

On the Logical Properties of Universally- quantified English Sentences

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SYNOPSIS

This paper investigates the logical properties of *any*-sentences (in contrast to those for *every*-sentences) within the framework of a logically-based grammar.

(1) a. John spoke to anyone who came.

b. John didn't shoot any bird.

Labov (1972) points out that (1 a) expresses the meaning of "a lawful generalization." This semantic characterization of (1 a) can be extended to include (1 b). Reichenbach (1947) would give (1 a) and (1 b) the following logical representations.

(2) a. $Ax ((X \text{ came}) \supset (\text{John spoke to } X))$.

b. $Ax ((X \text{ is a bird}) \supset \sim(\text{John shot } X))$.

In (2 a) and (2 b) *any* is analyzed as the universal quantifier. In (2 b) the apodosis "John didn't shoot X" is the proposition schema which represents the propositional part of (1 b) and the protasis "X is a bird" defines the category name under which the X in the schema behaves as an argument, so the X stands for a free argument variable. This causes the 'analyzability' of the X with respect to the schema. The same holds for (2 a). The universal quantification results in the same type of conjunctions as shown below.

(3) a. John spoke to X_1 and John spoke to X_2 and $\dots \infty$.

b. John didn't shoot X_1 and John didn't shoot X_2 and $\dots \infty$.

Assuming that Horn's (1972) Factoring is a set-formative rule, (1 a) and (1 b) can be derived by applying the rule to (3 a) and (3 b).

(4) a. John spoke to $(X_1 \text{ or } X_2 \text{ or } \dots \infty)$.

b. John didn't shoot $(X_1 \text{ or } X_2 \text{ or } \dots \infty)$.

The sets so formed are lexicalized with *any*.

Several arguments for the plausibility of this derivation of *any* are presented in this paper. After a brief survey, in Section I, of some important contributions in the literature, Section 2 discusses the referential problem for *any* in contrast to *every*, clarifying that Factoring, in sharp contrast to Conjunction Reduction, depends for its applicability crucially on the referential nonspecificity

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condition that must be imposed on the X 's in (3). Section 3 concentrates on the logical properties of sentences like (1 b) and on the set-formative function of *any*. There, under the proposed assumptions, it is naturally explained that the sets in (4) are obligatorily formed by Factoring on the referential condition that the individual X 's can only be included in the sets under the category names given by the protases. This condition will also explain the immunity of Factoring from the Cross-over Constraint in deriving (4) from (3) and, most importantly, that the existential interpretation for (1 b), often asserted by linguists, results from the logical entailment that the truth of the proposition with respect to one arbitrarily chosen argument X_i can vouch for the truth of it with respect to any other argument in the set (4 b) (the unmarked condition). The marked condition is necessary for (1 a). The stress on *any* signals reference to the totality of the set (4 a). Section 4, summarizes the points made in Sections 2 and 3. Section 5 presents evidence for the set-formative function of *any* in contrast with Fauconnier's (1975) Scale Principle, demonstrating that an analysis of *any* made otherwise than in quantificational terms will prove invalid.

0. Introduction

This article examines the two distinctive types of logical structure for universally quantified *any*- and *every*-sentences of English within the framework of a logically-based grammar. After a brief survey, in Section 1, of some important contributions in the literature, it is argued in Sections 2 and 3 that the distinctive logical properties of *any*-sentences and *every*-sentences in general can most adequately and appropriately be specified in terms of reference and the associated set-formative operations. Section 4 gives a summary of the points made in Sections 2 and 3, supplemented by Notes 1, 2, and 3 concerning the restriction on the occurrence of *any* in imperatives, the derivations of *either* and *both* along the same lines as those of *any* and *every*, and the distinction between the marked and the unmarked condition to be imposed on the occurrences of *any*. Section 5 presents evidence for the assumption that the semantic function of *any*, similarly to that of *every* (*all*), is set-formative, as is indicated by the general logical formula $Ax((Fx) \supset (Gx))$ posited for *any*-sentences in quantificational logic, and shows some deficiencies of analyses of *any* made otherwise than in quantificational terms, such as Fauconnier's (1975) Scale Principle and Lasnik's (1975) Disambiguation Theory.

1. Background and General Remarks

In the literature there have been repeated discussions of whether *any*, in any analysis of it as a quantifier word, should be a universal or an existential quantifier or both. Logicians and some linguists¹ treat this word uniformly as a surface form of the universal quantifier, while many linguists² distinguish between the universal *any* and the existential *any* on the basis of certain crucial differences in its syntactic and semantic behaviour. Recent discussions³, involving analyses

of the other forms of both the universal and the existential quantifier, have centered on this problem concerning the plausibility of a unified treatment of *any*.

Horn (1972) made an attempt to unify the two *any*'s under the Factoring Theory he developed in line with Quine's (1960) and Reichenbach's (1947) wide scope theory. Factoring, as will be discussed in detail in the following chapters, is indispensable to the set formation operation required to give rise to *any*. On the other hand, McCawley (1977) disclosed an essential problem for the Quinian approach.

- (1) a. Order any dish you think you like.
- b. $(\text{Ax} : \text{X is one of the dishes}) (\text{I request you (you order X)})$

The problem he posed regarding (1 a) and (1 b) is how to account along the lines of the logical representation (1 b) for the fact that in (1 a) exactly one object is involved. Some may object to this performative analysis of (1 a), but it is required to give a necessary scope relation under Quine's theory. He proposed a solution to this problem by the possibility of conventional implicature (in the sense of Grice (1975)) coming into effect here; that is, "distinctive singular number conventionally implicated that exactly one object is involved."⁴ But if this is the case, it still remains to be explained how conventional implicature interacts with the logical structure (1 b). Under the theory to be developed in this paper, this problem can be given a natural solution in terms of logical entailment and a logical structure that can be given for (1 a) even without any recourse to the performative analysis, (cf. Section 4 for the details). However, the problem with (1 a) and (1 b) is exactly the problem of working out some plausible way in which the semantic fact mentioned about (1 a) can coherently be associated with an appropriate logical form for it.

