

DISCOURSE REFERENTS

LAURI KARTTUNEN
University of Texas

This paper was presented at the International Conference on Computational Linguistics, held at Sönga-Säby, Sweden, in September 1969; the research was supported by National Science Foundation grant GU-1598 to the University of Texas at Austin. It was distributed among the conference preprints and was later circulated in mimeographed form by Indiana University Linguistics Club.

Karttunen's paper can be described as a summary of the work on reference that generative grammarians were about to do for the next five years. It contains preliminary statements of Karttunen's work on the logic of complement constructions (Karttunen 1970b, 1971a,b) and of the notion of "context" that figures in his analysis of presupposition [namely "context" as the set of propositions that the speaker and addressee take for granted at the given point of discourse; see Karttunen (1973, 1974)]; it also presents an analysis of coreference in terms of possible worlds that foreshadows that of Morgan (1973). The analysis of the surface object of want that Karttunen sketches in Section 1.26 is discussed at length (and justified ad nauseam) in McCawley (1974). The most interesting idea in Karttunen's paper appears not to have registered on many linguists or logicians. That is the idea that existential quantifiers have the dual function of asserting existence (thus binding a variable) and of introducing a constant that

can figure in subsequent discourse. This idea is a vindication of the informal notational practise of mathematicians, who will write an existentially quantified formula (say, $(\exists e)(\forall x)(xe = ex = x)$, as one of a set of postulates for group theory) and thenceforth use the variable bound by the existential quantifier as if it were a constant [as when they will write the next postulate as $(\forall x)(\exists x^{-1})(xx^{-1} = x^{-1}x = e)$]. Karttunen's observations provide a case for according this practice full status as part of a system of representing logical structure; that proposal allows one to cope with examples such as I have a proof of this theorem, but it won't fit in this margin, which are a horror to accomodate within standard logical notation (there is no "standard" logical representation of it that has a constituent corresponding to I have a proof of this theorem, though there must be such a constituent, since the sentence can be continued though Fermat says that he does and that it will fit in the margin of his copy of Euclid).

0. INTRODUCTION

Consider a device designed to read a text in some natural language, interpret it, and store the content in some manner, say, for the purpose of being able to answer questions about it. To accomplish this task, the machine will have to fulfill at least the following basic requirement. It has to be able to build a file that consists of records of all the individuals, that is, events, objects, etc., mentioned in the text and, for each individual, record whatever is said about it. Of course, for the time being at least, it seems that such a text interpreter is not a practical idea, but this should not discourage us from studying in abstract what kind of capabilities the machine would have to possess, provided that our study provides us with some insight into natural language in general.

In this paper, I intend to discuss one particular feature a text interpreter must have: that it must be able to recognize when a novel individual is mentioned in the input text and to store it along with its characterization for future reference. Of course, in some cases the problem is trivial. Suppose there appears in some sentence a proper name that has not been mentioned previously. This means that a new person is being introduced in the text and appropriate action must be taken to record the name of the person and what is said about him. Otherwise, the proper name is used to refer to an individual already mentioned, and the machine has to locate his file in the memory with the help of the name. This problem of identification will be more difficult where a definite

description--a definite noun phrase such as *the man Bill saw yesterday*--is used, since there will, in general, not be any simple look-up procedure for associating the description with the right individual. With definite noun phrases, there is also the problem that it is not possible to tell just from the noun phrase itself whether or not it is supposed to refer to an individual at all. For example, it is clear that the phrase *the best student* is not used referentially in a sentence such as *Bill is the best student*. There are thus two problems with ordinary definite noun phrases: (i) whether it is a definite description at all and (ii) how a definite description may be matched with an individual already mentioned in the text. The first question is clearly of the kind linguists can be expected to solve, but it will not be discussed here. The only aspect of definite descriptions that interests us here is the fact that they carry an existential presupposition: to call something "the..." presupposes that there be some such thing.

While it is in general a straightforward matter to decide whether or not a proper name in a text introduces a new individual, indefinite noun phrases pose a more difficult problem. To put the question in a general way, given an indefinite noun phrase, under what circumstances is there supposed to be an individual described by this noun phrase? This need not be understood as some sort of ontological question subject to philosophical speculation. In this paper I intend to approach it from a purely linguistic point of view. It is in just those cases where the appearance of an indefinite NP implies the existence of some specific entity that our hypothetical text interpreter should record the appearance of a new individual.

What I have in mind can perhaps be made clear with the help of the following examples. It is a well-known fact about language that indefinite noun phrases cannot be interpreted as referring to expressions when they appear in the predicate nominal position.

(1) *Bill is not a linguist.*

(1) is obviously a statement about one individual. It is not a statement about some linguist and Bill. It is also well-known that in generic sentences, singular indefinite noun phrases play a peculiar role.

(2) *A lion is a mighty hunter.*

In its generic sense, (2) is a statement about lions in general, not about any lion in particular, unless we want to postulate a hypothetical entity "the typical lion" of whom all generic statements about lions are predicated. It is clear that indefinite noun phrases have a very special role in (1)

and (2), and it is not difficult to decide that they could not introduce any new individuals into a discourse. It is out of the question that a text in which (1) appears would contain a later reference to "the linguist which Bill is not" or that (2), in its generic sense, would justify a later reference to "the lion who is a mighty hunter".

