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AMBIGUITY, GENERALITY, AND INDETERMINACY: TESTS AND DEFINITIONS*

ABSTRACT. The problem addressed is that of finding a sound characterization of ambiguity. Two kinds of characterizations are distinguished: tests and definitions. Various definitions of ambiguity are critically examined and contrasted with definitions of generality and indeterminacy, concepts with which ambiguity is sometimes confused. One definition of ambiguity is defended as being more theoretically adequate than others which have been suggested by both philosophers and linguists. It is also shown how this definition of ambiguity obviates a problem thought to be posed by ambiguity for truth theoretical semantics. In addition, the best known test for ambiguity, namely the test by contradiction, is set out, its limitations discussed, and its connection with ambiguity's definition explained. The test is contrasted with a test for vagueness first proposed by Peirce and a test for generality propounded by Margalit.

0. INTRODUCTION

Ambiguity is a notion important, not only to linguists, but also to philosophers. Yet, in spite of its importance, it has yet to receive a theoretically adequate characterization. In what follows, I shall address this deficiency.

I find it useful to distinguish two types of characterizations: tests and definitions. They have distinct, though related, roles in theoretical inquiry. A definition furnishes necessary and sufficient conditions for that of which it is a definition; while a test furnishes only prima facie evidence for that of which it is a test, and not necessary or sufficient conditions. Accordingly, this essay falls into two parts: the first looks into the problem of defining ambiguity and the second the problem of testing for it.

To eschew misunderstanding about the nature of tests and definitions in the context of linguistic theory, let me preface my essay with a sketch of the kind of linguistic theory I am presupposing. The purpose of this preface is to enhance appreciation of the treatment of ambiguity provided here; it is not to defend the linguistic theory adopted. Ample literature already exists serving that purpose.

1. BACKGROUND

The view of linguistic theory as adopted here is, I believe, implicit or explicit in the work of almost every linguist. Linguistic theory taken broadly has as its object the human capacity to use language. Clearly, a comprehensive characterization of such a capacity would involve a characterization of other capacities such as the capacity to form beliefs, to remember, etc. Linguistic theory taken narrowly has as its object the human capacity to recognize and form grammatical sentences. The usual assumption is that this capacity, the human grammatical capacity, can be significantly characterized in terms independent of those used to characterize other human capacities. Note that to hold that there is this independence of the grammatical capacity from other human capacities is not to hold that these capacities do not interact. Obviously they do interact, otherwise no account of the capacity to use language would be possible under the assumption of independence. This modular approach to the problem of characterizing the human capacity to use language is well illustrated in the treatment of indexical expressions. These expressions cannot be suitably used by a speaker, or properly understood by a hearer, unless he has the requisite knowledge of the situation in which such an expression is uttered. (See Lyons 1977, chap. 14, for discussion.) Nonetheless, these expressions have a grammar characterizable in terms independent of those used to characterize their contextual aspects.

Linguistic theory, in its broad sense, undertakes to state the principles governing a computational characterization of the human linguistic capacity. Linguistic theory in its narrow sense is grammatical theory which seeks to state the principles governing a computational characterization of the human grammatical capacity. Linguistic evidence is primarily speakers' judgments of the acceptability or unacceptability of expressions of their language. What these judgments mean for a theory of grammar is not trivial to ascertain. Whether or not an expression is grammatical is primarily a matter of theory; whether or not an expression is acceptable is primarily a matter of evidence; what the relationship is between acceptability and grammaticality, or more generally, between evidence and theory, is complex. To appreciate better the dichotomy between evidence and theory, or acceptability and grammaticality, consider this pair of sentences:

(1.1)　　*The rat we heard a report of experimented on ran away.

(1.2)   *The rat the cat the dog barked at chased ran away.

Both are judged unacceptable by speakers of English. Only the first is taken to be ungrammatical, violating a principle applicable to the formation of relative clauses. The second, in contrast, is taken to be grammatical; its unacceptability is thought to follow from principles pertaining to perception (Akmajian, Demers and Harnish, 1979, pp. 216–19). (See Fodor, Bever, and Garett, 1974 for detailed discussion.)

2. AMBIGUITY

In light of the sort of view of linguistic theory adopted above, one readily sees that it is one thing to define ambiguity and another to ascertain what kind of expressions are structured so that speakers' judgments provide a reliable indication of whether or not an expression is ambiguous. Before turning to the problem of formulating a test for ambiguity, I shall discuss four definitions of ambiguity. These definitions differ from one another in accordance with which theoretical concepts are taken to be basic.