McCawley (1977) also argued against Vendler's (1967) analysis of *any* which is not made in quantificational terms, or "in terms that has no equivalent in the predicate calculus."⁵ According to Vendler, with *any* the speaker presents an offer to the addressee, giving him freedom of choice in picking a referent for the NP containing *any*. McCawley, rejecting this analysis, asserted that choice is irrelevant to negative clauses like (2) below, and to affirmative ones either.

- (2) John didn't see anyone.

However, it does not seem correct to reject Vendler's analysis altogether. There is some truth to it, for the notion of OFFER and the consequent notion of CHOICE are more or less apparent in all occurrences of *any*, and especially clear in imperative sentences like (1 a). The problem is, assuming the semantics of *any* to be basically quantificational, how to explain Vendler's and Jackendoff's observation that *any* carries such notions, independently of the alleged distinction between universal and existential quantification.

Lasnik (1975), accepting Quine's analysis, made an appealing observation of the semantics of *any*. According to him, it is the resolution of potential scope

ambiguities. This necessarily presupposes the existence of some operator in sentences where *any* can occur grammatically. And these operators must be such that "can induce a meaning-affecting scope ambiguity in relation to the universal quantifier."⁶

- (3) a. I didn't solve all of the problems.
- b. I didn't solve any of the problems.

In (3 a) the *all* is commanded and preceded by *not* and is negated. This explains that *all*, one form of the universal quantifier, can be placed within the scope of negation. *All* is the unmarked form. The *any* in (3 b) is not negated and so it must be analyzed as having wide scope with respect to the negation operator, though it can occupy the position commanded and preceded by *not*. Thus Lasnik asserts that *any* is the marked form of the universal quantifier, that is, marked to occur in sentences involving operators, 'triggers', for *any* as defined above. This definition of the semantics of *any* is quite convincing. But observe the following sentences.

- (4) a. *I spoke with anybody yesterday. (=Lasnik's (1975) example)
- b. The acid consumed any rust. (=Bolinger's (1977) example)

There is apparently no scope ambiguity either in (4 a) or in (4 b). (4 b) is perfectly grammatical. Something more, besides the marked condition, seems to be involved in sentences like (3). See the schematizability of (4 b) discussed in Sections 2 and 4.

Finally, a brief mention must be made of polarization. The *any* in (3 b) is often referred to as "negative polarity *any*" but *any* is not a polarity item by itself, or it is not lexically marked to have negation built into its meaning as a word, as is often suspected. But it seems correct to assume that *any*, in general, occurs as polarized by those affectives or modals⁷ which can 'trigger' it; that is, in negative contexts, for example, it acquires negative polarity and in modal contexts certain suitable kinds of polarity. In this connection, Bolinger (1977) quite convincingly argued for the independence of *any* from built-in negation, giving the following pairs of sentences.

- (5) a. If many of them are OK, I'll eat my hat.
- b. ?If many of them are OK, I'll be glad.
- (6) a. If any of them are OK, I'll eat my hat.
- b. If any of them are OK, I'll be glad.

According to him, conditions are a normal environment for *any* (cf. Section 4 for the general formula (24 b) for *any*-sentences), but they must carry a negative implication if *many*, a negative-polarized item, can be accommodated easily. The meaning contrast undoubtedly attests to the plausibility of his argument.

Now, the context-dependent polarization of *any*, as it is suggested above, seems to have some important bearing on its logical force of universal quanti-

fication. This is the point discussed by Fauconnier (1975) under his Scale Principle, which is extensively discussed in Section 5.

2. Logical structures for *any* and *every* in positive sentences

Horn (1972) proposed deriving *any*-sentences and *every*-sentences from sources of the same type by applying to them different transformational rules. This approach is particularly appealing, for it enables the two quantifier words to be analyzed as the semantically opposed ... at least in one important respect, see below ... surface realizations of the universal quantifier. This proposal, needless to say, presupposes structures in lexical items like these quantifier words. The source structures are of the type commonly instanced by a conjunction of S's, S's commanded by AND, and the rule, which eventually yields *every*-S's is Conjunction Reduction, while the rule responsible for *any*-S's is Factoring. Assuming, for the moment, both rules to be transformational, which rule to apply under what conditions is our main concern in this section. Horn stops his arguments only by asserting that "before Factoring the structures are conjunctions but disjunctions after it."⁸ Aside from its theoretical consequences, the Factoring Theory is a subject worthy of especial consideration, since the theory is motivated by a factual assumption⁹ that the problems of *any* would be given a unified treatment.

We start an examination of the Factoring Theory by comparing the following pairs of sentences.

- (7) a. My goat can eat anything.
- b. My goat can eat everything.
- (8) a. John spoke to anyone who came.
- b. John spoke to everyone who came.

The alleged equivalence of (7 a) and (7 b) in truth value judgment does not help distinguish *any* from *every*. Sentences like these can be defined as generic on this equivalence. However, the crucial difference between (7 a) and (7 b) is deducible from the clear contrast in meaning between the paired sentences in (8). (8 a) conveys the meaning of "a lawful generalization,"¹⁰ hence it expresses a nonfactual assertion, from which one can infer that if one more person had come, John would have spoken to him. On the other hand, such an inference is impossible from (8 b) and this naturally follows from the observation that (8 b) is understood as the assertion of a fact in the past. This meaning contrast, which is attributable to the use of these different quantifier words, can be extended to the pair of sentences in (7).

Therefore, the underlying conjunctive structures for (7 a) and (7 b) must be different with respect to the number of conjoined S's.

- (9) a. My goat can eat X_1 and my goat can eat X_2 ∞
- b. My goat can eat X_1 andmy goat can eat X_n

The infinite vs. finite sequence of S's is a minimal distinctive feature of the contrast which is produced analogously to the one observed between (8 a) and (8 b). This initial expository work in the analysis of *any* is supported by Bolinger's (1977) remark about his example given in Section 1 and repeated below,

(4 b) The acid consumed any rust.

that "rust-consumption covers an infinite number of occasions."¹¹ In fact, the grammaticality of (4 b) is difficult to explain otherwise, and seems to stand on the same footing with the grammaticality of (8 a). Despite the strong 'success' implicature associated with both (4 b) and (8 a), which is certainly ascribable to the preterits, these sentences must be taken to be essentially nonfactive in meaning because of the infinite sequence of S's. But this is still a partial explanation of the grammaticality of the sentences.