But consider the following example. (3a) may be followed by any of the sentences (3b-d) that give us more information about a specific car first mentioned in (3a).

- (3) a. *Bill has a car.*
b. *It is black.*
c. *The car is black.*
d. *Bill's car is black.*

On the other hand, (4a) cannot be followed by any of the alternatives (4b-d).

- (4) a. *Bill doesn't have a car.*
b. **It is black.*
c. **The car is black.*
d. **Bill's car is black.*

The above examples show that just in case of (3a), the text interpreter has to recognize that the appearance of the indefinite NP *a car* implies the existence of a specific car that can be talked about again by referring to it with a pronoun or a definite noun phrase. But no car is introduced by (4a). The alternative continuations (4b-d) are inappropriate, since they presuppose the existence of something that is not there. To show that this is a linguistic and not an ontological fact, one only has to point out that examples (5) and (6) behave just like (3) and (4).

- (5) *Bill saw a unicorn. The unicorn had a gold mane.*
(6) *Bill didn't see a unicorn. *The unicorn had a gold mane.*

Let us say that the appearance of an indefinite noun phrase establishes a "discourse referent" just in case it justifies the occurrence of a coreferential pronoun or a definite noun phrase later in the text. In this paper, we will try to find out under what circumstances discourse referents are established. We maintain that the problem of coreference with a discourse is a linguistic problem and can be studied independently of any general theory of extralinguistic reference.

The present study was inspired by the notion of "referential

indices" in transformational grammar. Following a suggestion by Chomsky (1965), it has generally been assumed that the base component of a transformational grammar associates with each noun phrase a referential index, say, some integer. The purpose of Chomsky's proposal was not so much to account for the meaning of sentences, but to augment the notion of noun phrase identity. It seemed that the notion of referential identity was needed in addition to the two other types of identity, "structural identity" and "morphemic identity", for the structural descriptions of certain transformations. According to the standard theory, referential indices are merely formal indicators of coreference with no further semantic significance. They are not meant to imply the existence of discourse referents in our sense. This notion of coreferentiality has played an important role in recent syntactic arguments. It led to the study of pronoun-antecedent relations, largely ignored by traditional grammarians, which has revealed intricate constraints that have great theoretical importance. What we are studying in this paper can be looked at as further constraints on coreferentiality that extend beyond the sentence level.

1. CASE STUDIES

1.1 *A Note on Specificity*

In the following, we are going to examine case by case certain aspects of sentence structure that play a role in determining whether an indefinite NP establishes a discourse referent. In the examples that are discussed, there is a possible ambiguity that has to be mentioned in advance, although it will not be discussed until later. In general, indefinite noun phrases have both a specific and nonspecific interpretation. Example (7) can be interpreted to mean either (8a) or (8b).

(7) *Bill didn't see a misprint.*

(8) a. *There is a misprint which Bill didn't see.*

b. *Bill saw no misprints.*

If (7) is understood in the sense of (8a), we say that the indefinite NP *a misprint* is interpreted specifically. (8b) represents the nonspecific interpretation. Of course, not all indefinite noun phrases are ambiguous in this way. We could disambiguate (7) by adding the word *certain* ("a certain misprint") or an appositive relative clause ("a misprint, which I had made on purpose"). These changes would allow only the specific interpretation (8a). The addition of the word *single*

("a single misprint") would allow only the sense (8b). There are also cases where the verbs involved partially disambiguate the sentence by making one interpretation far more plausible to the reader than the other. For example, the NP *a piano* in (9a) is naturally understood nonspecifically, that is, as meaning 'any piano', while the same noun phrase in (9b) suggests the interpretation 'a certain piano'.¹

- (9) a. *John tried to find a piano. [but he didn't
succeed in finding
one]*
- b. *John tried to lift a piano. [but he didn't
succeed in lifting
it]*

It is something about the verb *lift* that suggests that a *piano* describes some specific object. On the other hand, (9a) is easily understood to inform us only about the kind of object John was trying to find. We note in passing that, if interpreted in the above manner, (9b) establishes a discourse referent, i.e., 'the piano that John tried to lift', but (9a) certainly does not justify a later reference to 'the piano that John tried to find'. Example (7) establishes a referent in its specific sense 'the misprint which Bill didn't see', but fails to do so in the sense of (8b).

Let us forget, for the time being, that indefinite noun phrases can also be understood specifically and consider first only nonspecific interpretations.

1.2 Complement Clauses

As pointed out above, an indefinite noun phrase does generally establish a discourse referent when it appears in a simple affirmative sentence. But if the sentence is negated, a nonspecific NP fails to establish a referent. Let us, tentatively, accept this finding for simple sentences and look at cases where an indefinite NP belongs to a complement clause. There are many other factors that play a role here besides negation.

1.2.1 Modal verbs

The following examples are anomalous in the intended sense, although there is no negation involved.

