her to learn.

Following L & F's previous arguments that a topicalized *for*-phrase originates in the matrix VP, the second *for*-phrase in sentence (107) must then originate as the subject of the complement.

Let us turn now to L & F's third motivation for positing VP complementation: the claim that a change in the sense of the *tough* predicate will correspond to a change in the subcategorization of the type of complement it takes.

Bresnan (1971) has argued that most *tough* predicates can only be subcategorized for VP complementation in any deep structure configuration in which they occur. Berman and Szamosi (1972), in their reply to Bresnan, note that this is not the case, in part, because many *tough* predicates can occur with two *for*-phrases. Such is the case they claim, only if the two *for*-phrases are non-coreferential, as illustrated below. [Their examples (77-78)]

(108) a. For his wife to accept this view would be tough for John.

b. For DuPont to solve that problem first would be a bitch for G.E.

c. That his play was banned in Boston was tough for the author.

Otherwise the embedded identical NP must be deleted by an obligatory rule of equi.

L & F dispute their conclusions. First, they argue that most *tough* predicates can convey two senses. Only one sense conveys the "true" *tough* meaning relevant to their discussion and permits tough movement (deletion). They describe the semantics of this sense as "denoting the effect of a state of affairs or situation on an entity (p.560)". The second sense of *tough* predicates can be paraphrased by "tough on". Here the semantics "describe an entity

in terms of action on or change of state of that entity (p.560)". The second sense of *tough* predicates is not the relevant one, and it is this sense which requires a subcategorization for a sentential complement.

For simplicity, I have labeled the true *tough* sense as [+agentive], and the second sense, as [+benefactive]. L & F distinguish the semantics of the *tough* predicate in sentence (108a) above from that of (109) below [their (A3a)], the former being the [+benefactive] sense and the latter, the [+agentive] sense.

(109) That view is tough for John to accept.

Sentence (108a) is paraphrased by (110a) [their A.4] while sentence (109) is paraphrased by (106) [their A.5a].

(110) a. For his wife to accept this view would be tough on John.

b. In John's case, that view can be accepted only with difficulty.

L & F further assert that, contrary to Berman and Szamosi's claim, equi NP Deletion is not obligatory with sentential complementation. Many *tough* predicates occur with two identical *for*-phrases [see my example (107) above], but the reading of the *tough* predicate is always the non-relavant [+benefactive] reading, predicting the fact that raising (deletion) cannot in such sentences. They illustrate with the following examples [their A.7a-b]:

(111) a. For Joe Namath to break his leg would be tough for him (on him).

b. It is easy for students (on students) for them to be spoonfed knowledge.

However, upon close examination it can be shown that their analysis is again incorrect. Consider their example (111a). They claim that this

sentence can only express a "tough on" [+benefactive] reading. This is not the case. The sentence can be continued in two different ways, each exemplifying one of the senses of the predicate.

(112) a. For Joe Namath to break his leg now would be tough for him; he's wearing that new protective padding. [+agentive]

b. For Joe Namath to break his leg now would be tough for him (on him); it would ruin him for the season. [+benefactive]

In addition, we can perform object raising and retain the two *for*-phrases, if one of them is topicalized. The sentence remains ambiguous.

(113) For Joe Namath, his leg would be tough for him to break right now.

There are even more damaging counter-examples. The following sentence contains two *for*-phrases, but it is not ambiguous. It has only the [+agentive] reading.

(114) For her to feed her children is difficult for a mother in Iran.

Again we can topicalize the matrix *for*-phrase and still have the application of Object Raising. Therefore, the remaining *for*-phrase must originate as the underlying subject of an embedded S. This example provides additional evidence against the claim that Object Raising (Deletion) can occur only out of a VP.

(115) For a mother in Iran, her children are difficult for her to feed. [+agentive]

In addition to the empirical counter-evidence presented above, there are theoretical reasons for rejecting a VP comp. Such an analysis is incompatible with the notion of selectional restrictions as now defined. Selectional restrictions were orginally formulated by Chomsky (1965) to

state co-occurrence relations between the different grammatical functions of the sentence. A verb is selected in terms of the nouns that function as its subject and object. If the complements following *tough* and similar types of predicates are generated as VP's there is no way within the system as now defined to specify the selectional restrictions required between the verb of the complement and the noun to be interpreted as its subject. A structurally defined subject is lacking, by definition, in VP complements. The following sentences then could quite easily be generated as a grammatical string by their grammatical model.

(116) a. *The trees are a breeze for the animals to reflect.

b. *The East is impossible for Marsha to set in.

c. *Physics is difficult for the flowers to understand.

It might be suggested that selection be redefined to refer to linear strings of symbols rather than structures marked for grammatical relations.[13] In this formulation selection would hold between a sequence of the following sort: V⟶CS / N aux ___. However it is not always the case that the noun directly preceding the verb is the subject on which selection is to be specified. Consider the following:

(117) a. The woman who invented the lead pencil died.

b. Will the person at the end of the line speak up?

The sentences of (118) show us further that the features assigned to the whole noun phrase must be considered, not just a single noun selected from a linear sequence.

(118) a. *One of the inventions died.

b. *One of the women gathered.

Sentence (118a) is ungrammatical because *die* selects an animate subject. The pronominal subject is interpreted as inanimate by virtue of its

relationship to the following prepositional object whose semantic features it assumes. The verb in (118b) demands that its subject be plural. In this case the pronoun does not assume the number features of the following noun. Unless L & F first define a completely new system of selectional restrictions based on the linear properties of a string, their grammar is forced to specify the subject of every verb in the underlying structure as the present system demands.

E. A Proposed Solution

Having presented evidence to argue against the deep structural analysis of *tough* predicates offered by Chomsky, Berman and Szamosi, Lightfoot and Lasnik and Fiengo, let me sketch what I take to be a more correct analysis. Let us assume a deep structure configuration similar to the one proposed by Postal (1971). My analysis, represented in (119), differs from his in that the superordinate S in underlying structure contains an optional prepositional *for*-phrase. (The following discussion is valid for the [+agentive] sense of *tough*-constructions only.)

(119) [[for NP_2 to V NP_3] be easy (for NP_1)]

As the schema in (119) illustrates, NP_1 is optional. The selectional restrictions on *tough* predicates require that it be [+animate] when present. An obligatory identity holds between NP_1 and NP_2. Therefore, if NP_2 is [+animate], NP_1 cannot be present in the deep structure. When both NP_1 and NP_2 occur, then it is obligatory that NP_2 either be deleted by a rule of equi NP deletion or pronominalized. If pronominalization is the option selected within a derivation, there exists a surface filter which states that NP_1 and the pronominalized NP_2 cannot be juxtaposed. Sentences (107) and (113-115) above are examples of acceptable outputs resulting from the proniminalization of NP_2. If only one *for*-phrase appears

at the surface, and it is [+animate], then the sentence is syntactically ambiguous.

The *for*-phrase could derive from NP_1 in the deep structure, as the second occurrence occupying the NP_2 position would have been deleted by equi; or it could derive from an NP_2 position which was not deleted because NP_1 was not represented in the underlying structure.

One interesting property of *tough* sentences remains to be explained. Often no *for*-phrase appears at the surface as in (120).

(120) The Duke of Buccleuch is hard to spell.

The complement subject in such sentences is unspecified. There is a restriction on the possible interpretations which can be attributed to the missing subject. It must be [+animate]. That the sentences of (121) are ungrammatical is proof of this constraint.

(121) a. *A high temperature is easy Δ to crystalize at.

b. *The West is impossible Δ to rise in.

c. *Ms. Thornberry's yard is difficult Δ to blossom in.

The complement verbs of (121) have very narrow selectional requirements. Their subjects can never be [+animate]. Therefore the following condition obtains on the deep structural configuations of *tough* predicates.

If $NP_2 = \Delta$, there exists $NP_1 = \Delta$. The Δ of NP_2 can only be deleted under identity with the Δ of NP_1 which is required by selection to be [+animate].

The deep structure presented in (119) differs substantially from those proposed by Chomsky and by Berman and Szamosi. In their configurations the matrix *for*-phrase is obligatorily present. The complement *for*-phrase is either unspecified (Chomsky) or deleted by the derivational process (B & S). At the point at which Object Raising is to occur, there is no violation of Chomsky's Specified Subject Condition in their analyses. However, those

tough moved sentences which contain a *for*-phrase that originated in the underlying complement will contradict the claim made by Chomsky regarding this condition. Movement has taken place out of a subordinate S which specified an intervening subject. Such sentences provide evidence against Chomsky's Specified Subject Condition.

Returning to our original quantified sentences which led us to the analysis of object raising just presented, I attempted to demonstrate that systematic scope differences occurred in sentences which are assigned surface structures that are similar in all essential features, but which are different at the deep level. Now that I have justified the raising type analysis for tough predicates given in (119), I must show that they also exhibit the same systematic scope variation with deletion predicates in the crucial cases. With the *tough* class of predicates, evidence was presented to conclude that an inanimate object of the *for*-phrase originates, and remains throughout the derivation, as subject of the complement S. It is this derivation that exhibits the essential contrasts with corresponding deletion derivations, for it shows the same surface command dependencies, but different underlying ones. Therefore we should compare the scope assignment of *tough* sentences containing such an inanimate complement subject with a corresponding deletion sentence. We should expect to find a contrast in preferred scope reading. And in fact we do.