Horn (1972) did not specify any condition on which Conjunction Reduction (referred to as CR hereafter) can apply, but for the reason given below, it is reasonable to apply CR to (9 b) and derive the following structure.

(10) My goat can eat (X_1 and $X_2 \dots$ and X_n).

And then, the reduced structure, depending on the number of the X's, is to be changed into (11 a) or (11 b).

- (11) a. My goat can eat $\left\{ \begin{array}{l} \text{both of the X's} \\ \text{both X's.} \end{array} \right\} \quad (n=2)$
 b. My goat can eat $\left\{ \begin{array}{l} \text{every one of the X's} \\ \text{every X.} \end{array} \right\} \quad (n>2)$

Here we must raise a problem relevant to this analysis of *any* and *every*. The problem is what are designated by the X's in (9 a) and (9 b). We would like to argue that the X's in (9 b) are referring variables, that is, variables which are determinate in reference. And we assume that this determinateness of reference is responsible for the applicability of CR. Notice that CR is an optional rule. The unreduced structure (9 b) is perfectly grammatical, though as a whole it may become increasingly uncontrollable perceptually as the number of conjoined S's grows.

Now turning to (9 a), we find that it is not immediately clear what that structure can predict about the entities designated by the X's. However, it seems to be the case that the X's are nonreferring variables, that is, indeterminate in reference, as suggested in connection with (8 a). This indeterminacy of reference is the necessary, but not sufficient, condition that must be imposed on the applicability of Factoring. As for CR, the determinateness of reference noted above is the necessary and sufficient condition for its applicability. Factoring, as was defined by Horn (1972), applies obligatorily to structures like (9 a) only on condition that each S-conjunct is commanded by a certain class of operators, such as the ability modal in the case of (9 a). That this condition is necessary but not sufficient is clear from the fact that Factoring and CR can alternatively

apply to (9 b) (observe the example (14) given below). The obligatoriness of Factoring arises essentially from the condition of referential indeterminacy. Under these two conditions Factoring applies to (9 a) and the conjunctive structure is transformed into the structure factored with respect to the X's.

- (12) My goat can eat $(X_1 \text{ or } X_2 \dots \infty)$.

This structure is doomed to change into (13 a) or (13 b) and further into (13 c).

- (13) My goat can eat $\left\{ \begin{array}{l} \text{a. any one of the X's.} \\ \text{b. any of the X's.} \\ \text{c. any X.} \end{array} \right\}$

The set of X's in (12) and the X's in (13) are now definite by virtue of some general or category name of the set. Consider, in contrast, the example (14) provided by Vendler (1967) and discussed by Jackendoff (1972).

- (14) I have some apples here. You may take $\left\{ \begin{array}{l} \text{any one} \\ \text{any} \end{array} \right\}$ of them.

In (14) the set of apples which corresponds to the set of the X's in (10) is definite and the set name is also given, but the identity of an object offered is unspecified. Factoring, therefore, may be defined as a set-formative rule which can apply by referring to a specifiable category name of a set.

Some supporting pieces of evidence for our analysis of *any* and *every* are given by the following pairs of sentences.

- (15) a. *Any beaver and any otter build dams.

- b. Any beaver or any otter builds dams.

- (16) a. Every beaver and every otter build dams.

- b. *Every beaver or every otter builds dams.

The sentences in (15) and (16) are all examples of CR, and the rule was applied with *and* or with *or* to the source structures of the same *and*-conjunction type given in (17) below.

- (17) a. Any beaver builds dams and any otter builds dams.

- b. Every beaver builds dams and every otter builds dams.

The contrast between the *any*-S in (15 b) and the *every*-S in (16 a) seems to be a direct reflex of the distinction in derivational history between each S-conjunct in (17 a) and that in (17 b). The difference suggested in terms of reference between sets formed by Factoring and those by CR is also reflected in the following contrast (due to Perlmutter (1968)).

- (18) Dams are built by $\left\{ \begin{array}{l} \text{*any} \\ \text{every} \end{array} \right\}$ beaver.

- (19) I said of $\left\{ \begin{array}{l} \text{*any} \\ \text{every} \end{array} \right\}$ beaver that it builds dams.

By-phrases and *of*-phrases like those in (18) and (19) require referring arguments for objects of these prepositions and, naturally, *every* but not *any* can meet this requirement.

3. Logical Structure for *any* in Negative Sentences

As mentioned in Section I, linguists' judgments sharply diverge in the interpretation of *any* in negative sentences as between the universal and the existential quantifier. Some argue that the *any* superficially preceded and commanded by a negative element, often referred to as "negative-polarity *any*", is interpretable only as an existential quantifier. These linguists, therefore, distinguish two *any*'s in their approaches to the problems of *any*. Others accept the universal quantifier analysis by logicians such as Quine, Reichenbach, etc., and asserted that *any* has wide scope with respect to negation. A representative case for discussion in this regard is the word *none*, (see the details given in Supplementary Note 3 in Section 4).

Despite all of the above, it is quite insignificant to argue for or against this distinction of *any*, because $Ax (\sim Fx)$ and $\sim Ex (Fx)$ are logically equivalent. From our discussion of CR and Factoring it follows that, even in negative contexts, the source of *any* must have the universally quantified structure as the only input available to Factoring. The derived set is certainly not obtainable from the existentially quantified structure, which is evidently not necessary to explain the distinctive set-formative properties of *any*.¹² The set derived by Factoring is an intermediate to which some not yet clarified logical principle may apply to provide an existential interpretation for *any* in negative clauses.

Now, we examine a logical analysis of a negative sentence in (20 a) below. According to Reichenbach (1947), (20 b), instead of (20 c), would be the logical representation for (20 a).

- (20) a. John didn't shoot any bird.
- b. $Ax ((x \text{ is a bird}) \supset (\sim Fx))$.
- c. $\sim Ex (x \text{ is a bird}) \& (Fx)$.