- (10) a. *You must write a letter to your parents.
They are expecting the letter.
- b. *Bill can make a kite. *The kite has a long
string.*

Discourse Referents

Traditionally, sentences with a modal auxiliary have been considered as simple sentences. However, it has been argued convincingly by Ross (1969b) and others that modals should be analyzed as main verbs of higher sentences. Therefore, let us assume that, even in the above examples, the indefinite NPs originate in a complement clause, just as they do in (11).

- (11) a. *John wants to catch a fish. *Do you see the fish from here?*
b. *Mary expects to have a baby. *The baby's name is Sue.*

There is a great number of verbs that behave like *want* and *expect* in this respect, e.g., *try*, *plan*, *intend*, *hope*. What is common to all of them is that the complement sentence by itself is understood to represent a yet untrue proposition at the time specified by the tense and time adverbials in the main clause. The present problem, is in fact, another point in favor of the view that modals originate in a higher sentence, because it enables us to acknowledge the similarity of the anomaly in (10) and (11). The conclusion is that nonspecific indefinites do not establish discourse referents when they appear in a complement of a modal verb.

1.2.2 Implicatives

There is a class of verbs that, if they are not negated, imply the truth of the proposition represented by their complement sentence. Let us call them "implicative verbs".² In English, this group includes verbs such as *manage*, *remember*, *venture*, *see fit*. An indefinite NP in the complement of an implicative verb establishes a referent, as shown by the following examples.

- (12) a. *John managed to find an apartment. The apartment has a balcony.*
b. *Bill ventured to ask a question. The lecturer answered it.*

But if the implicative verb in the main sentence is negated, a nonspecific indefinite fails to establish a referent.

- (13) a. *John didn't manage to find an apartment. *The apartment has a balcony.*
b. *Bill didn't dare to ask a question. *The lecturer answered it.*

There are also verbs that inherently have a negative implication. In English, this type includes verbs such as *forget*, *fail*,

and neglect. Consider the following anomalous discourses.

(14) a. *John forgot to write a term paper. *He cannot show it to the teacher.*

b. *John failed to find an answer. *It was wrong.*

These implicative verbs have the very interesting property that, if there is double negation, the implication is positive, and an indefinite NP does, after all, establish a referent.

c. *John didn't fail to find an answer. The answer was even right.*

d. *John didn't remember not to bring an umbrella, although we had no room for it.*

This property distinguishes clearly verbs with negative implication, such as *forget*, from modal verbs discussed above, although both types deny the truth of the proposition represented by the complement sentence.

1.2.3 Factive verbs

There is a group of verbs, called *factive verbs* (Kiparsky and Kiparsky 1971), that presuppose the truth of the proposition represented by the complement. For example, *know*, *realize*, and *regret* are factive. It is not surprising to find out that an indefinite NP does establish a referent in a complement of a factive verb, of course, provided that the complement itself is affirmative.

(15) *John knew that Mary had a car, but he had never seen it.*

In contrast to the implicative verbs discussed above, negation in the main sentence has no effect at all.

(16) *Bill didn't realize that he had a dime. It was in his pocket.*

The truth of the embedded proposition is presupposed even if the factive verb itself is negated. Consequently, (16) is quite acceptable as a continuing discourse.

1.2.4 Nonfactive verbs

The class of verbs commonly called *nonfactive* (Kiparsky and Kiparsky, 1971) includes such verbs as *believe*, *think*, *say*, *claim*, *doubt*. In general, nothing is presupposed about the truth of the embedded proposition. Notice, however, that the following discourse would be contradictory.

- (17) *I doubt that Mary has a car. *Bill has seen it.*

On the other hand, there is nothing wrong with the following example.

- (18) *Bill doubts that Mary has a car. I have seen it.*

What makes these verbs difficult to handle is that there are two persons involved - the speaker and the subject of the non-factive verb--these roles may, of course, coincide. The speaker is not committed to any view whatsoever about the truth of the embedded proposition, although he may imply what his beliefs are as the discourse continues. For example, in (18), the speaker--unlike Bill--must hold that the complement is true. The nonfactive verb is binding for the speaker only in case he is talking in the first person as in (17). But even in case that the speaker withholds judgment or disagrees altogether, an indefinite NP in the complement of a nonfactive verb that implies positive belief does establish a referent of a peculiar sort. It can be referred to again in a complement of a similar nonfactive verb that has the same subject.

- (19) *Bill says he saw a lion on the street. He claims the lion had escaped from the zoo.*

What this amounts to is that a text-interpreting device will have to sort out what belongs to the world as seen by the speaker and the world as seen by X. The same referents need not exist in all of these worlds.

A nonfactive verb that implies positive belief (*claim, think, believe, say, etc.*) allows an indefinite NP in the complement to establish a referent as far as the world of the subject person is concerned but need not have the same effect in the speaker's world. A nonfactive verb with negative implication (*doubt*) may still allow that a referent be added to the speaker's world, albeit not to the world of the subject person.