(122) a. A six foot box is ready for any corpse to fit into.

b. A six foot box is easy for any corpse to fit into.

The preferred scope assignment of (122a) gives outside scope to the indefinite, for on its most natural reading, the sentence can be paraphrased as (123):

(123) There exists at least one six foot box such that it

is ready for any of the corpses to fit into it.

In the (b) sentence, the reverse holds, as this paraphrase of its most natural interpretation illustrates:

(124) Every corpse is such that a six foot box which is easy for it to fit into.

I have illustrated that a contrast in the relative scope interpretation in certain sentences corresponds systematically to a difference in the derivational analysis of these sentences. The differences were captured in the standard theory in such a way as to permit generalizations to be made. Revisions of the standard theory analysis of these sentences as proposed by both the generative semanticists and the interpretive semanticists make it impossible for the generalizations to be captured. Although, as I have shown, many of the revisions can be rejected on independent grounds, the facts pertaining to the interaction of quantifier scope and command relations require that we abandon the newer analyses and return to the derivations of complement constructions that were, in their essential features, established by the standard theory.

Section 5: The Semantics of Quantifier Scope in Complement Constructions

Up to this point, we have treated the semantics of the sentences under consideration in a very cursory manner. We simply observed that a relative scope constrast obtained in certain sentences pairs and investigated the syntactic ramifications that followed. The relative scope dependencies we ascribed to the quantifiers in each of the sentences are valid representations of their preferred readings, as will be shown below. But there exist other semantic distinctions that must be examined in greater detail. We find that there are three semantic readings that an indefinite noun phrase occurring in our examples may receive. (For

simplicity, I will use a feature notation to designate the three interpretations. I am not suggesting that the grammar actually employ such devices in explicating the semantic contrasts.) An indefinite may be interpreted along two dimensions: 1) with respect to its specificity [±specific], or 2) with respect to its universality or "nomicity" [±generic].[13] Using combinations of the two feature classes we would predict four possible readings of the indefinites; however, one combination does not exist. The three reading which can be ascribed to an indefinite are:

(i) [+generic, -specific]

(ii) [-generic, -sepecific]

(iii) [-generic, +specific]

A. Some Semantic Considerations of Generic Indefinites

Both [+specific] and [-specific] indefinites are best represented by a particular quantifier, the differences expressed by the position of the quantifier with respect to an opaque context in the underlying representation.[14] The particular is also the most accurate representation of a [-generic] reading of the indefinite. However, an indefinite which is [+generic] is no longer particular in nature. It assumes the characteristics of a universal quantifier occurring inside the scope of a possible worlds operator.[15] Therefore the substitution of a referent in the semantics is not required. The possible worlds situation provides an opaque context that places the generic in an opaque phrase position in the underlying representation. As a result all generic quantification must be interpreted non-specifically, explaining why we do not find indefinites bearing a

[+generic, +specific] reading, one of the four possible feature combinations.

A second interesting fact follows from the opacity implied by generic statements. Other indefinites located inside a generic expression must also be [-specific] since there is no requirement demanding their instantiation due to the opaque nature of the generic context. We will see that this is so when we give the precise semantics of the quantified sentences we are comparing. First, other semantic characteristics of generic statements need to be examined in greater detail. Consider a generic sentence of the following form:

(125) An abbreviation ends in a period.

This sentence could be paraphrased by:

(126) All abbreviations end in periods.

which may lead one to conclude that generics are universally quantified expressions. This is certainly true, but there are many semantic differences between generic statements such as (125) and (126) and normal universally quantified statements of which (127) is a typical example.

(127) All the abbreviations in the dictionary end in a period.

The semantics of sentences like (125) and (126) on the one hand, and sentences like (127) on the other differ in two respects. Sentence (127), as well as other true universals, presuppose that there are such things as abbreviations; for both the positive and negative versions entail instantiation. The sentence, moreover, presupposes that at least some of those abbreviations are found in the dictionary. Sentences (125) and (126) make no such existence claims in the universe of discourse about abbreviations. The linguistic existence of abbreviations may be pruely hypothetical. For example, a decree could have been passed banning any use of abbreviations, so our generic is making a nomic statement about another world state where there are abbreviations. A conditional expression is a

is a valid paraphrase of generic sentences.

(128) If there are any such things as abbreviations, they must end in periods.

A more convincing example can be given to illustrate that existence is not required of the generic noun phrase in the universe of discourse. Consider the following law of science:

(129) All bodies that travel faster than the speed of light have negative energy.

From relativity theory we know that no body can accelerate from below the speed of light to beyond the speed of light. However, no one knows whether there can be bodies which start out surpassing the speed of light, but if they do they must have negative energy. As far as we know, no objects are being specified by the generic description. Yet (129) is certainly a true nomic expression according to the laws of relativity theory.

A standard logical representation of normal universally quantified expressions makes no claims concerning the linguistic existence of the quantified noun phrase. The logical formula is conditional in form. It states that if anything has one property, then it has a certain other property.

(130) $\forall x(P_x \supset Q_x)$

This formula does not adequately express the semantics of the natural language use of universal quantification where instantiation is required. It does reflect, however, the substitutional semantics of generic expressions in natural language.

There is a second important difference between generic statements and normal universal ones. For a sentence like (127) expressing normal universal quantification to be judged true, it must be the case that the

predicate holds over every member of the set referred to. The sentence admits of no exceptions. If we found just one abbreviation in the dictionary which did not end in a period, sentence (127) would be false. This is certainly not the case with generic expressions. Exceptions do not make the general statement false, for exceptions are just that, exceptions. Of course, one may ask how many times the predicate may fail to apply before we are no longer expressing a law-like statement, but merely making a statistical claim. This is a valid question to which I have no answer. But the fact remains that very few nomic statements have no exceptions, and the ability to admit exceptions is a defining property of generics. Therefore a second general characteristic of generic expressions is that the predicate need not be true of every member of the set under consideration. To build this requirement into our logical representation of generics, we need the concept of alternative world states. An alternative world is one in which the laws of nature governing the generic in question in this world are never violated. Otherwise it is identical to the world referred to by the generic expression. Thus, we could claim that dinosaurs had small brains, but there may have been exceptions to this generalization in prehistoric times. So we will set up alternative prehistoric states which are similar in all respects to the real one except that the laws of nature admitted no exceptions to the brain size specification of dinosaurs. We may formalize the logic of generics as follows (where w is a world in which certain laws $L_1 \ldots L_n$ hold):

(131) $(\forall w)\ (\forall x)\ (P_{x \epsilon w} \supset Q_x)$

Although the relation between the real world and the set of alternative worlds referred to by a generic statement has not been formally established, there are limits on the choice of w. If one wished to determine

whether the following sentence is a valid generic statement about the real world:

(132) All cats have wings.

one would try to construct a set of alternative worlds in which the laws of nature permitted this statement to be true; and this could certainly be done. But such world states would not be among the set {w} of nomically possible worlds for cats. The only worlds permitted in {w} are those consistent with the natural laws pertaining to cats in the real world. And the property of having wings is not among these. Therefore, any such alternative world where this property is ascribed to cats is excluded from {w} . Of course, we have failed to specify how the relevant laws of nature for any particular generic expression are to be determined. But such an investigation belongs to the realm of certain natural sciences, and not to an inquiry in linguistic semantics.

B. Contrasting the Semantics of Deletion Predicates with the Semantics of Raising Predicates

Now let us turn to our original sentences. We stated earlier that a scope difference obtains between quantifiers found in raising configurations and those found in deletion configurations. Thus, given the following two sentences where example (133) results from a deletion transformation and example (134) results from a raising transformation; on their preferred readings, the quantifier representing the indefinite noun phrase will receive wide scope in the deletion case and will receive narrow scope in the raising case.

(133) A senator is anxious to speak at every rally.

(134) A senator is likely to speak at every rally.

One might observe that the essential difference between sentences

(133) and (134) is not one of scope, but rather one of specificity. Sentence (133) on the preferred reading is predicating a property about a specific senator. Sentence (134), on the other hand, is a generic statement which is making no claims about any particular senator on its preferred reading. The reasons are not well understood why sentence (133) seems to refer to a specific senator; however, the fact that it has derived from a deletion configuration cannot serve as an explanation. Sentence (135) below also derives from a deletion configuration (as was illustrated above), yet we do not seem to be able to use it to refer to a specific senator.

(135) A senator is silly to speak at every rally.