2.1 Definitions of Ambiguity

I shall begin my survey of definitions of ambiguity with the oldest. To set out its definition as well as the definitions of generality and indeterminacy, from which ambiguity is to be distinguished, one must rely on the basic concepts of traditional semantics: meaning, denotation, and connotation. Here, meaning is cognitive meaning, in the sense of Alston (1964, p. 74), or conceptual meaning, in the sense of Leech (1974, pp. 10–13). The denotation of an expression is the set of objects to which it truly applies; and the connotation of an expression is the property, or properties, possession of which by an object licenses the application of an expression to it. These are, of course, the concepts of connotation and denotation found in J. S. Mill (1843, Bk I, chap. 2). In traditional semantics, these three concepts are related as follows: the meaning of an expression fixes its connotation, and its connotation, in turn, fixes its denotation.

Equipped with these concepts, one can provide the obvious and traditional definition of ambiguity. One can also define generality and indeterminacy. These definitions not only clarify the concepts but also

distinguish them from one another. First, one has the definition of ambiguity.

(2)   An expression is ambiguous iff the expression has more than one meaning.

An example of an ambiguous expression is the word 'pike': it can mean a kind of fish, or it can mean a kind of weapon.

Indeterminacy is quite a different concept. It was stated above that the meaning of an expression fixes its connotation. The connotation of an expression must be possessed by each object in its denotation. In this way, an expression determines that the object in its denotation possess certain properties, namely, the properties which are its connotation, and not possess certain others, namely, those incompatible with its connotation. It does not determine any other properties. It is with respect to these last properties that an expression is indeterminate.

(3)   An expression is indeterminate iff there is some property which neither is included in the expression's connotation nor is a species of any property included in its connotation.

For example, the word 'square' is indeterminate, since its connotation does not include or exclude being any particular size; and the word 'mother' is indeterminate, since its connotation does not include or exclude being of any particular ethnic origin. In fact, every common noun is, presumably, indeterminate inasmuch as, for any common noun, there is undoubtedly some property which its connotation does not either include or exclude. Yet, it need not be the case that every common noun be ambiguous. Therefore, one concludes that indeterminacy and ambiguity are distinct.

Generality is distinct from both indeterminacy and ambiguity, though it is frequently confused with the former.

(4)   An expression is general iff the expression's connotation is a genus of more than one species.

Examples of words which are general are given below:

(5)   metal: gold, copper, silver, iron, mercury, . . .
       color: red, green, blue, . . .
       tree: birch, oak, maple, . . .
       parent: mother, father.

Generality and ambiguity are distinct: an expression may be general without being ambiguous and an expression may be ambiguous without being general. An expression may be ambiguous, that is, have only one meaning, though its one meaning fixes a connotation in which there is a genus of distinct species. Generality and indeterminacy are also distinct, since every common noun is indeterminate but not every common noun is general.

Other definitions of generality have been suggested. Consider the one which can be found in articles by Roberts (1984, pp. 300–301) and by Margalit (1983, p. 132):

> (6)   An expression is general iff a meaning of the expression is disjunctive.

The underlying idea is, I think, that if the meaning of an expression on the basis of which it is general is formulated, then the meaning would have the form of a disjunction. So, the formulation of the meaning of 'metal' whereby it is general with respect to being gold, being silver, etc., would be in the form of a disjunction. But this definition affords little theoretical insight into generality, since, without any formalization of meaning, the concept of disjunctive meaning remains completely obscure. What, then, is the inspiration for the definition?

It has long been observed that there are semantic relations which obtain between lexical entries in the lexicon of a language. Synonymy and antonymy are two such relations. Another is hyperonymy, or superordination. This relation is used to explicate the fact that the lexicon of a language reflects taxonomies of various kinds. Examples of taxonomies in the English lexicon are given in (5) above. This relation between expressions in a language can be defined through a simple modification of the definition of generality given in (4).

> (7)   A word is general with respect to another word iff the connotation of the former is a genus of the connotation of the latter.

Thus, considering the examples in (5), one sees that the word 'parent' is general with respect to the word 'mother' and that the word 'tree' is general with respect to the word 'maple'.

The inspiration for the definition in (6) is that a general expression can be paraphrased by an expression made up of a disjunction of expressions. So, for example, the word 'parent' can be paraphrased by

the expression 'mother or father'. The assumption, then, is that the meaning of a general expression will reflect the disjunction of its paraphrase. If this is so, then the definition provided in (7) is to be preferred to the ones in (4) and (6). Generality is primarily a relation among lexical items of a language. This fact is given prominence in (7), where generality is defined as a relation among lexical items of a language; yet it is obscured in both (4) and (6), where it is defined, not as a relation, but as a property. Moreover, the relata of the relation are words, and not simply expressions of any sort. Thus, generality is not defined between the expression 'tall father' and 'tall friendly father', or even between 'parent' and 'tall parent', since each of the expressions 'tall father', 'tall parent', and 'tall friendly father' is not a word. Generality is defined, however, between 'parent' and 'father', since each is a word and the connotation of the word 'parent' is a genus of the connotation of the word 'father'. (7) honors the fact that the relation is defined between words; whereas neither (4) nor (6) do. Finally, the definition in (6) suffers from the further drawback of gratuitously committing one not only to a formalization of meaning but also to a formalization in which disjunction can be formulated.