1.2.5 General remarks

We can now generalize the previous observation about single sentences to cover also complement clauses. A non-specific indefinite NP in an affirmative sentence (single sentence or a complement) establishes a discourse referent just in case the proposition represented by the sentence is asserted, implied, or presupposed by the speaker to be true. A nonspecific indefinite in a negative sentence establishes a referent only if the proposition is implied to be false. This latter stipulation is needed because of negative implicatives discussed in Section 1.2.2. In general, discourse

referents exist in the realm - world as seen by the speaker. However, the nonfactive verbs discussed in Section 1.2.4 establishes referents in other realms and are ambiguous as far as the speaker is concerned.

In order to decide whether or not a nonspecific indefinite NP is to be associated with a referent, a text-interpreting device must be able to assign a truth value to the proposition represented by the sentence in which the NP appears. It must be sensitive to the semantic properties of verbs that take sentential complements; distinguish between assertion, implication, and presupposition; and finally, it must distinguish what exists for the speaker from what exists only for somebody else.

1.2.6 An apparent counterexample

There is an interesting group of verbs that seem to provide a counterexample to the general rule. Consider the following discourses.

- (20) a. *I needed a car. *It was a Mustang.*
b. *Seymour wants a knife. *It is sharp.*
c. *John promised Mary a bracelet. *The bracelet was very expensive.*
d. *The casting director was looking for an innocent blonde. *She was from Bean Blossom, Indiana.*

Provided that the indefinite NPs are interpreted nonspecifically, all examples in (20) are anomalous, although they look superficially identical to those in (21), which behave as expected.

- (21) a. *I owned a car. It was a Mustang.*
b. *Seymour imagines a knife. It is sharp.*
c. *John bought Mary a bracelet. The bracelet was very expensive.*
d. *The casting director was looking at an innocent blonde. She was from Bean Blossom, Indiana.*

In (20), what appears to be an ordinary nonspecific object NP fails to establish a referent, although the sentence is affirmative assertion. There are many other verbs in addition to those in (20) that have this peculiar consequence, for example, *ask for*, *desire*, *expect*, *hope for*, *propose*, *request*, *suggest*, *wait for*, *yearn for*. It seems significant that most if not all of these verbs, in addition to ordinary noun phrase objects, also take sentential complements, as the

following examples show.

- (22) a. *Seymour wanted to have a knife.*
 b. *I propose that you eat a bagel.*
 c. *John promised to give Mary a bracelet.*
 d. *Mary expects John to buy her a bracelet.*

In fact, these are the same modal verbs discussed above (Section 1.2.1) that imply that the proposition represented by the complement is not yet true. We can thus account for the peculiarity of (20a-d) by assuming that, in spite of the simplicity of the surface structure, the ordinary noun phrase objects of these verbs are derived from underlying representations that contain sentential objects. This is clearly one of those cases where semantic problems can be simplified by assuming a more abstract deep structure. But it is not entirely clear what kind of embedded sentence should underlie the surface object. There seems to be little evidence for deciding this question beyond the observation that it certainly should be some type of existential or possessive construction. This is because of many near paraphrases of the following type.

- (23) a. *John wants a car. John wants to have a car.*
 b. *I suggest an immediate halt in the bombing.*
 I suggest that there be an immediate halt
 in the bombing.
 c. *I expect no change in the situation. I expect*
 there to be no change in the situation.

In some cases, an existential paraphrase seems more natural, in other cases, one prefers a possessive interpretation. Observe the difference between (23a) and (24a) and the two kinds of promising in (24b) and (24c).

- (24) a. *John wants a revolution. John wants there to*
 be a revolution.
 b. *John promised Mary a bracelet. John promised*
 Mary that she will have a bracelet.
 c. *John promised Mary a miracle. John promised*
 Mary that there will be a miracle.

Whatever the correct solution is with regard to the exact nature of embedded sentence, there is no reason to consider the exceptional nature of verbs such as *want* and *need* as a serious counter-example to the general theory of discourse referents.

1.3 Short Term Referents

In the preceding sections, it was tacitly assumed that discourse referents are stable entities that are established once and for all. But we have to recognize that an indefinite NP that fails to establish a permanent referent may nevertheless permit the appearance of coreferential noun phrases within a limited domain. Consider the following examples.

- (25) a. *You must write a letter to your parents and mail the letter right away. *They are expecting the letter.*
- b. *John wants to catch a fish and eat it for supper. *Do you see the fish over there?*
- c. *I don't believe that Mary had a baby and named her Sue. *The baby has mumps.*

In (25a), it seems that the indefinite NP *a letter* may serve as antecedent for a coreferential definite NP *the letter* provided that the latter is contained in a conjoined complement sentence, but not otherwise. Outside the scope of the modal *must*, 'the letter' ceases to exist. Similarly, in (25b), there is no fish that could be talked about outside the scope of *want*. Within the pair of conjoined sentences in the complement it is a different matter.

In order to take care of these phenomena, a text-interpreting device apparently has to process complex sentences starting from the inside. For example, in case of (25c), it first has to consider the part *Mary had a baby and named her Sue*. On the basis of the first member of the conjunct, it can, tentatively, set up a referent corresponding to the NP *a baby* and accept *her* in the second sentence as coreferential. After considering the whole sentence beginning with *I don't believe that...*, it then may decide that there is no such baby after all. In short, a text interpreter must keep track of the status of referents it has established and delete them when necessary.