Now we observe that both sentences (134) and (135) are making generic statements concerning *senators* and *rallies*. Nevertheless, there is a semantic difference between them that is more than just the meaning differences of the matrix predicates involved, and this difference necessitates assigning them different logical interpretations. Though both sentences are making generic statements, they are ascribing nomic properties to different classes of objects in each case. Sentence (134), the raising example, defines a universal property of *rallies* on its preferred interpretation. It claims that rallies are the sorts of things that are likely to have a senator speaking at them. Sentence (135) on the other hand is expressing a property of *senators* on its preferred reading, stating that senators are such that speaking at every rally is a silly thing for them to do. Therefore in the logical structure representing the two generics, a different quantifier will take wide scope - the one binding the noun phrase of which a property is being predicated. When an indefinite occurs in such nomic expressions and the generic focus falls on another NP, then

the indefinite is interpreted with the semantic force of $\begin{bmatrix}-\text{generic}\\-\text{specific}\end{bmatrix}$. Using the notation we developed earlier for generic statements, the following formulae will illustrate the semantic differences we have informally described.[16]

(134') $(\forall w)\ (\forall \text{rally } y \in w)\ (\text{likely}\ (\exists \text{senator } x \in w\ (x \text{ speak at } y))$

'A senator is likely to speak at every rally.'
$\begin{bmatrix}-\text{generic}\\-\text{specific}\end{bmatrix}$

(135') $(\forall w)\ (\forall \text{senator } x \in w)\ (((\forall \text{rally } y \in w)\ x \text{ speak at } y) \supset x \text{ silly}.$

'A senator is silly to speak at every rally.'
$\begin{bmatrix}+\text{generic}\\-\text{specific}\end{bmatrix}$

We can compare the logical structure of these two generics with that representing the preferred reading of sentence (133), a non-generic expression.

(133') $(\exists \text{senator } x)\ (x \text{ anxious } ((\forall \text{rally } y)\ (x \text{ speak at } y)))$

'A senator is anxious to speak at every rally.'
$\begin{bmatrix}-\text{generic}\\+\text{specific}\end{bmatrix}$

Thus we see that these three sentences illustrate the three different semantics that an indefinite noun phrase may bear; and in terms of scope, the three readings are interpreted as the interaction between various scope orderings and different quantifier choices. We have also just demonstrated that the relative scope ordering contrasts which were originally posited for deletion and raising sentences such as (133) - (135) are semantically valid. The logical structures (133') and (135'), which represent the preferred readings of the deletion derivations, both give the quantifier binding *senator* higher scope. Our theory predicts that this should be the case, for *senator* commands *rally* at the underlying syntactic level. The logical structure representing the preferred reading of the raising derivation, formula (134'), assigns the quantifier binding *senator* lower scope. The reason for this scope ordering is due to many

factors, among them the positions of the two quantifiers on the hierarchy of inherent quantifier properties and the clause mate relationship defined for the two quantifiers at the deep structure level. These factors will be explicated in more detail as we proceed.

The preferred scope interpretations of sentences (133) - (135) require a more in depth analysis. We need to explain why the most natural interpretation changes from predicate to predicate. In order to do this, we must first examine the logical behavior of the predicates in less complicated constructions. We do this in order to determine what systematically results when a single quantifier interacts with one of the predicates. First, let us consider what semantics we find when the indefinitely quantified noun phrase which occurs as surface subject in the example sentences is combined with one of the predicates.

(136) A senator is anxious to speak.

(137) A senator is silly to speak.

What possible interpretations can sentences (136) - (138) receive in terms of the interaction between the quantified NP and the predicate? In sentence (136) the indefinite, *a senator*, can only be interpreted outside the scope of *anxious*. The senator referred to is either the individual to which the property *anxious* is being ascribed or the generic class to which the property is being attributed. In either case we would logically represent the sentence with a formula in which the quantified noun phrase was positioned outside the scope of the matrix predicate. Formula (136') gives us the meaning representation of the preferred reading in which an individual senator is specified.

(136') $\exists$ senator x (x anxious (x speak))

In considering sentence (137), we observe that there are two logically

possible paraphrases; however, only one represents a valid interpretation of (135).

(139) If any senator speaks, that's silly.

(140) If any senator speaks, then she is silly.

These may be represented logically by the following formulae:

(139') $(\forall w)$ (silly ($\exists$ senator x ε w (x speak))

(140') $(\forall w)$ ($\forall$ senator x ε w) (x speak $\supset$ x silly)

Clearly, sentence (137) may only be interpreted as (140) where the NP variable binding operator ranges over the whole expression and consequently, occurs outside the scope of *silly* in the meaning representation. The semantics of (137) parallel that of (136) in this respect. Both sentences express a predication of a property to the individual or set of individuals referred to by the indefinite noun phrase. It is interesting to observe that the two sentences exhibit a syntactic similarity as well, for the matrix predicates in both cases are deletion predicates. Thus, the indefinite noun phrases are located in the matrix S in the underlying structure, in construction with the matrix predicates. A semantic consequence of such a syntactic configuration is the requirement that the indefinite be interpreted outside the scope of its predicate.

Sentence (138) differs from the previous two both syntactically and semantically . Syntactically, it differs in that the predicate *likely* is not a deletion predicate, resulting in the fact that the indefinite noun phrase is not a constituent of the matrix S in the underlying tree. It is located inside the subordinate S. This difference is reflected in the semantics of the sentence. Sentence (138) exhibits an ambiguous scope interpretation. The meaning can be represented by two scope orderings. On one reading the indefinitely quantified NP, *a senator*, occurs outside

the scope of *likely*. This reading is one which ascribes a property to senators. It states that if someone is a senator then she is likely to speak. The logical form of this reading is given in (141):

(141) ($\forall$ w) ($\forall$ senators x ε w) (likely (x speak))

On the other reading the indefinite occurs inside the scope of *likely*. What is likely is that a certain situation will be the case. The claim is made that it is likely that some senator or other will speak. This interpretation is represented in (142):

(142) (likely ($\exists$ senator x (x speak))

There is a third reading which is quite obscure. It is one which refers to a specific senator and ascribes some property to her. With this case, as with the reading expressed in (141), the operator binding *senator* is outside the scope of *likely*. Its semantics is given in (143).

(143) ($\exists$ senator x) (likely (x speak))

Because the indefinite is asymmetrically commanded by the matrix predicate in the underlying synactic structure, it is capable of occurring inside, as well as outside of the scope of the predicate in the logical representation. However, of the three possible readings, that expressed in (142) in which a "likely situation" is referred to, seems to be the one preferred. The logical arrangement of elements in the preferred reading reflects that found in the deep syntactic tree, where the noun phrase in question is more deeply embedded than the predicate. Notice that of the three predicates, only the raising predicate permits an interpretation similar to that found in (142) where the surface subject is not assigned a higher scope than the predicate.

Now consider the second quantified noun phrase that occurs in our original examples (133) - (135). This noun phrase is introduced by a universal quantifier expressed as *every*, and at the surface it is located

inside the complement. We must ascertain the range of interactions such a noun phrase can have with the various predicates. Sentences (144) - (146) are examples of the relevant type:

(144) Mary is anxious to get every job she applies for.

(145) Mary is likely to get every job she applies for.

(146) Mary is silly to take every job she applies for.

There is a syntactic similarity which obtains in all three sentences with respect to the position of the universally quantified noun phrase. In each case it is a member of the underlying structure of the complement S and is asymmetrically commanded by the matrix predicate. The result of this configuration is the same in every instance: the semantics permit a scope ambiguity. A similar syntactic situation obtains with the sentence previously discussed, example (138), and we witness the same semantic behavior. Nevertheless, we do find preferred readings which will have an influence on the final outcome of the relative scope interpretation for two quantifiers. Consider sentence (144). It has two possible paraphrases reflecting the varying scope possibilities. The two paraphrases may be stated as follows:

(147) Each job Mary applies for she's anxious to get.

(148) Mary is anxious that if she applies for any jobs, then she get them.

Sentence (147) and (148) are true under different conditions. The two paraphrases are not synonymous. Sentence (147) claims that whenever Mary applies for a job, she's anxious to get it, while sentence (148) conveys to us that she is anxious to get every one of the jobs she applies for. The difference lies in the number of jobs she is anxious over at any one time. In sentence (147) she is anxious about each job as it comes up;

thus, she is anxious about one job at a time. She has as many anxieties as she has job applications. In sentence (148) she has one anxiety and it is concerning the complete set of jobs that she has applied for. Her anxiety results from a desire to get offered all of the jobs, quite an unrealistic desire. Some of the jobs in the set referred to in (148) may be purely hypothetical, whereas this cannot be the case in sentence (147). We can assign the following logical representations to the two paraphrases.

(147') ($\forall$job x) (Mary apply for x $\supset$ Mary anxious (Mary get x))

(148') Mary anxious ($\forall$job x (Mary apply for x $\supset$ Mary get x))

Although sentence (144) is perceived as fairly ambiguous, it does appear to have a preferred reading - the unrealistic reading paraphrased in sentence (148).

We will see that the examples containing the other two predicates function analogously. Consider the following:

(149) Mary is likely to get every job she applies for.