Details aside, (20 b) can be rewritten as (21) to which Factoring applies and derives the intermediate structure (22).

- (21) John didn't shoot BIRD₁ and John didn't shoot BIRD₂ ∞
- (22) John didn't shoot (BIRD₁ or BIRD₂ ∞).

The disjunctive set in (22) is endowed with the necessary and sufficient condition on which the *any*-insertion can apply. To make this clearer, we need to know exactly what is asserted by the logical analysis (20 b). The $(\sim Fx)$ contained in its representation constitutes a proposition schema¹³ which can independently be isolated as in (23), in which the X stands for a free variable.

- (23) John didn't shoot X.

If (20 b) is intended to represent the meaning of (20 a), (20 a) must have (23) as part of its meaning¹⁴; that is, (20 a) must be capable of being schematized. Recall Labov's (1972) example and Lasnik's (1975) example which are repeated below.

(8 a) John spoke to anyone who came.

(4 a) *I spoke with anyone yesterday.

In Section 2 we observed that the grammaticality of (8 a) is explainable along the lines of (21). Now in view of (23), (8 a) must also be schematized and receive an analysis only with respect to the free variable X. This is natural because its grammaticality crucially hinges on the analyzability of the X under the conditional interpretation of the restrictive clause. (4 a) lacks such a clue, which accounts for the ungrammaticality. (4 a) will be given, most naturally, a logical representation in which Fx is bounded by the existential quantifier, that is, simply $\exists x Fx$. This, as well as (20 c), is inappropriate as the structure for *any*. As for (20 a), negation may be held responsible for its schematizability, but decidedly not¹⁵. The condition truly conducive to schematization in general must be given by the conditional structure defining the free variable X as is represented in (20 b), which does have the primary function of delimiting a category and not of identifying a referent for the X in the schema. This is the motivation for and the condition on schematization leading to the analyzability of the X under the given category.

As far as the referential problem of *any* is concerned, there seems to have been no disagreement among linguists, and our position is in complete agreement with those general claims made by Seuren (1968) and more recently by Hogg (1975) that with *any* "no reference is made to any specific piece of reality"¹⁶ and that "there is no assertion or presupposition of the existence of specific objects."¹⁷ These claims are most succinctly expressed in (20 b), though it is beyond the scope of this paper to discuss the ways in which these scholars incorporated their own claims into the structures they assumed for *any*.

There is, however, a problem regarding the relationship between the argument X and negation. It is precisely the relationship of one to one, as is explicitly shown in (21). Bolinger (1977), in his discussion of *any* on the logical model, asserted that "*any* is not in a one-to-one mechanical relationship with negation"¹⁸ and that "the relationship is one of semantic compatibility, of ontological, not grammatical, sense."¹⁹ He is right if only the surface form *any* is taken into consideration. In our set-formational approach, the same point can be made in terms of (22), for the set size is potentially infinite and each argument is referentially nonspecific, only recognizable under the category concept of BIRD. The problem posited by Bolinger seems to result from the ontological case for a set of variables like (22).

Of the utmost importance to the theory under which we are endeavoring to explain the derivation of *any* is the problem of how (20 b) is to be related

through (21) and (22) to (20 c), for the two structures represent one and the same meaning and so there must be some coherent way to connect these structures. The obstacle lying between (21) and (22) is the Cross-over Constraint (referred to as CC hereafter), which prohibits one logical operator from crossing over another. The operators relevant to our problem are the universal quantifier and the negation operator. CC must be violated in deriving (22) from (21), though it works as expected in the case of *every*-sentences, in which case *and*-conjunction is forced in forming a set necessary for the *every*-insertion. This seems to suggest that there is at least one condition on the applicability of CC and that it is the referential condition to be imposed on the individual arguments classifiable under a category concept. If the arguments are referentially determinate, CC must apply, but may not in the case where they are not. If this is the case, Factoring, needed to derive (22) from (21), can be assumed to be immune from CC. In this connection, LeGrand (1975), in her universal quantifier analysis of *any*, made a similar proposal to the effect that the universal quantifier can cross over the negation operator if it is changed into *any* but not if it is changed into *every*. This is indeed an insightful observation, but she did not give any explanation for it. And, since she did not discuss Horn's Factoring Theory with respect to *any*-sentences, it is not proper to suggest that the immunity of Factoring from CC we explained in terms of reference may be one reason for her proposal.

Now, from the discussions given to the structure (22) it follows quite naturally that an arbitrary argument X_i must be singled out for a truth value judgment on the proposition [John didn't shoot BIRD_i], because the X_i included within the factored set is referentially nonspecific, and, most importantly, the truth of Fx_i , based on the arbitrariness of the choice, can vouch for the truth of the proposition with respect to every other argument in the set. This is a case of logical entailment and can explain the logical equivalence between (20 b) and (20 c). This also implies that the existential interpretation for (20 a), persistently asserted by some linguists, is a result of this logical entailment.

4. Set-formational Processes

We summarize the points made in Sections 2 and 3 as follows.

$$(24) \quad a. \quad Px = (Ax : Fx) (Gx)$$

$$b. \quad Px = Ax((Fx) \supset (Gx))$$

: Formula (24 a) is intended to represent the logical properties of *every*-S's and (24 b) those of *any*-S's.

$$(25) \quad A. \quad Px \rightarrow P(x)$$

: Schematization of Px with respect to argument X . $P(x)$ is identical with the schema Gx contained in Formula (24). Thus the X bracketed in the schema is interpretable as being capable of forming a set under the concept — a category

name — given by the Fx in (24).

B. (i) $P(x) \rightarrow [Px_1 \text{ and } Px_2 \dots \text{ and } Px_n]$

(ii) $P(x) \rightarrow [Px_1 \text{ and } Px_2 \dots \dots \dots \infty]$

: Proposition-set formation from Schema (25) only if each Px_i is true with respect to argument X_i . (i) holds, because the set is identifiable as definite on the basis of the referential specificity of X_i , as is suggested by Formula (24 a) and (ii) holds, because the set size is potentially infinite because of the referential nonspecificity of X_i , as suggested by Formula (24 b).