Notice also that the lifespan of a short-term referent is not always so neatly bound as the above examples suggest. Sequences of the following type are quite common.

- (26) *You must write a letter to your parents. It has to be sent by airmail. The letter must get there by tomorrow.*

At least in case of modals (and the future *will*), it is possible to continue discussing a thing that actually does not yet exist, provided that the discourse continues in the same mode. In this case, every successive sentence is prefixed by

the same type of modal. Even the following example is possible.

(27) *Mary wants to marry a rich man. He must be a banker.*

Under the nonspecific interpretation of *a rich man*, there is no specific individual yet that Mary wants to marry--and there may never be one. By continuing with another modal, however, it is possible to elaborate on the attributes of this as yet nonexistent individual.³ In the following sections we will present other cases where the lifespan of a short-term referent may be extended.

1.4 Suppositions

Another way to talk about what is not is to suppose that it is. Consider the following discourses.

- (28) a. *Suppose Mary had a car. She takes me to work in it. I drive the car too.*
 b. *If Mary has a car, she will take me to work in it. I can drive the car too.*
 c. *If Mary had a car, she would take me to work in it. I could drive the car too.*
 d. *I wish Mary had a car. She would take me to work in it. I could drive the car too.*
 e. *When Mary has a car, she can take me to work in it. I can drive the car too.*

All of the above examples elaborate a hypothetical situation that is based on the counterfactual or dubious premise that Mary has a car. The difference between the first and the second pair is that in (28c-d), the condition is implied to be unrealizable or hard to realize. There are clearly several ways in which a supposition may be introduced in a discourse. Essentially, however, all of the above examples reduce to the form

If S_0 then S_1, S_2, \dots, S_n

Whatever referent is introduced by S_0 exists for the sequence S_1-S_n , which apparently has no fixed length, although there obviously are certain conditions that all sentences belonging to it have to fulfill. The following discourse would be anomalous.

(29) *I wish Mary had a car. *I will drive it.*

That is, fictitious individuals may be referred to anaphorically only as long as the proper fictitious mode is sustained, but

when the illusion is broken, they cease to exist.

As the above examples show, a text interpreter must also be able to cope with short-term referents that owe their existence to some condition that in reality is not fulfilled. It must catch a supposition in whatever form it comes and recognize where the supposition ceases to be in force. Neither of the two tasks is likely to be easy. For example, what looks like a command may, nevertheless, be a supposition.

- (30) *Lend him a book and he'll never return it.*

1.5 Commands and Yes-No Questions

It is to be expected that indefinite noun phrases in commands and yes-no questions fail to introduce referents. The proposition corresponding to an interrogative or imperative sentence ordinarily is not assumed to be true. Thus, there is something missing in the following examples.

- (31) a. *Does John have a car? *It is a Mustang.*
b. *Give me a hotdog, please. *It looks delicious.*

But it is again possible to have coreference within the imperative or interrogative sequence itself.

- (32) a. *Does John have a car and is it a Mustang?*
b. *Give me a hotdog, please, but don't put any mustard on it.*

There are, however, ways to interpret the following examples as acceptable.

- (33) a. *Did you write a letter? Let me see it.*
b. *Give me a hotdog, please. I will eat it.*

For example, the interrogative sentence in (33a) need not be taken as a true question at all, but as an expression of surprise prompted by a preceding assertion. (33b) could be understood as elliptic. What is implicit is "You will give me a hotdog". Discourses such as in (33) clearly are not counterexamples, since their acceptability is not due to the appearance of an indefinite NP in a command or yes-no question, but to other considerations.

1.6 Quantifiers

Indefinite noun phrases are generally ambiguous in sentences that contain quantifierlike expressions. The following examples can be understood at least in two ways.

- (34) a. *Harvey courts a girl at every convention.*
 b. *Most boys in this town are in love with a go-go dancer.*

(34a) can mean that, at every convention, there is some girl that Harvey courts, or that there is some girl that Harvey courts at every convention. Let us call the above paraphrases the nonspecific and the specific interpretation of the NP *a girl*, respectively. (See the note on specificity in Section 1.1.) In the specific sense, Harvey always courts the same girl, in the nonspecific sense, it may be a different girl each time. Similarly, a *go-go dancer* in (34b) also has two interpretations. However, the following discourses leave no room for such ambiguity.

- (35) a. *Harvey courts a girl at every convention. She is very pretty.*
 b. *Most boys in this town are in love with a go-go dancer. Mary doesn't like her at all.*

In (35), only the specific interpretation is possible. There must be a unique girl and a unique go-go dancer. This fact indicates that a nonspecific indefinite fails to establish a discourse referent in case there is a quantifierlike term in the sentence, in spite of the fact that the sentence is an affirmative assertion.

But notice that the following example is ambiguous again.