This sentence is also ambiguous, as can be shown with the following hypothetical situation. Imagine that Mary is a linguist looking for work. She is applying for many positions. Since she is highly qualified, her chances of getting any one of the jobs she applies for are very high. However, her chances are very slim of being offered all of them. In fact, though she is a top candidate for each position, she may end up getting none. Therefore, the first possibility could be true while the second one is false. We can define two readings for sentence (149). The logical form is given below each paraphrase.

(150) Every job Mary applies for she is likely to get.

(150') ($\forall$job x) (Mary apply for x $\supset$ likely (Mary get x))

(151) Mary is likely to get all the jobs she applies for.

(151') (likely ($\forall$ job x (Mary apply for x $\supset$ Mary get x)))

Sentence (149) has a preferred reading and it is the one paraphrased by sentence (151). This is the improbable reading where it is claimed that not only does she have a chance at each of the jobs, but that her chances are high of getting them all. In both the underlying structure and the logical form of the preferred reading, the quantifier follows the matrix predicate.

Now let us turn to the sentence containing the predicate *silly*. It, like the sentences containing the other two predicates, has two types of interpretations. One of them specifies a set interpretation of the quantified noun phrase, and the other specifies an individual interpretation. In the set interpretation, the predicate under consideration applies only once to the set referred to by the quantified noun phrase taken as a whole; whereas in the individual interpretation, the predicate applies to each member of the set. And again, in this case it is the set interpretation which conveys the preferred meaning. Consider the sentence given earlier:

(152) Mary is silly to take every job she applies for.

We can once more establish a hypothetical situation on which to define the two readings. Mary applies for numerous jobs. On the one hand, each of them is such that Mary would be silly to take it. Therefore, Mary is silly if she takes any of the jobs she applies for. Here we witness the individual reading. Not only is it the non-preferred one, but it also seems to be making a very irrational claim. The following formula expresses the logical form of this reading.

(153) ($\forall$ job x) ((Mary apply for x and Mary take x) $\supset$ Mary silly)

On the other hand, one might be claiming that Mary is silly to accept all of the jobs; that to accept a lot of jobs at once is a silly thing to do. This is the set interpretation and it is the preferred one. It expresses what can be considered a reasonable opinion. We can represent its logical form by (154).

(154) (((∀ job x) Mary apply for x and Mary take x) ⊃ Mary silly)

In formula (153) the quantifier ranges over the complete conditional, including the consequence containing the predicate *silly*. However, formula (154) finds the quantifier located inside the antecedent, thereby limiting its range of scope to exclude the predicate *silly*.

We can now summarize the effect of the syntactic configuration underlying the sentences of all three predicates in their interaction with an embedded universal quantifier. The structural descriptions manifest an asymmetric command relation obtaining between the matrix predicates and the universal quantifiers, with the former dominating the latter. Consistently the logic reflects the syntactic facts by allowing an ambiguous scope interpretation of these two constituents, but selecting the one which adheres to the syntactic arrangement of the constituents as preferred. In short, the quantifier can occur either inside or outside the scope of the matrix predicate in the logical representation because it is embedded under the predicate at the deep level. Nevertheless, the most natural reading of such sentences is one in which the logical order of elements matches the syntactic order.

C. Preservation of the Binding Relation Principle

Considering all six sentences upon which the whole discussion was based, three exhibiting an interaction between the predicates and an indefinite and three showing one between the predicates and a universal,

the following hypotheses emerge from the data:

(i) If in the syntactic base a quantifier functions as a clause mate with a given predicate, then the quantifier will be unambiguously assigned a logical interpretation outside the scope of that predicate.

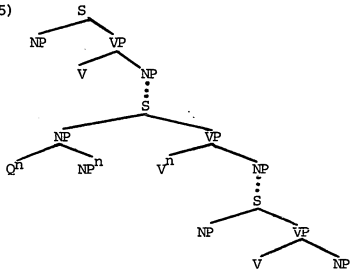
(ii) If in the syntactic base a quantifier is asymmetrically commanded by a given predicate, then ambiguous scope orderings are permitted between the quantifier and the predicate, with the one reflecting the deep structure configuration preferred.

Hypothesis (i) is supported by the analysis of sentences (136) and (137). Evidence for hypothesis (ii) is drawn from the semantics of sentences (138) and (144) - (146). Notice that an examination of the surface structures alone in these sentences gives us no clue as to why the semantics should vary among them. This results only from an analysis of deep syntactic differences.

The predictions outlined in the hypotheses should come as no surprise, for the relationship stated therein of a quantifier to some given predicate is just that dictated by the requirements of a first order logic which demands that a variable always remain inside the scope of the quantifier that binds it. In the syntactic deep structure (and here an *Aspects* model is assumed) the quantifier and the noun phrase being bound, some NP_x, are immediate constituents of the same higher noun phrase. NP_x, in turn, is in a peer relationship with a given predicate. In a logical representation of the deep structure tree, the quantifier must necessarily keep the variable NP_x within its scope, for NP_x marks the syntactic position from which the quantifier was moved. Since this position functions as an argument to the given predicate, then the predicate will automatically be

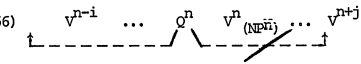
within the quantifier's scope. The reverse is prohibited if these syntactic facts obtain; that is, the quantifier cannot logically occur inside the scope of the predicate. Thus, given the following *Aspects* type deep structure:

(155)



its logical representation will allow Q^n to occur anywhere outside the scope of V^n, but never inside the scope of V^n, for then it would cease to bind the NP^n position. The following schema characterizes the logical possibilities:

(156)



The hypotheses presented above can be generalized into one principle given as follows:

(157) Preservation of the Binding Relation Principle

Given: NP_x = peer with predicate P

Q_x = quantifier binding NP_x

in the syntactic deep structure, T

Then, in the logical interpretation of T, Q_x can move freely

as long as NP_x continues to remain within the scope of Q_x. Therefore, Q_x can move anywhere to the left of P, but cannot move to the right of P.

D. Deletion and Raising Predicates in Multiply Quantified Sentences

Consider now the sentences containing two quantifiers:

(158) A senator is anxious to speak at every rally.

(159) A senator is silly to speak at every rally.

(160) A senator is likely to speak at every rally.

Based on Principle (157) what predictions can we make concerning the permitted and preferred scope orderings of sentences (158) - (160)? For sentences (158) and (159) the principle states that the indefinitely quantified noun phrase must occur outside the scope of the higher predicate, while the universally quantified noun phrase permits either scope ordering, though preferring to be inside the scope of the predicate. Consequently, there is a very high probability that the indefinite will receive wider scope than the universal on the preferred reading. Of the six theoretically possible combinations of the logical operators with the predicate:

(i) $Q_a \quad Q_{every} \quad Pred$

(ii) $Q_{every} \quad Q_a \quad Pred$

(iii) $Pred \quad Q_a \quad Q_{every}$

(iv) $Pred \quad Q_{every} \quad Q_a$

(v) $Q_a \quad Pred \quad Q_{every}$

(vi) $Q_{every} \quad Pred \quad Q_a$

only three are permitted by the binding principle, orderings (i), (ii), and (v). Ordering (v) is predicted to be the one preferred, as is the case. Of the three permitted readings, two of them, orderings (i) and (v), give the indefinite higher scope than the universal. Therefore, the

indefinite has a two in three chance in sentences like (158) and (159) of being assigned wider scope. Hence, we discover the explanation for the original analysis of the preferred semantics of these sentences.

Sentence (160) is more difficult to analyze. If we examine the predictions made concerning this sentence and compare them with the actual logical structure assigned to it in formula (134') as its preferred reading, we will see that there is some discrepancy. Since *likely* is a raising predicate, both quantified noun phrases can occur inside or outside the scope of the predicate in the logical form. Therefore, all six combinations of linear orders are possible readings for the sentence. The binding principle permits the sentence to be six-ways ambiguous and the original hypotheses predict that the readings adhering to orderings (iii) and (iv) should be more preferred. However, the preferred reading given in (134') mirrors the linear arrangement found in (vi). The permitted and preferred readings need to be examined in greater detail.

The principle stated above gives information about only the interaction of the quantifiers with the predicate. It tells us nothing about how two quantifiers will interact with each other unless this behavior is influenced by a quantifier's relation to the given predicate. In the case of a raising predicate, since all scope orderings are permitted, there is no reason to predict from the principle alone which one of the quantifiers will receive higher scope assignment. Therefore, we must look for other factors to help us determine which relative quantifier ordering we should expect to find preferred. There are two possible scope interpretations. We may refer to one senator who speaks at all the rallies, a wide scope indefinite reading; or to each rally which has its own possibly different senator speaking at it. Here, we have a wide scope

universal interpretation, the type which is more salient for sentence (160). The explanation for this can be found in the hierarchy of inherent quantifier properties detailed in chapter 3. It states that, all things being equal, the quantifier *every* has a greater tendency than the quantifier *a* to receive outside scope assignment. From this it should follow that the individual readings represented by orderings (ii), (iv) and (vi) will be preferred over the other three. Let us see if this is the case.