C. (i) $[Px_1 \text{ and } Px_2 \dots \text{ and } Px_n] \rightarrow P[X_1 \text{ and } X_2 \dots \text{ and } X_n]$

: Argument-set formation by Conjunction Reduction, which applies to the set of propositions in (B (i)) only by mentioning the referentially specific X_i .

(ii) $[Px_1 \text{ and } Px_2 \dots \text{ and } Px_n] \rightarrow P[X_1 \text{ or } X_2 \dots \text{ or } X_n]$

: Argument-set formation by Factoring, which can apply to the same set as in (B (i)) only if the propositions share some common affective element, such as negation, which the rule must mention. Factoring disregards the referential specificity of X_i as a condition on its applicability.

(iii) $[Px_1 \text{ and } Px_2 \dots \infty] \rightarrow P[X_1 \text{ or } X_2 \dots \infty]$

: Argument-set formation by Factoring, which applies obligatorily to the set of propositions in (B (ii)) only on the referential nonspecificity condition that is imposed on X_i .

D. (i) $[X_1 \text{ and } X_2 \dots \text{ and } X_n] \rightarrow$ a. *both of the N's*, or *both N's*
b. *every one of the N's* or *every N*

(ii) $[X_1 \text{ or } X_2 \dots \text{ or } X_n] \rightarrow$ a. *either one of the N's* or *either N*
b. *any one of the N's* or *any of the N's*, or *any N*

(iii) $[X_1 \text{ or } X_2 \dots \infty] \rightarrow$ The same as in ((ii) b).

: Lexicalization of the argument-set depending on the number of X_i . In ((i) a) and ((ii) a) the number is 2 and in ((i) b), ((ii) b), and (iii) it is larger than 2.

(26) a. Principle of Free Choice: an arbitrary argument X_i is to be freely chosen from within the disjunctive sets (D (ii)) and (D (iii)).

b. Principle of Logical Entailment: the truth of Px_i or equivalently Gx_i in (24 b) with respect to the X_i chosen on Principle (26 a) can vouch for the truth of $P(x)$ with respect to every other argument in the set (D (ii)), or the set (D (iii)) where any additional variable can be included.

Supplementary Note 1

The condition $(Fx) \supset$ contained in (24 b) is involved in restricting the occurrences of *any* in imperatives. Bolinger (1977) produced a number of examples

to show this restriction, from which the following sentences are selected to see what is the case with *any* in this context.

(27) (Well, Mary, Tomorrow your vacation begins.)

- a. *Go anywhere.
- b. Go somewhere.
- c. Go anywhere you like.²⁰

Bolinger seems to suggest, in accordance with Jespersen's definition of the general meaning of *any*, "one or more, no matter which," that the 'whateverness' meaning is responsible for the ungrammaticality of (27 a) as against the grammaticality of (27 b) and asserted that the *any* in (27 c) is "determined"²¹ by the restrictive relative on it. But these explanations are not adequate, which can be seen clearly from (28).

(28) *Go anywhere you like, or I'll shut you up in your room all the summer.

(28) as a whole is contrived to express a threat, but for this purpose the first conjunct, the same sentence as in (27 c), must be understood as a command. The impossibility of so understanding it is the reason for the semantic anomaly of (28). (27 c) can only mean an offer (in the sense of Vendler (1968)) which the speaker presents to the addressee, giving him freedom of choice. In logical terms, (27 c) is given a formula just like the one in (24 b). The restrictive in (27 c) is a direct reflex of the $(Fx) \supset$ bounded by the universal quantifier, but in (27 a) there is no clue to the condition necessary for a definition of the argument X, so that the impreative is disqualified as an offer. Next, consider the following sentences.

(29) a. *Hey, George, call anybody on the phone.

b. "I just can't make up my mind where to go."—"Go anywhere."

c. Just go out and bring in anybody who hasn't already signed up.

According to Bolinger, (29 a), which is a command, excludes *any* and in (29 b) the *any* gets by because it is a second mention but (29 b) does not mean a command. It is a dare, the consequence of which is left unsaid, but if it is expressed as in the following sentence, it becomes a threat.

(30) Let me hear you call me any of those names and I'll show you what's what.

As for (29 c), which is a command, the *any* is perfectly acceptable because of the restrictive relative. These observations are extremely useful, having each a direct bearing on the referential nonspecificity of the arguments in question.

Supplementary Note 2

Here we concern ourselves with the derivation of *both* and *either* along the lines of (25D (i)) and (25D (ii)). First observe the following *and*-sentence and

or-sentences.

- (31) a. He didn't speak Tamil or Malay.
 b. He didn't speak Tamil and he didn't speak Malay.
 c. He didn't speak Tamil or he didn't speak Malay.

(31 a) is ambiguous as was pointed out by Horn (1972), between one reading derived from (31 c) by CR and the other reading obtained from (31 b) by Factoring. Now, in the set-formational approach, (31 b) must be the source of *either*, though the set [Tamil or Malay] can be formed either from (31 b) or (31 c). But insertion of *either* can resolve this ambiguity.

- (32) a. He didn't speak either Tamil or Malay.

b. He didn't speak $\left\{ \begin{array}{l} \text{either one of the languages.} \\ \text{either one of them.} \\ \text{either.} \end{array} \right\}$

If *Tamil* and *Malay* are a second mention, we can construct the sentences in (32 b). The *either* in (32 b) refers ambiguously to one or the other language in the set formed from the original *and*-sentence in (31 b). Incidentally, the *one* in *either one* seems to be a pronoun perhaps because of the specificity of the languages in question, (while the *one* in *any one*, as correctly pointed out by Lasnik (1975), is a numeral. This observation of Lasnik's supports the referential part of our analysis of *any*; that is, noun phrases containing *any* are referentially nonspecific). Because of the specificity of reference, (31 b) can also be understood in such a way that *Tamil* and *Malay* are outside of the scope of negation. Only on this interpretation CR can apply to (31 b), disregarding the negative element, and the resultant sentence is as follows.