- (36) *Harvey courts a girl at every convention. She always comes to the banquet with him. The girl is usually also very pretty.*

(36) admits both the specific and nonspecific interpretation of *a girl*. The reason for the anomaly of the nonspecific interpretation in (35) and its acceptability here is apparently that, in (36), every successive sentence continues to have a similar quantifierlike term - *at every convention*, *always*, *usually*. There is also nothing wrong with the nonspecific interpretation of the NP *a book* in (37).

- (37) *Every time Bill comes here, he picks up a book and wants to borrow it. I never let him take the book.*

We have to say that, although a nonspecific indefinite that falls into the scope of a quantifier fails to establish a permanent discourse referent, there may be a short-term referent within the scope of the quantifier and its lifespan may be extended by flagging every successive sentence with a quantifier of the same type.⁴

2. SPECIFICITY

Let us now return to the problem of specificity that was first introduced in Section 1.1. As we already pointed out, many of the examples above that were judged anomalous in the intended sense can also be given another interpretation that makes them perfectly acceptable. Although "nonspecific" indefinites do not permit coreference in (38), there is nothing wrong with these examples provided that the indefinite NP is understood "specifically".

- (38) a. *Bill didn't find a misprint. Can you find it?*
 b. *John wants to catch a fish. You can see the fish from here.*

How should we represent this distinction? As the terms "specific" and "nonspecific" imply, transformational grammarians have traditionally assumed that there is a feature [\pm specific], just as there is a feature [\pm definite], and that indefinite NPs are to be marked with respect to specificity. Let us call this view, that goes together with Chomsky's original proposal that coreference be marked with integer-type indices, the classical theory. There is also another approach to these problems suggested by Emmon Bach (1968), James D. McCawley (1970b), George Lakoff, and others. The essential feature of their proposals is that referential indices are variables, bound by quantifiers that act like quantifiers in symbolic logic. What corresponds to the indefinite article is, of course, something very similar to the existential quantifier in predicate calculus. (Bach calls it "the some operator".) Base structures resemble formulas in symbolic logic. This approach to syntax has now become known as "generative semantics".

It is easy to see that in the framework of generative semantics there is no justification nor need for a feature such as [\pm specific]. The ambiguities in question are naturally accounted for by the fact that the quantifier-binding variable that underlies some indefinite noun phrase may be placed in different positions in the base structure. Specificity thus becomes a matter of the scope of quantifiers.

As far as the problems discussed in this paper are relevant to choosing a theoretical framework, they seem to argue in favor of adopting the Bach-McCawley proposals. It is rather difficult to see how one could achieve an adequate description of the facts in the classical theory. For example, consider the following case. Both (39a) and (39b) are ambiguous with respect to specificity.

- (39) a. *Bill intends to visit a museum.*

b. *Bill visits a museum every day.*

In the specific sense, both examples establish a discourse referent. It would make perfect sense to continue with a description of the museum Bill intends to visit or the museum Bill visits every day. In the nonspecific sense, there is no such museum at all. So far so good, we can say that the NP *a museum* can be [\pm specific]. But what about example (40)?

(40) *Bill intends to visit a museum every day.*

It is clear that (40) is ambiguous in many ways. For example, the quantified time adverb *every day* could be assigned either to the complement or to the main clause. Let us now consider only the former case. The remaining ambiguities should be attributable to the indefinite NP *a museum*; in fact, we should have a two-way ambiguity between the specific and nonspecific interpretation. But example (40) is still ambiguous in more than two ways. It could be interpreted to mean (41a), or (41c).

(41) a. *There is a certain museum that Bill intends to visit every day.*

b. *Bill intends that there be some museum that he visits every day.*

c. *Bill intends to do a museum visit every day.*

It is easy to see why this happens. What the feature [\pm specific] accomplishes in case of (39a) is that it clarifies the relation between the indefinite NP *a museum* and the verb *intend* in the main sentence: Is Bill's intention about some particular museum or not? In (39b), we employ the same device to characterize the relation between the quantified time adverb *every day* and the indefinite noun phrase: Is it the same museum every day or not? To do the work in (40) we would need two features, one to characterize the relation between *intend* and *a museum*, another for the relation between *a museum* and *every day*. Under the interpretation (41b), for example, *a museum* would be non-specific with respect to the verb *intend* but specific with respect to the quantified time expression. But to say that there are several varieties of specificity is a way of saying that there is no feature [\pm specific] at all. The classical theory clearly is not sufficient to account for the multiple meanings of (40).⁵

On the other hand, in the Bach-McCawley framework we are able to account for the ambiguities in a straightforward way. The three senses of (40) discussed above might be represented

roughly as in (42).⁶

- (42) a. $(\exists x)[\text{museum}(x) \text{ . } \text{intend}(\text{Bill}, (\text{every day}) \text{visit}(\text{Bill}, x))]$
 b. $\text{intend}(\text{Bill}, (\exists x)[\text{museum}(x) \text{ . } (\text{every day}) \text{visit}(\text{Bill}, x)])$
 c. $\text{intend}(\text{Bill}, (\text{every day})(\exists x)[\text{museum}(x) \text{ . } \text{visit}(\text{Bill}, x)])$