(161) a. (∀ w) (∀ rally y ε w) (likely ((∃ senator x ε w) (x speak at y)))

b. (likely ((∀ rally y) (∃ senator x) (x speak at y)))

c. (∀ rally y) (∃ senator x) (likely (x speak at y))

We claimed that (161a) is the preferred reading. However all our hypotheses state that it should be (161b), for this formula adheres to both the predictions of the linear order hypotheses in that both quantifiers reflect the order found in the syntactic deep structure; and those of the quantifier hierarchy, by giving the universal higher scope than the indefinite. How can we explain the salience then of reading (161a)? First, let us determine what the semantic differences are between the two readings.

Formula (161a) is making a generic claim about rallies, stating that any one of them would have a high probability of having a senator speak at it. Thus each rally has a probability of its own and there are as many probabilities as there are rallies. Formula (161b) refers to a probable situation: that for some given set of rallies delimited by the discourse, it's probable that all of them will have some senator or other speak at them. Here there is only one probability. It relates the chances that a state of affairs will exist in which some senator or

other will be speaking at all the rallies under consideration. As earlier, the difference here lies in the number of probabilities being spoken of in each case. And again, the reading represented by (161b) could be false even though that represented by (161a) was true. Of the two readings, it seems to me that the generic reading given in (161a) is the more preferred; however, I must admit that the sentence is very ambiguous between the two readings and both are quite salient. If it was the case that some speakers find (161b) more preferred, then this would be explainable by the previous hypotheses. An explanation for why (161a) can appear to other speakers as the preferred reading will be postponed until other factors can be considered.

Formula (161c) differs from (161a) as a reading in that the indefinite occurs outside, rather than inside, the scope of the predicate. This linear arrangement results in a semantic analysis of the indefinite as [+specific] since it is no longer inside the scope of the opaque modal operator, *likely*. It also looses its nomic character. The reading states that each rally has its own specific senator who is likely to speak at it. Though this reading is one of the three readings where the universal ranges over the indefinite, nevertheless it is a very obscure reading for (160). The explanation for this may lie in the fact that the arrangement of operators violates Hypothesis (ii) twice. Both quantifiers in (161c) occur in a higher position in the formula than they do in the deep syntactic tree.

Sentence (160) has three other theoretically possible readings, those giving the indefinite wider scope than the universal.

(162) a. $(\forall w)$ $(\forall$ senator x ε w) (likely $(\forall$ rally y ε w)
(x speak at y)))

b. (likely $((\exists$ senator x) $(\forall$ rally y) (x speak at y))).

c. (∃ senator x) (∀ rally y) (likely (x speak at y))

All three readings do occur as interpretations of sentence (160) to a greater or lesser extent. These interpretations assign the universal a collective interpretation so that it is the same senator who speaks at all the rallies. Formula (162a) is a generic reading of senators, claiming that if someone is a senator, it is likely that she will speak at all the rallies. Formula (162b) describes a likely situation. It states that there is a good chance that there is some senator who will speak at all the rallies. The readings expressed by (162a and b) are not as preferred as those given in (151a and b). However, they are more salient than the obscure reading represented by (151c). Formula (152c) has much the same obscurity as (151c), probably because the same linear arrangement of elements with respect to the predicate obtains in it as in (151c). Thus, it also stands in opposition to Hypothesis (ii). Formula (152c) states that there is a specific senator who, given some set of rallies, is likely to speak at all of them. We can arrange the six readings of sentence (150) in order of preference with the most salient given first.

(153) a. (∀w) (∀ rally y ε w) (likely ((∃ senator x ε w) (x speak at y)))

b. (likely ((∀rally y) (∃ senator x) (x speak at y)))

c. (∀w) (∀ senator x ε w) (likely ((∀ rally y ε w) (x speak at y)))

d. (likely ((∃ senator x) (∀ rally y (x speak at y)))

e. (∀ rally y) (∃ senator x) (likely (x speak at y))

f. (∃ senator x) (∀ rally y) (likely (x speak at y))

The underlying syntax, then, of sentences (158) to (160) gives us some idea of how they will be interpreted. The configurations underlying sentences (158) and (159) tell us that they will not permit as many readings

as sentence (160), and that one relative scope ordering will be highly preferred over the other. The syntax of (160) informs us that the sentence will be very ambiguous and that no reading should be emphasized over any of the others (though some will come across as slightly preferred or very obscure).

The logical formulas representing the preferred reading of sentences (158) and (160):

(158') (∃ senator x) (x anxious ((∀ rally y (x speak at y))

(160') (∀w) (∀rally y ε w) (likely ((∃ senator x ε w) (x speak at y)))

can easily be mapped into logically based syntactic trees to serve as the underlying representations. It will be a straightforward matter, then, for the semantic component to render the correct preferred interpretation, given quantificational configurations corresponding to these as input. The preferred formula of sentence (159) will be problematic for the grammar.

(159') (∀w) (∀senator x ε w) (((∀rally y ε w) x speak at y) ⊃ x silly)

In order to give an adequate logical representation to capture the meaning expressed in the preferred interpretation of (159), it was necessary to place the quantifier binding *rally* inside the antecedent of a conditional expression, as in (159'). Formula (159') states that a senator must speak at *all* the rallies to be labeled silly. If we did not put the universal binding *rally* inside the antecedent, we would get a completely different meaning, for formula (164):

(164) (∀ w) (∀senator x ε w) (∀rally y ε w) (x speak at y ⊃ x silly)

translates into:

(165) A senator is silly to speak at any rally.

Sentence (159) is true on the preferred reading only if the senator

speaks at all the rallies, while sentence (165) can be true if she speaks at any one of them. To insure that speaking at the complete set of rallies is predicated of senators by the logical interpretation rules when the preferred reading is judged true, *every rally* must occur inside the conditional antecedent of a predicate calculus formula. The problem for us is that the linguistic representation of (159) will not have the form of a conditional. There is no syntactic justification for representing it as such. In line with the other predicates under consideration, the S subordinated to *silly* must be represented as a complement structure. There will be no conditional antecedent to place the quantifier inside or outside of. Therefore, there will be no way, consistent with the semantics formulated so far in logical theory, to express the meaning difference exhibited by (159) and (165). The logic of quantifier interpretation incorporated into the semantics will have to be extended in a manner divergent from standard quantificational logic. One way to capture the necessary semantic distinctions would be to represent the noun phrase *every rally* in sentence (159), which is the problematic sentence, as a collective quantifier along the lines formulated in chapter 2. This would insure that the semantics would predicate the complete set of rallies, not just any one of them, in a true interpretation, without requiring a conditional expression.

One thing remains to be explained about the interpretation of sentences (158) - (160). Why is it that on the preferred readings two of the sentences express generic interpretations while one does not? Sentences (159) and (160) are more readily interpreted generically. Is there any common factor which can account for this phenomenon in both sentences? Upon examination of their underlying structural configurations we see that the two sentences share a structural similarity. Both have sentential subjects

under the analysis I have given them. The noun phrase which appears as surface subject must be moved into that position by the derivation, after the sentential complement has been extraposed. We can tentatively theorize that an indefinite noun phrase is more likely to be interpreted specifically if it occurs as subject at both the deep and surface levels. This would account for the contrast between sentence (158) and sentences (159) and (160); however, a complete explanation of these contrasts must certainly depend on an in depth analysis of the semantics of the predicates involved.

Now we see that sentence (159) containing the predicate *silly* is paired with the other sentences in two different ways. On the one hand, it is similar to the example containing *anxious* in giving the indefinite wide scope over the universal, *every*, on the preferred reading. This is accounted for by the underlying syntactic similarity of the two sentences which places the indefinite in the matrix S along with the higher predicate. On the other hand, it resembles the *likely* example by preferring a generic interpretation. This results from the sentential nature of the underlying matrix subject.

The predicates we have just been discussing have all been of the type which involved raising or deletion in reference to the matrix and complement subjects. These are the predicates we originally referred to as S to S predicates. It remains to be shown whether a similar semantic analysis can be carried out for the S to O and O to S predicates.

The S to O predicates are not problematic. The semantics of sentences containing them adher to the semantic patterning of the S to S type sentences just discussed. Sentence (166), below, containing the S to O deletion predicate *persuade*, has the same three scope possibilities as the *anxious* example.

(166) I persuaded a foreign student to enroll in every course. Again, the indefinite, *a foreign student*, can only be interpreted outside the scope of *persuade*, so that *persuade* is represented as a relation holding between *I* and *a foreign student*. The universal, *every course*, may be interpreted either inside or outside the scope of *persuade*, the difference manifested in the semantics by the number of acts of persuasion; that is, whether it was done separately for each course or once to include all the courses. Of course, when it occurs outside the scope of *persuade*, it may be read with wider or narrower scope than the indefinite. Since the indefinite has wider scope on two of the possible readings, there is a two-thirds probability that the preferred reading will be one of those which assigns it higher scope. And the preferred interpretation is the one predicted by the binding principle and the preference hypothesis, where the indefinite is outside the scope of the predicate and the universal is inside. The reading is represented in (166'):

(166') ($\exists$ foreign student x) (I persuade x (($\forall$ course y) (x enroll in y))

The semantics of the S to O raising sentence, example (167), function analogously to those of the *likely* example.