- (33) He didn't speak $\left\{ \begin{array}{l} \text{both Tamil and Malay.} \\ \text{both of them.} \end{array} \right\}$

As discussed in Section 3, this referential condition induces the noun phrases to behave as operators of the same type and so they are sensitive to CC with respect to negation. Finally, it is worthy of note that (33) derived from (31 b) by CR with *and* and (31 a) derived from (31 c) by the same rule are logically equivalent. This suggests that CR can be triggered differently by referring to referential noun phrases as in (31 b) or to negation as in (31 c).

Supplementary Note 3

Here we present a discussion of the condition on the applicability of the principles in (26). Principle (26 a) is blocked by a certain class of operators which force reference to the totality of the sets in (25D (i)) and (25D (ii)), typically by the generic operator, with the result that *any* is marked and *any-N* is semantically definite. Consequently Principle (26 b) can not apply. The Principles apply otherwise; that is, if the sets are within the scope of negation, interrogation,

or condition, where the individual X's are called into question. This induces the unmarked form of *any*. To exemplify this marked vs. unmarked distinction, we make an attempt at an analysis of *none*.

Curme (1931) observed that *none* in the singular is replaceable by *not one* and *none* in the plural by *none* to convey emphasis and that, when not emphasized, *none* occurs ambiguously with respect to its number agreement with a following verb.

(34) a. None of the books $\left\{ \begin{array}{l} \text{is} \\ \text{are} \end{array} \right\}$ fit to read.

b. None of the books are fit to read.

A schematic logical representation for (34 a) is given below.

(35) a. $\sim [X_1 \text{ or } X_2 \dots \text{ or } X_n]$ of the books BE fit to read.

b. $\sim (X_i)$ of the books $\left\{ \begin{array}{l} \text{are} \\ \text{is} \end{array} \right\}$ fit to read.

The sentences in (35 b) result from the application of Principles (26) to (35 a), (the unmarked condition). Neg-incorporation is obligatory and the effect of Principle (26 b) is implicitly or explicitly shown in the form of the distinctive number agreement. On the other hand, the set in (35 a) can be referred to as a whole, because it is definite in size, (the marked condition), and the result is as follows.

(36) Not (just) any of the books are fit to read.

If this analysis is correct, the source of the emphatic *none* must be $Ax\sim$ and it seems impossible to derive (34 b) from (36), for Neg-incorporation must be blocked because of the marked condition. This suggests that the *none* derived from (35 a) can independently receive stress, involving a distinctive perceptual strategy which puts greater emphasis on Principle (26 a)—the resultant alternate form is *not one*—, or on Principle (26 b)—resulting in *none*.

Now, observe Labov's (1972) examples in (37).

(37) a. (Just) anybody can not stay here.

b. *Anybody can not stay here.

The grammaticality of (37 a) is due to the marked condition as in the case of (36). However, Labov defined the stress on *any* as having the effect of limiting the scope of *any* in such a way that the negation directly applies to the quantifier, adding that "it is not ANYbody who can not stay here but some other, less inclusive set."²² But the stress involved in these cases is not a contrastive stress but an emphatic one. The stressed *anybody* is definite by virtue of the signalled totality and the name of the set inclusive of all the people concerned, thus qualifying as subject NP. The ungrammaticality of (37 b) can be predicted by Principles (26), since the unmarked *anybody* is referentially nonspecific and so

it is disqualified as subject NP. Next consider Dahl's (1970) examples in (38).

- (38) a. Can I take any apple? (= Is there any apple I can not take?)
 b. Can I take any apple? (= Is there any apple I can take?)

Dahl presented these sentences as decisive pieces of evidence against Reichenbach's (1947) analysis of *any* as free argument variable, in which analysis, Dahl asserted, the difference between (38 a) and (38 b) can not be explained. The difference, however, is similarly accountable for in terms of our set-formative analysis, for the *any* in (38 a) is marked to refer to the totality of a set and (38 a) questions the possibility of taking the whole set, while (38 b) questions the existence of an arbitrary argument, in accordance with Principles (26), which the asker is permitted to take. Observe, then, the sentences in (39) cited from Labov (1972).

- (39) a. If anyone can do it, John can do it.
 b. If anyone can do it, that is John.

The marked condition inhibits the inclusion of an additional argument into the set, as in (39 a), while the unmarked condition can account for the identification of an arbitrarily chosen argument with the person called *John*, as in (39 b).

5. Deficiencies of some Definitions of the Semantic

Function of *Any* made otherwise than in Quantificational Terms

5.1 The Scale Principle

In this section we first recapitulate Fauconnier's Scale Principle, for it involves proposition schemata similar to, but not of exactly the same type as, the (Gx) contained in (24 b) in Section 4, in his explication of the semantics of *any*. Fauconnier (1) (1975) argued convincingly that some phrases, typically grammatical superlatives, which are not polarity items, are polarized with respect to logical structures. Our interest in his Scale Principle is characterizable by the following triples of sentences.

- (40) Socrates can understand $\left\{ \begin{array}{l} \text{a. any} \\ \text{b. the most complex} \\ \text{c. any, even the most complex,} \end{array} \right\}$ argument.

- (41) Socrates does not understand $\left\{ \begin{array}{l} \text{a. any} \\ \text{b. the simplest} \\ \text{c. any, even the simplest,} \end{array} \right\}$ argument.

The grammatical superlatives in (40 b) and (41 b) can occur in positions for the *any* in (40 a) and (41 a) and also in apposition to *any*, as in (40 c) and (41 c), accompanied by *even*, an indicator of the existence of a pragmatic scale²³, (which is relevant to his Scale Principle). The availability of the quantified readings

for (40 b) and (41 b), more strictly the implicature of universal quantification, depends on the Scale Principle which says that if a proposition schema Rx , *Socrates can understand X* or *Socrates does not understand X*, holds for a point X_1 on a complexity scale associable with it, then $R(x_1)$ implicates $R(x_2)$ in case X_1 is lower than X_2 on the same scale and that, as a corollary, if X_1 is the lowest point, $R(x_1)$ implicates $Ax (Rx)$, (cf. Fauconnier (1) and (2) (1975).