Another advantage of generative semantics is that there is an explanation ready for the fact that (40) establishes a discourse referent under only one of the three interpretations we have considered, namely (42a). The rule is that an indefinite NP establishes a permanent referent just in case the proposition to which the binding quantifier is attached is assumed (asserted, implied, or presupposed) to be true, provided that the quantifier is not itself in the scope of some higher quantifier.⁷ The first part of the rule accounts for the difference between (42a) and (42b-c), the second part is needed to explain why (39b) establishes a permanent referent only under one of the two possible interpretation. Notice that, in (42a), the quantifier underlying the NP *a museum* is attached to the main proposition. Since the main proposition is asserted to be true and there is no higher quantifier involved, (42a) establishes a referent corresponding to the NP *a museum*. Now, consider the other two interpretations of (40). The verb *intend* is one of the modal verbs discussed in Section 1.2.1. We know that the complement of a modal verb taken by itself is not implied or presupposed to be true. In (42b) and (42c), the quantifier underlying the NP *a museum* is attached to the complement. Therefore, the above rule correctly predicts that no referent corresponding to *a museum* is established under these two interpretations.

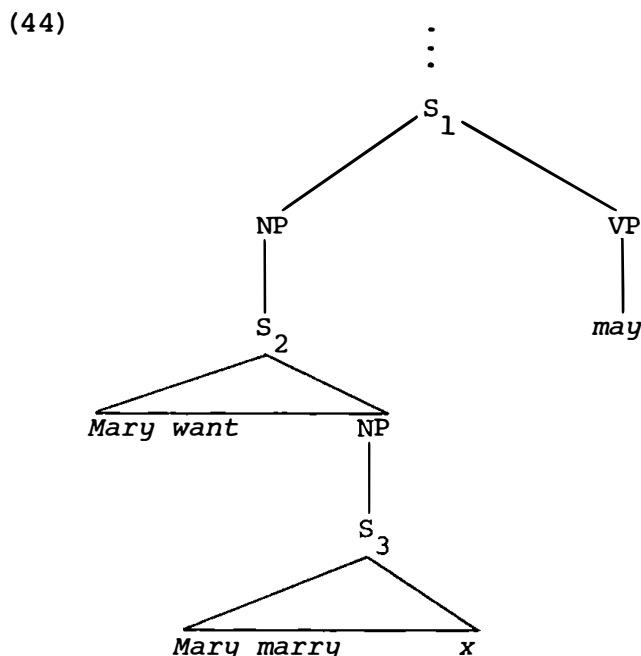
From the point of view of a text-interpreting device, the classical theory has little to recommend itself. The problems studied above clearly argue in favor of the Bach-McCawley framework. In processing a sentence, a text interpreter apparently has to associate an indefinite NP with a variable and attach the binding quantifier to some sentence above the NP using whatever clues there are present to assign the scope with as little ambiguity as possible. Clues that reduce scope ambiguity include the presence of an appositive relative clause or of special words such as *certain*, *single*, and *some* in the noun phrase itself and the surface order of quantifiers, negation, and articles in the rest of the sentence. Second, the interpreter has to keep track of the truth value of the

Discourse Referents

proposition represented by the sentence to which the quantifier is attached. The following example demonstrates some of the difficulties that are involved. Let us start a discourse with (43).

(43) *Mary may want to marry a Swede.*

Highly schematically, the underlying structure of (43) is something like (44).



The quantifier that binds the variable underlying the NP a Swede may belong to any of the three sentences, S_1 , S_2 , and S_3 , which causes (43) to be ambiguous at least in the following three ways.

- (45) a. *There is some Swede whom Mary may want to marry.*
 b. *It may be the case that there is some Swede whom Mary wants to marry.*
 b. *It may be the case that Mary wants her future husband to be a Swede.*

Of the three sentences involved, only S_1 is asserted by the speaker to be a true proposition. The two other sentences, S_2 and S_3 , are both commanded by a modal verb (*may* and *want*), therefore, their truth is not implied or presupposed. The indefinite NP *a Swede* establishes a discourse referent just in case its binding quantifier is attached to S_1 . This

can be demonstrated easily by pointing out that, if the speaker continues the discourse with (46), the preceding sentence (43) can only be understood in the sense of (45a).

(46) *She introduced him to her mother yesterday.*

However, the following continuation, where the pronoun *it* stands for S_2 , permits both (45a) and (45b).

(47) *Suppose that it is true, then she will certainly introduce him to her mother.*

As a final example, after some thought it should be obvious that a discourse consisting of (43) and (48), where the first *it* in (48) stands for S_2 and the second *it* for S_3 is three ways ambiguous just as (43) by itself. Since all three component propositions of (44) are now either asserted or supposed to be true, there is no way of resolving the inherent scope ambiguity by looking at the coreferentiality of *a Swede* and *him*.