(167) I expected a foreign student to enroll in every course. When the indefinite is interpreted inside the scope of the predicate, then the sentence refers to an expected situation, that expressed in the complement. If it is interpreted outside the predicate's scope, then the expectation is made of the foreign student. In the first case the sentence expresses a relation between an individual, *I*, and a sentence, S; and in the second case, it is a three place relation between two individuals, *I* and *a foreign student*, and some task, S. The difference between the two scope readings of the universal and the predicate lies, as above, in the number of expectations. Of the six possible readings, the preferred inter-

pretation is one in which both quantifiers lie inside the scope of the predicate, with the universal ranging over the indefinite. This is also the reading which follows from the predictions. It is represented in (167'):

(167') (I expected ((∀course y) (∃foreign student x) (x enroll in y))

Notice that the indefinite cannot be read generically in either of these sentences. It seems that the indefinite must be in the surface subject position to be interpreted in this way.

The O to S predicates are much more difficult to analyze semantically. Sentence (168) is an example of a O to S deletion predicate and sentence (169) is a comparable O to S raising example.

(168) A hammock is ready for everyone to sleep in.

(169) A hammock is easy for everyone to sleep in.

Sentences (168) and (169) exhibit the same semantic contrast as was found in the *anxious - likely* pair above. The indefinite in (168) receives a specific interpretation while sentence (169) makes a generic statement. But this is not the essential difference between the two. Our analysis claims that the main factor separating a deletion type quantified sentence from a raising type quantified sentence is a difference in relative quantifier scope. In the example containing the deletion predicate the indefinite is assigned wide scope. According to our analysis the raising example should assign the overt universal wide scope. But it is not immediately apparent that this is the case. Consider the following example:

(170) A hammock is too flimsy for everyone to sleep in.

Sentence (170) is normally analyzed as having undergone deletion and therefore derives from a deep structure configuration identical in its essential features to that underlying sentence (168). Yet, at first glance, it appears to have the same preferred semantic analysis as sentence (169). Both sentences assert generic claims and they both appear to be predicating

generic properties of hammocks. However, upon close examination, one can perceive a difference. Sentence (170), on any salient reading, is making a generic claim about hammocks. Sentence (169) is quite ambiguous, but it is my intuition that the sentence is a statement about people, not about hammocks. It seems to be making a claim about what it is possible for people to do, while sentence (170) is asserting what is nomically true of hammocks. Let us compare the two syntactic types with only one quantifier.

(171) A hammock is difficult for Mary to sleep in.

(172) A hammock is too flimsy for Mary to sleep in.

Sentence (171) is addressing itself to what type of thing Mary has trouble sleeping in. On the most preferred interpretation, the focus of the sentence is on Mary. The difficulty is being predicated of a sentential formula rather than of an object. Sentence (172), on the other hand, is ascribing a property to hammocks. On the preferred reading of the raising sentence, the quantifier occurs inside the scope of the matrix predicate, but on the preferred reading of the deletion sentence, it occurs outside of the predicate's scope. Perhaps the following pair of sentences will make the contrast clearer:

(173) A standing deer is easy to shoot.

(174) A standing deer is too innocent to shoot.

Sentence (173) is not a generic about standing deer, but about the ease of shooting standing deer. It is a generic statement concerning what type of object is easy for hunters to shoot. The generic focus of the stateemnt is the deleted complement subject - the shooters. In contrast, sentence (174) is a generic about standing deer.

Returning to the sentences with two quantifiers, on the preferred interpretation, the generic focus of sentence (170) is *a hammock*, while in

(169) it is the people referred to by the phrase *everyone*. There is a second important difference between these two sentences. The relative scope assignments are not the same in each sentence. In sentence (169), the overt universal has higher scope, that is, the sentence conveys an individual interpretation. The ability to sleep in a hammock is predicated of every member of the set of people. Sentence (170) assigns the overt universal lower scope so that it is read with a collective interpretation. A hammock is too flimsy for the people to sleep in together. It does seem to be the fact though, that sentence (169) is much more ambiguous than sentence (170). Let us attempt to assign a logic for the preferred interpretations of all three sentences.

(168') $(\exists$ hammock y) (y ready $((\forall$ people x) (x sleep in y)))

(169') $(\forall$ w) (easy $((\forall$ people x ε w) $(\forall$ hammock y ε w) (x sleep in y)))

Sentence (170) presents a problem from a standard logical perspective, for it is analogous in its quantificational semantics to the problematic semantics discussed in reference to sentence (170), the sentence containing the higher predicate *silly*. As mentioned above, the sentence is only true on the preferred interpretation if the claim is asserted of all the people together. The way to insure such an interpretation in standard logic is to place the universal inside the antecedent of a conditional expression. But it does not make sense to represent (170) as a conditional. Formula (170') is certainly a strange logical representation of (170), not really capturing the meaning of the sentence.

(170') $?(\forall$ w) $(\forall$ hammock y ε w) $(((\forall$ people x ε w) x sleep in y)
$\supset$ x too flimsy)

An extended logic containing a collective quantificational representation such as that developed in chapter 1 would be able to represent the semantics of (160) on its preferred reading. It could express the correct

scope relations without resorting to a conditional statement, and this would allow us to represent the complement as an argument of the predicate.

Sentence (169) requires additional consideration. Observe that, unlike the raising sentence containing the predicate *likely*, the indefinite is represented in (169) by a universal quantifier instead of an existential. I do not understand why this should be the case; however, it does have semantic consequences. In a logical interpretation, formula (169') would continue to have the same truth conditions were the quantifier scope relations to be reversed, as in (169'').

(169'') (∀w) (easy ((∀hammock y ε w) (∀people x ε w) (x sleep in y)))

Formulae (169') and (169'') are equivalent. This could account for why the sentence is perceived as so ambiguous, with the preferred scope interpretation much less clearly defined than in the S to S and S to O raising sentences.

Footnotes

1. The first discussion of object raising is found in Chomsky (1964). Rosenbaum (1967) formulated the transformational rule to perform the raising operation. The class of predicates to which the rule applies was examined in greater detail by Postal (1971). It was he who first referred to the rule as *tough* movement. A very extensive treatment of this class of predicates occurs in Berman (1974).

2. There are several other idioms which function like *make headway* and *maintain appearances*; namely, *make an impression*, *make allowances* and *keep tabs*. But some idioms do not permit object movement: *take advantage*, *pay heed* and *pay attention*. Speakers vary as to which idioms they will permit to undergo *tough* movement. However, these last three seem unacceptable to everyone. A fuller discussion of the interaction of idioms with movement adjectives can be found in Kissebirth (ms.) and Berman (1974).

3. This point was brought to my attention by Gilles Fauconnier.

4. The historical data was obtained from Mustanoja (1960) and Jespersen (1940: Vol. 5).

5. Actually, Postal states that the restriction on surface subjects is more rigid. Only definite NP's can be moved into subject position. Moreover, that generic indefinite forms occur as surface subjects gives support to the fact that "generics are structurally definite in some sense even with a superficially indefinite form." (1971:p.29). However Postal has made the restriction too narrow. True indefinites may occur as surface subjects if they convey a [-specific] reading. They need not be used in a generic sense. That is, the remaining portion of the sentence need not be interpreted as a generic characteristic of the indefinite subject. The sentence may be expressing a generic characteristic of some other noun in the sentence. Such is the case in (i) and (ii) below.
   (i) A math test is easy for Martha to pass.
   (ii) A cheap hotel will be hard for you to find.
   Sentence (i) is making a generic claim about Martha, not about math tests. Though *a math test* is not [+generic], neither is it [+specific]. Equally, sentence (ii) is not making any generic claims about *cheap hotels*, as evidenced by the paraphrases of (ii) shown in (iii). These sentences derive from the same source as (ii) and have the same interpretation, but here it is more obvious that the generic expression is not predicated of the indefinite, rather of the pronoun *you*.
   (iii) a. To find a cheap hotel will be hard for you.
   b. It will be hard for you to find a cheap hotel.

6. Notice that (67c) is ambiguous, but the indefinite is [-generic] on both readings. On one reading the indefinite gets high scope over the universal *everyday*, so that we are ascribing the characteristic of swimming in the Charles everyday to a particular woman. On the other reading, a characteristic is being denoted of the Charles - that it is swum in by a woman everyday. In both cases the subject is expressing true indefiniteness, as seen by the fact that it can be

represented by the existential quantifier. Lasnik and Fiengo claim in their footnote 5 (p.545) that indefinites are ungrammatical as subjects of verbs which are in the simple present tense form, as these verbs denote characteristics. Thus the following example is judged ungrammatical by them.