Fauconnier (1) states that the X in the general form for proposition schemata stands for "possible additional free variables"²⁴ and Rx corresponds to "the literal, nonquantified reading of a sentence."²⁵ Thus, it seems that the Scale Principle works by referring to a set of free variables defined by the set name *argument* in the cases of (40) and (41) and that a complexity scale is independently associated with Rx . Incidentally, complexity, it seems to us, need not be the only parameter for an evaluative judgment on the set of variables. The set of X 's involved in Rx must, therefore, be essentially like the one defined in (25) in Section 4; that is, $R(x_1, x_2 \dots)$ must be identical with $P(x_1 \text{ or } x_2 \text{ or } x_3 \dots \infty)$. The only difference between these two types of sets is that in the latter the X 's are structured²⁶ but in the former nonstructured, as is clear from his characterization of Rx . The Principle of Logical Entailment (26 b) in Section 4 allows for the picking of an arbitrary argument X_1 , accounting for the quantificational effect of *any* in (40 a) or (41 a) but not of the superlative in (40 b) or (41 b). So it seems quite reasonable to assume that the Scale Principle, independently motivated but based essentially on the logic of quantification, can predict the occurrence of the polarized superlatives as in (40 b) and (41 b) but not the occurrences of *any* in (40 a) and (41 a) which are uniquely due to the set-formative properties of *any*. This also implies that in (40 c) and (41 c) two different mechanisms are at work underlyingly with respect to *any* and the superlatives.

Fauconnier (1), however, pursuing the line of his analysis of superlatives, proposed a definition of the function of *any*, which, he asserts, is preferably the indication of the low point under the Scale Principle. But such an extension of his analysis will prove inappropriate, for there exist many actual examples given, for example, in Poutsma (1916) which are quite intractable under the Scale Principle. Poutsma (1916) noticed implicatures in *any* but only vaguely, roughly distinguishing these into two categories, "appreciatory" and "depreciatory", as its secondary meanings. *Any* does carry implicatures to greater or lesser degrees in all its occurrences, but it remains essentially quantificational. The reason is simply that implicatures are not logical entailments. First consider (42).

(42) Any house has its trials.

In (42), *any* is normally strongly stressed, which is attributable to the generic operator, and the interpretation with respect to *any house* may contain implicatures²⁷ such as those describable by *however large or small, however rich or poor*, and the like, and one of these concessive clauses can actually follow the *any house* parenthetically. All this implies that the implicature is not basic to the semantics of *any*, only added to make the force of universal quantification

explicit. The stress on *any* may be taken to indicate its neutrality with respect to polarization. (Polarization, if it occurs, should be accounted for in connection with the Principles in (26), but the generic operator underlying (42) blocks free choice of an arbitrary argument.)

The following example is also quoted from Poutsma (1916).

- (43) You must buy a typewriter, —but don't get anything.

Notice that the stress on *any* is obligatory. It has the effect of indicating the totality, not any fraction, of the set of typewriters. Clearly the stress involved here is a case of the contrastive stress which signals the existence of some other alternative set²⁸. To these freely additional variables the Scale Principle may apply to bring in a suitable evaluative judgment on them, probably depending on the discourse context. Now observe the stress assignment exhibited in (44) and (45),

- (44) a. He can not understand any argument. (existential)
 b. He can not understand any argument. (generic, universal)
- (45) a. He does not understand any argument. (existential)
 b. He does not understand any argument. (generic, universal)

The stress on *any* in (44 b) and (45 b) has the same effect as in (43). This is borne out by the possibility that another 'universal quantifier', *just* or *absolutely*, can occupy the position immediately preceding the stressed *any*, as pointed out by Horn (1972). Thus the logical representations for (44 b) and (45 b) involve negation as a higher predicate; that is, they must have the common schematic form, $\sim Ax ((Fx) \supset ((Gx)))$ and the respective proposition schemata are as follows.

- (46) a. He (can) understand X. (for (44 b))
 b. He understands X. (for (45 b))

Incidentally, the ability modal in (44 a) does not play any positive role in constructing the schema in (46 a), but it displays its semantic effect of providing a distinctive interpretation for the factored set of X's. The same is true of negation in the case where it is contained in a schema. It is significant that the negation both in (44 b) and in (45 b) is excluded from the respective schemata in (46). This observation is intended to suggest that the Scale Principle must refer to the schema in (24 b) in Section 4 and not to "the literal, nonquantified readings of (44 b) and (45 b), which will require the negative element to be included in the schemata for (44 b) and (45 b). As for (44 a) and (45 a), on the other hand, the negation must be involved in providing the relevant schemata so that the formula $Ax ((Fx) \supset \sim(Gx))$ will be appropriate for them but the scale reversal by negation does not seem to be able to explain the fact that the *any*'s are unstressed. This fact should be accounted for by the unmarked condition imposed on *any* by the negation commanding (Gx).

5.2 The Disambiguation Theory

In Section 1 we also mentioned Lasnik's (1975) suggestion that "the primary function of *any* is the resolution of potential scope ambiguities."²⁹ This disambiguation theory must presuppose the existence of at least one logical operator in addition to the universal quantifier in the logical representation for *any*-sentences and that the two operators can independently 'trigger' *any*, inducing "a meaning-affecting scope ambiguity". Such ambiguities can be observed in sentences like (47) below.

- (47) a. You may take any one of these apples.
b. I didn't solve any problems.

And the scope ambiguities in question are given in (48) in terms of logical paraphrases (due to Lasnik (1975)).

- (48) (47 a) a. You have permission (for all x, you take x).
b. For all x (you have permission to take x or not to take x).
(49) (47 b) a. Not for all x (x is a problem \rightarrow I solved x).
b. For all x (x is a problem \rightarrow I didn't solve x).

The permission operator in (48) and the negation operator in (49) can induce the potential scope ambiguities in relation to the universal quantifier, as is shown above. But observe the sentences in (50) below.

- (50) a. *He spoke with anyone yesterday.
b. Yesterday he spoke with anyone who came.