(48) *Suppose that it is true and that she does it, then she will certainly introduce him to her mother.*

Although the argument against the traditional feature [\pm specific] should leave no doubt about its uselessness in discussing anything but the simplest kind of scope ambiguity, it does not necessarily mean that the familiar terms "specific" and "nonspecific" should be rejected. They have proved quite useful and no harm is done, provided that they are understood in a relative sense and not as denoting some absolute property inherent in indefinite noun phrases. For example, consider interpretation (45b) of (43), which assigns the quantifier to S_2 . One might want to say that, with respect to the verb *want* the indefinite NP *a Swede* is specific. On the other hand, if the quantifier is attached to S_3 , as in (45c), *a Swede* could be called nonspecific with respect to *want*. In general, let us call an indefinite NP specific with respect to a given verb (or quantifier, or negation) if the latter is in the scope of the quantifier associated with the NP. It is nonspecific in case the verb commands the quantifier. This kind of definition seems consistent with the way these terms have been used in recent literature, and there is no reason to stop using them as long as the relative nature of specificity is understood.

3. SUMMARY

It is time to review the situation. We started by asking the seemingly naive question, "When is there supposed to be an individual associated with an indefinite noun phrase?" Naive

Discourse Referents

as it may be, it must be answered in case there is ever going to be a device for interpreting written texts or everyday conversation with anything approaching human sophistication. There is also another reason to be interested in the subject. From a linguistic point of view, it is a problem of coreference constraints of a somewhat different kind than those studied under the label "Pronominalization". The present type of constraints are even more basic. It would seem that the question whether two noun phrases can be coreferential at all must precede the question whether a pronoun-antecedent relation may hold between them. Second, if relative clauses are derived transformationally from conjoined sentences by Relativization, as many linguists believe, the constraints discussed here are also a prerequisite for that transformation. For these reasons, the problems studied in this paper are of some theoretical interest quite independently from whether the results lead to any practical applications.

We found that in simple sentences that do not contain certain quantifierlike expressions, an indefinite NP establishes a discourse referent just in case the sentence is an affirmative assertion. By "establishes a discourse referent" we meant that there may be a coreferential pronoun or definite noun phrase later in the discourse. Indefinite NPs in yes-no questions and commands do not establish referents.

In studying more complicated examples, it was found necessary to replace Chomsky's integer-type referential indices by bound variables. In this framework, the traditional problem of specificity is treated as scope ambiguity. We studied several types of verbs that take complements and their semantic properties. We concluded that, in general, an indefinite NP establishes a permanent discourse referent just in case the quantifier associated with it is attached to a sentence that is asserted, implied, or presupposed to be true, and there are no higher quantifiers involved.

There are a couple of special problems - "other worlds" and short-term referents. Although discourse referents ordinarily exist for the speaker, there is a class of "world-creating" verbs, such as *believe*, that also establish referents of another kind. These exist for somebody else, not necessarily for the speaker. Therefore, we need to distinguish between the speaker's world and other realms and allow for the possibility that they are not populated by the same individuals. Second, there are short-term referents, whose lifespan may be extended by continuing the discourse in the proper mode. What this proper mode is depends on the circumstances. For example, every successive sentence may have to contain (i) a modal as the main verb, (ii) a quantifier of

a certain type, or (iii) be in the counterfactual mood. That is, it is possible to elaborate for a while on situations that are known not to obtain or that may or should obtain and discuss what sometimes or always is the case.

NOTES

¹These examples are due to Baker (1966).

²I am indebted to Robert E. Wall for suggesting the term "implicative" to me.

³What remains unexplained here is the fact (pointed out to me by John Olney) that *must* in (27) has two meanings depending on the specificity of the NP *a rich man* in the preceding sentence. If the first sentence is about a specific man, then *must* in the second sentence is interpreted in a rather weak sense: 'It is likely that he is a banker'. But if the NP *a rich man* is nonspecific, the second sentence means: 'It is necessary that he be a banker'.

⁴George Lakoff (1970c) has suggested that quantifiers and negation be analyzed as verbs (predicates) instead of giving them a special status, as is usually done in symbolic logic. It is yet unclear to me whether there is any substantive issue involved or whether he is only proposing another notation.

⁵There are other good arguments against the feature [_± specific] in Fodor (1968). Unfortunately, they did not persuade the author herself.

⁶The complement of *intend* is what W.V.O. Quine calls "opaque context". I ignore here his view that one should not be permitted to quantify into such a context. It seems to me that the objections he raises have to do with the double role names play in such contexts and only call for more sophisticated linguistic analysis. Notice that Quine approves of (i) while rejecting (ii) as meaningless (Quine 1960, p.166).

(i) (∃x)(Tom believes x to have denounced Catiline)

(ii) (∃x)(Tom believes that x denounced Catiline)

From a linguistic point of view, however, there is nothing but

Discourse Referents

a superficial difference between (i) and (ii) due to subject raising that has applied in (i) but not in (ii).

⁷By "higher quantifier" I mean quantifiers such as *all*, *each*, *many*, and *few* - in fact, everything except the quantifier associated with the singular *some* and the indefinite article. The reason for making this distinction is the fact that, if there are two indefinite singular NPs in the same sentence, both establish a referent no matter what their order is.

(iii) *A dog was killed by a car.*

This example, of course, justifies a later reference both to the dog and the car.