(i) Someone swims in the Charles.

I must disagree both with their judgements and their claim. Sentence (i) is grammatical if it is interpreted as an attribute of the Charles, rather than of the subject *someone*. Sentence (67c) presents further counterevidence to their claim.

7. For a discussion of these problems see Perlmutter (1968).

8. It is true that not all native speakers accept the sentences of (73) as grammatical. However, it should be noted that the same can be said of the sentences which are crucial to L & F's argumentation. The following examples are all judged questionable or unacceptable by quite a sizable sampling of native speakers.
   (i) ?John is being easy to please.
   (ii) ?John is intentionally difficult to interest.
   (iii) ?Be hard to manage.
   (iv) ?John tries to be easy to find.

9. Notice that this same inadequacy occurs with Perlmutter's deep structures for the passive: the identity must hold between the subject of *try* and the *object* of the verb to undergo passive. It is irrelevant that an identity can be constructed between the subject of *try* and the subject of some interpolated abstract verb.

10. Speakers from the greater New York area accept, for the most part, sentences like (81c) as well as other sentences which result from the movement of an NP after Dative Shift has occurred. Evidence to this effect is given in Langendoen, Kalish-Landon and Dore (1974).

11. The rule schema of Passive employed is exactly that formulated by Fiengo (1974). He has split the rule into two parts, one to prepose the "object" and the other to postpose the "subject". It is this second part that is applicable to my discussion and it is the one that is cited. Fiengo gives no explicit formulation for the rule of *There*-insertion; thus the one presented has been constructed in accordance with his discussion of this rule. It is identical to the *There*-insertion rule stated in Milsark (1974).

12. Some might argue that the ungrammaticality of (97b) is due to the inanimacy of the for-phrase object, claiming that such sentences are never permitted for them. But the restriction on raising from *There*-insertion contexts is independent of this [±animate] distinction. Milsark (1974) has shown that most non-copular verbs which permit *There*-insertion have two meanings, only one of which is evidenced with *there*. *Stand* is such a verb. It can mean either "to take a position" or "to be positioned", the former meaning giving an agentive interpretation to its subject, and the latter giving a patient interpretation. Only verbs carrying the second meaning are candidates for the *There*-insertion transformation. The opposite is true of *tough* predicates. Raising cannot take place unless a complement

verb entails the first reading. Therefore:

(i) The chandelier is hard for Eva to stand under.

can only mean that Eva has difficulty taking a place under the chandelier. It cannot mean that it is difficult for her to be situated under the chandelier.

13. The concepts [±specific] are relational terms and in the actual interpretation, attention must be given to how the indefinite noun phrases interact with the various predicates in the sentence along these dimensions. I will not give a descriptive account here of the precise opaque contexts that give rise to a non-specific reading. Such an accurate account of the semantics is beyond the scope of this discussion and is not necessary to the points I am making.

14. For a detailed treatment of specificity with regard to opaque contexts see chapter 2, sections 5 and 6, and Fodor (1970). The use of $(\exists x)$ to represent [±specific] was justified in chapter 2, by removing existence claims from the semantic interpretation of this quantifier.

15. The logical analysis of generic interpretations given here follows with some modification that outlined in Dahl (1973b). The modal operator which introduces generic expressions is not the possibility operator which is used in standard logic to represent all possible worlds. Rather it is one which delimits the possible worlds to a subset of nomically possible worlds in which certain laws of nature hold constant. The properties of this operator will become clearer as the discussion procedes.

16. I am using a many-sorted logical notation in these formalizations, for it more closely adhers to the underlying syntactic representation which would be assigned to the sentences by the grammar.

Chapter V

Incorporating Quantifier Scope into a Grammatical Model

Section 1: The Role of Surface Command in Defining Quantifier Scope

We have just shown that three syntactic properties of a sentence are relevant to a determination of its quantificational scope semantics. These three properties are the inherent semantic characteristics of the interacting quantifiers, the grammatical functions of the quantified noun phrases and the command relations obtaining between the two noun phrase positions quantified into. Grammatical functions at both the deep and the surface level must be taken into consideration; for transformations, such as passive, which alter grammatical relations, have an effect on scope interpretation. Through our investigations deep structure command has been shown to be a relevant parameter of scope determination. We have neglected any mention of the role that surface command relations might have.

The following paradigm illustrates that surface asymmetric command alone will not be influential in determining scope.

(1) a. It is likely that a senator will speak at every rally.

b. That a senator will speak at every rally is likely.

c. A senator is likely to speak at every rally.

There is little semantic change from sentence to sentence. All three sentences of (1) have a strong preferred reading which assigns the universal wide scope. The three sentences derive from one underlying structure in which the two noun phrases being considered are clause mates. The three do not share identical command dependencies at the surface. Only sentence (1c) is transformed into a configuration where one quantified noun phrase asymmetrically commands the other. As the underlying command relations in (1a) - (1c) are identical but the surface command relations

vary, and since the sentences convey the same scope interpretation, we can conclude that surface command factors have no effect on the scope assignment of two interacting quantifiers in these sentences.

However, the situation is more complex. Other paradigms do not exhibit the same semantic regularites shown in (1). Observe that the scope interpretation does not remain constant in the following pair.

(2) a. It is hard for a child to solve every riddle.

b. Every riddle is hard for a child to solve.

The preferred reading changes from the (a) to the (b) sentences though both derive from the same underlying structure. In (2a) the indefinite is given wide scope. For any child selected, it will be hard for her to solve the complete set of riddles. In (2b) the universal receives wide scope on the preferred reading. Therefore, each riddle has the property of being hard to solve. The surface command relations also change from (2a) to (2b). In (2a) the two quantified noun phrases are clause mates, and the subject noun phrase receives wide scope over the object noun phrase. The quantified NP's in (2b) are clause mates at the deep level, but exhibit an asymmetric command relation at the surface level. It is the quantifier which commands at the surface that receives wider scope assignment in (2b). Consequently, in this paradigm surface command relations are relevant.

How can we account for the differences exhibited in the interpretation of the sentences of (1) and the sentences of (2)? The following pair will give us some insight into the problem. Notice that the sentences of (3) are identical in structure to those of (2). Only the quantifiers have been interchanged. They now bind different noun phrases. The universal binds the underlying subject and the particular binds the underlying object. It is the particular quantifier in this paradigm that is raised,

rather than the universal.

(3) a. It is hard for every child to solve a riddle.

b. A riddle is hard for every child to solve.

Sentences (3a) and (b) have the same meaning. They state that every child has difficulty solving riddles. The universal receives wider scope in both sentences.[1] The sentences of (3) behave like the sentences of (1). Raising does not effect a change in meaning. The two paradigms share a common factor. In both the indefinite is raised. We observe that in (2b), where surface command relations have an effect, it is the universal that is raised. It seems that the various parameters of quantifier scope interact with each other. Surface command is relevant only when the commanding quantifier is higher on the inherent properties hierarchy.

Section 2: Perceptual Strategies and the Parameters of Scope Determination

In order to incorporate this information into the mechanism which predicts scope relations, the grammar requires that the mechanism be one that is capable of evaluating the interaction of the relevant parameters, rather than one which evaluates each parameter in isolation. A matrix is one type of mechanism which is able to provide the needed representation.

It can be incorporated into the grammar as a type of perceptual strategy. Along one dimension the interacting parameters are listed. The other contains the quantifiers being considered. The factors which appear in the columns would include those outlined above, namely, deep structure grammatical relations, surface structure grammatical relations, the inherent properties of the quantifiers, deep structure command relations, and surface structure command relations. The importance of each parameter is ascertained with respect to each of the two quantifiers which interact. For each quantifier, we will decide whether it takes precedence over the other on the feature being considered. If so, we will enter some

sort of indication of the fact in the appropriate cell. The matrix evaluates the influence of the parameters by tallying the cells which are filled and then assigning a numerical value to each quantifier. The dispersion between the two values will determine whether the utterance is ambiguous and if so, the degree to which any reading is preferred. The greater the distance between the totals, the more likely it is that the sentence will be perceived as unambiguous; that it will be assigned a level 5 or a level 1 reading. If the totals are close to one another, then we predict that the sentence will be perceived as fairly ambiguous, perhaps a level 3 interpretation. Let us compare matrices of this sort for the sentences of (2) and (3).

(2a) It is hard for a child to solve every riddle.

	DS Gr. Rel.	SS Gr. Rel.	Inh. Prop.	DS Com.	SS Com.
a	✓	✓			
every			✓		

(2b) Every riddle is hard for a child to solve.

	DS Gr. Rel.	SS Gr. Rel.	Inh. Prop.	DS Com.	SS Com.
a	✓				
every			✓		✓

(3a) It is hard for every child to solve a riddle.

	DS Gr. Rel.	SS Gr. Rel.	Inh. Prop.	DS Com.	SS Com.
a					
every	✓	✓	✓		

(3b) A riddle is hard for every child to solve.