(50 b) presents a serious problem for Lasnik's theory, for despite its apparent lack of a logical operator, as is the case with (50 b) which is ungrammatical as predicted by the theory, (50 a) is perfectly grammatical. In order to explain this, it is possible to postulate for (50 a) a logical structure involving a modal operator, IF. The *any* in (50 b) is the same *any* that occurs in conditional *if*-clauses and the *anyone who came* may be understood as a syntactic paraphrase of *if anyone came*. From this it must be deduced that a restrictive relative on *any*, in general, has exactly the same effect as that of the $(Fx) \supset$ in (24 b) in Section 4, condition-defining the X in the schema (Gx) . This definition of the X is the very source of the referential aspect of the semantics of *any*. Thus the logical representation for (50 b) will be the following.

- (51) $Ax((x \text{ came}) \supset (\text{he spoke with } x \text{ yesterday}))$.

Additionally, this conditional modal, IF, does not interact with the universal quantifier, which is obvious from the logical function of IF defined above, though this interaction must be assumed to explain the grammaticality of (50 b) under Lasnik's Disambiguation Theory.

Conclusion

In this paper, we emphasized the role of the Principle of Logical Entailment (26 b) in giving a natural explanation for the existential interpretation of *any* in negative contexts and the universal interpretation of *any* in certain modal contexts in a logically coherent way. An arbitrary argument can be selected from within the factored sets (25C (ii)) and (25C (iii)) on the Principle of Free Choice (26 a), which leads to the unmarked condition on *any*. The universal quantification of *any* results from the marked condition imposed on *any* by certain logical operators, most typically the generic operator, which force reference to the totality of the factored sets (25C (ii)) and (25C (iii)). The stressed *any* versus the unstressed *any* reflects this distinction between the marked and the unmarked condition. As for *every*, there is no possibility of such a markedness condition because of the referential specificity of the X's in the set (25C (i)).

This analysis of *any* and *every* depends on the assumption that Factoring and CR, here redefined as distinctive set-formative rules, apply alternatively to the set of propositions (25B (i)) or (25B (ii)) developed from the respective schemata (24 a) and (24 b) essentially on the basis of the referential condition on the X's. The negative element or the modal 'can', if contained in the schema (25B (ii)), contributes but only secondarily to the formation of the factored set (25C (iii)), but these elements must be referred to, disregarding the referential specificity of the X's in (25B (i)), in forming the distinctive set (25C (ii)) from (25B (i)), or more specifically, must be extracted outside of the schema (24 b), thus qualifying as logical operators capable of factoring the proposition-set (25B (i)) as in (25C (ii)).

Notes

1. Reichenbach (1947), credited with the logical insight that *any* is a universal quantifier in all its occurrences, is followed by Quine (1960) and by linguists such as Savin (1971), Labov (1972), LeGrand (1974), Lasnik (1975), Bolinger (1977), etc.

2. This position has been defended by linguists—Klima (1964), the first to single out the 'affective' contexts where *any* is understood as an existential quantifier, —Dahl (1970), Lakoff (1970), Horn (1972) (who also made an important attempt to unify the two *any*'s), Lawler (1974), Fauconnier (1975), McCawley (1977), etc.

3. Cf. LeGrand (1974), McCawley (1977), and especially Bolinger (1977) for the detailed discussion of this problem.

4. McCawley (1977), p. 377.

5. Jackendoff (1) (1972), p. 339.

6. Lasnik (1975), p. 307.

7. Lawler (1974), for example, seems to divide the occurrences of *any* into two major types, referring to them as 'negative-polarity' *any* and 'possible-polarity' *any*. This distinction, needless to say, holds only for polarity *any*'s,

the *any*'s triggered by certain affectives and modals, and can not be extended to include nonpolarity *any*'s.

8. Horn (1972), p. 147.

9. Horn (1972) observes that there are some facts pointing to the possibility of a unified treatment of the two *any*'s. Both can be modified by *at all* and *whatever*. The *nothing but* and *anything but* construction are suggestive of it.

10. Labov (1972), p. 796.

11. Bolinger (1977), p. 30.

12. The distributive property of *any* discussed by Labov (1972) is one among the set-formative properties of *any*. This property is shared by *every*. The property distinguishing *any* from *every* is the [-fact] transfer feature in his feature analysis. So the grammaticality of *any*-S's must depend on the existence in *any*-S's of some elements which can receive the [-fact] feature inherent in *any*. These two properties are more systematically reanalyzed in our set-formative analysis of *any* and *every*.

13. Schema (23) is exactly the Fx without the universal quantifier which Reichenbach gives for *Anything goes*. As Reichenbach (1947) states, Fx 'means the same' as Ax (Fx) and the argument X must stand for a free variable.

14. The relation of Schema (23) to (20 a) is usually defined as a propositional part of the sentence in a logically-based grammar.

15. Notice that the negative must be part of the schema.

16. Seuren (1969), p. 125.

17. Hogg (1975), pp. 146-147.

18. Bolinger (1977), p. 34.

19. Bolinger (1977), p. 34.

20. The *any*'s are just like those occurrences of *any* in *if*-clauses and in antecedent NP's of restrictive relatives of the general type [that ... may ...]. The *if* and *may* seem to have in common some modality which is congenial to the semantic nature intrinsic to *any*. In this connection, observe the following example quoted from Poutsma (1916).

As a matter or principle I always burn any letters I receive.

Poutsma mentioned that the present tense form *receive* has the value of *may receive*. The restrictive relative clause is a syntactic paraphrase of the conditional structure *if I receive any letters*. The *may* is called for to strengthen the conditional meaning of the restrictive relative and this paraphrase relationship permits of the present tense form.

21. Bolinger (1977), p. 24.

22. Labov (1972), p. 802.

23. Fauconnier (1) (1975) states that "the function of *even* in general seems to introduce pragmatic scales..."

24. Fauconnier (1) (1975), p. 362.

25. Fauconnier (1) (1975), footnote 15, p. 363.

26. By 'being structured' is meant that the X's are obtained derivatively

from the source schema in (24 b).

27. The implicatures concerned here are conversational in the sense of Grice (1975), so belonging to pragmatics.

28. The stress on *any* here seems to have the same semantic effect as the stress involved in the following construction.

- (i) He is anything but a fool.

This may suggest that (43) is an incomplete or an elliptical sentence which must be read as the following with the exception unexpressed.

- (ii) —Don't get anything (but...).

29. Lasnik (1975), p. 306.

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