	DS Gr. Rel.	SS Gr. Rel.	Inh. Prop.	DS Com.	SS Com.
a					✓
every	✓		✓		

From the matrices above we predict that the preferred scope readings will change from (2a) to (2b), but will remain constant from (3a) to (3b). We do expect that (3b) will be slightly more ambiguous than (3a); that is, that the non-preferred reading which gives higher scope to *a riddle*, will have a bit more salience in (3b).

The matrices as they are now constituted have been greatly over-simplified. One can quickly observe a major shortcoming in them. Every factor is compared for the two quantifiers on an equal basis. We should not expect that correct predictions would result from such an analysis. Both the grammatical relations and the inherent properties data form hierarchies. It should follow that two items being compared which are close to each other on a hierarchy would not have as great an effect on scope determination as two items on disparate ends of the hierarchy. Additionally, it is not clear that the parameters entered in each column should be given equal weight. We have shown in chapter 4 that deep structure command is a more reliable determinant of quantifier scope than surface command. The inherent characteristics of a quantifier seem to be the most important factor in scope determination. For example, we demonstrated in chapter 3 that *each* receives wider scope in almost every circumstance. A more accurate matrix would indicate differences using a numerical value rather than a binary opposition. However, an accurate evaluation mechansim would require much more extensive research into the parameters involved than what has been done in this study.

Section 3: The Treatment of Preferred and Ambiguous Readings

How would a perceptual strategy such as we have outlined above fit into the grammatical model? Since the perceptual strategy functions to predict both judgments of scope ambiguity and preferred readings, it appears that the information it provides is more pragmatic in nature than semantic. Preferred readings cannot be predicted in isolation from the speaker. Individual speakers will exhibit variation in their judgments of ambiguity and preference. This was observed to be the case in chapter 3. A matrix predictor would be capable of incorporating individual differences. These would presumably result from differing degrees of importance being assigned to one factor over another by individual speakers. When a sentence is evaluated, the numerical values entered into each cell in the matrix would vary from speaker to speaker.

There is a second reason to consider preferred readings the concern of the pragmatics. Syntactic factors are not the only indicators of preferred readings. A truly workable matrix must include additional columns to code such non-syntactic factors such as: the amount of stress applied to each quantified noun phrase, the semantic nature of the context in which the sentence appears and even the type of common noun that is being quantified. For example, we can observe the role this latter parameter plays by comparing the difference in the preferred readings exhibited by the following two sentences.

(4) a. All the women built a suspension bridge.

b. All the women threaded a needle.

Obviously the difference in meaning is due to a difference in the nouns that interact. What the expected interpretation will be depends on our knowledge of the world.

It might be suggested that preferred readings are indeed in the

realm of pragmatics, but that judgments of scope ambiguity should be determined at the semantic level. There are two independent justifications for a position which regards ambiguity judgments and preferred readings as aspects of the same phenomenon, and they argue against the separation approach. First, there is no clear division between ambiguous and non-ambiguous sentences with respect to intuitions concerning scope ambiguities. Some sentences which are classified as ambiguous are only slightly so. In fact, the obscure readings may never be perceived by quite a large number of speakers. Such sentences, though classified as ambiguous, may seem more similar to unambiguous sentences, and quite dissimilar to other ambiguous sentences where all the readings are obvious. Therefore, it seems more accurate to order the ambiguities on a continuum ranging from very ambiguous to completely unambiguous. In such a system, individual variation can be put into perspective. Suppose a number of speakers were to give very different ambiguity judgments on a particular sentence. Half claimed it was ambiguous and half claimed it wasn't. We would be at a loss to incorporate their disparate opinions into a grammatical description of that sentence using only binary distinctions of ambiguity. However, if the level of ambiguity was to be rated on a scale, one could observe whether all the disparate judgments clustered around a single point, and if so, use this value as a way of classifying the sentence with respect to the others being judged. Under this system finer distinctions can be drawn among sentences, and a more accurate assessment can be made of speakers' intuition regarding them.

The second argument that can be advanced in favor of the single treatment approach is one concerning the simplicity measure. The parameters needed to determine scope ambiguity judgments are precisely those which determine preferred readings. The simpler and therefore more

highly valued grammar is one which does not require a duplication of the evaluation mechanism, but determines both factors simultaneously by means of a unitary system.

Section 4: The General Grammatical Model

Since we consider the determination of scope ambiguities and preferred readings to be in the domain of the pragmatics, how will the remainder of the grammar function with respect to quantifier scope? We must determine the most adequate form of the syntactic representations assigned to sentences containing multiple quantification and the exact semantic interpretations of each one. As noted earlier, the Keenan model will be utilized since it already contains the mechanisms necessary for the formal expression of the semantic properties of logical elements.[2] Furthermore, it adheres sufficiently to the basic tenets of transformational generative grammar, so as to be capable of incorporating many of the insights linguists have achieved concerning the non-logical properties of language.

Keenan grammar (KG) has defined the syntax and semantics for only a subset of the sentences of English. Our investigations have involved a much larger set of sentences. Specifically, we have been examining various syntactically defined complement constructions. Only one such structure has been incorporated into KG, the complements which are classified semantically as factive predicates.[3] In addition, grammatical relations have not yet been specified in the base strings. Because of the limits of KG, we will adopt only a modified form of it. The overall structure of the base sentences will remain intact. However, the open sentences will be adjusted. All noun phrase positions in the open sentence will continue to be filled by pro-names. But, the syntactic relationships expressed in the standard theory deep structures will be represented here.

In this way we can obtain the necessary grammatical and command relations in order to allow us to predict scope readings. However, we must sacrifice one of the essential features of KG. We will not be able to assign a semantic interpretation to every aspect of our sentences, for many of the syntactic configurations referred to in this study haven't as yet been defined in KG syntax and semantics. Since the focus of this study is on quantificational semantics, we will accept this limitation until such time as the remaining syntactic properties can receive their semantic definition. In essence, our deep structures will resemble KG base strings with respect to their logical elements and the standard theory underlying structures with respect to the syntactic properties of the sentence. This compromise will permit the necessary statement of the formal semantic definition of quantifier scope, as well as the construction of the proper mechanism to predict actually occurring scope ambiguities.

We must now investigate the manner in which the various components of the grammar interact to produce all and only the correct scope readings for quantified sentences. In the standard theory if a sentence is logically ambiguous, it is assigned one deep structure but two semantic interpretations. Preference in the choice of readings results from "extraneous" surface factors. Neither the semantic interpretations nor the extraneous surface factors are specified in standard theory (see chapter 1). The model we propose will assign multiple deep structures to logically ambiguous sentences, but on the basis of their *potential* rather than *observed* ambiguity. A sentence like (5):

(5) Three landlords visited five tenants.

which permits eight possible logical representations, according to the syntax defined in chapter 3, will be assigned eight deep structures. All the known logically possible scope dependencies will be realized as

alternate deep structures. Some of the possible combinations will be semantically equivalent to other combinations. The semantic component will be sensitive to this fact and will reduce the number of possible readings by equating the truth conditions for those individual representations which are indeed equivalent. Sentence (5) will be assigned seven distinct sets of truth conditions. The sentence, however, may not actually be perceived as seven ways ambiguous. It is the function of the pragmatic component to specify the number of perceived ambiguities utilizing pragmatic information which interacts with perceptual strategies developed above. In our model, therefore, at the syntactic level a sentence begins by receiving the maximum number of logically possible representations. These possibilities become gradually reduced as its description proceeds through the semantic and pragmatic components until the description of the sentence reflects only the readings actually assigned to it by the speaker.

Section 5: Summary

This dissertation began with a description of the traditional philosophical and linguistic treatment of quantifier scope. In chapter two I extended the traditional approach to include a wider range of natural language sentences and a larger number of readings. In chapters three and four, I attempted to define the parameters that determine multiple and preferred scope interpretations, chapter three confined to a discussion of clause mates and chapter four examining complement constructions. In this, the final chapter, I tried to suggest a grammatical model whereby the analyses discussed in the first four chapters could be utilized; however, the data could be incorporated in a number of alternate ways. Our final model is consistent with the standard theory, modified to the extent that the logical features of a sentence are represented in the base and

are given full specification in the semantic component. Because of the limitations of this study, the perceptual strategies which interact with the pragmatic component have only been sketched in brief outline.

Footnotes

1. We are presenting here a simplified analysis of the semantic interpretation of (2) and (3) for the purpose of constructing a mechanism to adequately predict the scope semantics of a sentence from its internal structure. The model we present is but a first approximation. It will be better understood if the data is kept simple. Our intent is not to provide the final representation of the model but to suggest the type of mechanism needed to satisfactorily determine scope readings. To truly represent the scope dependencies of the two interacting quantifiers in (2) and (3) it is necessary to involve the predicate in the description. A complete account of the quantificational semantics of sentences like the ones being discussed was defined in chapter 4.

2. The superiority of a logically-based deep structure over the standard syntactically-based deep structure has been argued for in Keenan (1972) and Fauconnier (1971).

3. See Kiparsky and Kiparsky (1971).

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