Meanwhile, it is worth noting that the definition in (7) has a denotational corollary: namely, if one expression is general with respect to another, then the denotation of the former contains the denotation of the latter. So, for example, the word 'flower' is general with respect to the word 'tulip', hence the denotation of 'flower' contains the denotation of 'tulip'. Notice that the converse of the corollary does not hold: it is not the case that if the denotation of one expression contains the denotation of another, then the one is general with respect to the other. The denotation of the word 'father', for example, contains the denotation of the word 'son', but the word 'father' is not general with respect to the word 'son'. The fact that the converse does not hold bodes ill for the prospect of success by treating generality in purely denotational terms.

Although the foregoing definitions of ambiguity, generality, and indeterminacy afford some insight into important semantic aspects of natural language, nonetheless the insight they afford is limited. It is limited because of the limitations on the traditional semantic concepts of meaning and connotation. Connotation proves elucidating primarily in the semantic analysis of common nouns and predicative adjectives in lan-

guages whose morphologies permit the derivation of abstract nouns from concrete common nouns and predicative adjectives. In English, for example, there is this derivational relationship between such words as 'animal' and 'human' and such words as 'animality' and 'humanity'. Relying on this fact about English morphology, one says that the word 'animal' connotes animality or that the word 'human' connotes humanity. But many languages lack this sort of morphology; Chinese has no morphology, for example and for these languages, the concept of connotation is not illuminating. Indeed, it seems that the concept of connotation is completely inapplicable to adverbs, prepositions, articles, and conjunctions. After all, what could the connotation of the preposition 'to' possibly be? Finally, without some formalization of the concept of meaning, there is little theoretical insight to be derived from the semantics built upon it.

Although meaning and connotation have eluded formalization, denotation has not. Denotation is a set and the mathematics of sets is as well understood as the mathematics of anything. For a variety of motives, philosophers have tried to define ambiguity simply in terms of denotation. Scheffler (1979, p. 13) proposes this one:

(8)   A word is ambiguous iff its denotation on one occasion of its use diverges from its denotation on another occasion of its use.

So, a word like 'table' is ambiguous; for, according to Scheffler, its denotation on one occasion of its use, say, in the sentence,

(9.1)   Three men moved the table,

where 'table' denotes pieces of a kind of furniture, diverges from its denotation on another occasion of its use, say, in the sentence,

(9.2)   The table of trigonometric functions contains an error,

where 'table' denotes arrays of information.

The fatal flaw in this definition is that one has no theoretical handle on what it is for two sets to diverge. Surely it is not the case that two sets diverge just in case they are disjoint. Scheffler (1979, pp. 14–15) admits that the set consisting of pieces of furniture of a certain kind diverges from the set consisting of arrays of information and that the set consisting of large pieces of furniture of the kind in question does

not diverge from the set consisting of small pieces, yet both pairs of sets are disjoint. Scheffler seems to view ambiguity as a linguistic reflex of cleavages in the universe of discourse induced by the human conception of natural kinds. But, on such a view, one has merely insinuated connotation into one's semantic theory under the guise of divergence in sets of objects. But this view of ambiguity cannot be correct. On the one hand, there are words whose denotations diverge along the lines of natural kinds. But these words need not be ambiguous. Any general word has divergences among subsets of its denotation which are along the lines of natural kinds. So, for example, the set of pieces of gold diverges from the set of pieces of silver, but the word 'metal' is not ambiguous between denoting pieces of gold and denoting pieces of silver. At the same time, one should not be misled by the examples into thinking that the relevant distinction in the case of ambiguity is that the sets are distinguished by whether the objects in them are concrete or abstract. There are too many cases where the denotations of an ambiguous word all consist of concrete objects (e.g., 'pike': fish versus weapon) or all consist of abstract objects (e.g., 'circle': perimeter of a figure versus the area enclosed by the perimeter). On the other hand, there are words whose denotations do not diverge into disjoint sets of different kinds, and yet they are ambiguous. Such words are autohyponymic. (See Horn 1983 for discussion.) Autohyponyms are words which are ambiguous between denoting a set and denoting a proper subset of the set. Examples are 'dog', 'drink', etc. The word 'dog' denotes canes familiares as well as their proper subset, namely, male canes familiares; the word 'drink' denotes beverages as well as their proper subset, alcoholic beverages. In any case, the divergences between sets of objects which are associated with ambiguity are just too heterogeneous to hold out any hope of finding in them anything of linguistic significance for the concept of ambiguity.

It should be pointed out that a sentence can be ambiguous utterly independently of any ambiguity of its words. Consider the sentence:

(10)   The man saw his wife drunk.

This sentence is amphibolous. Amphiboly obtains when a sentence can accommodate distinct phrasal structures.

(10.1)   The man saw [his wife drunk].

(10.2)   The man [saw his wife] drunk.

In the first case, the wife was drunk when her husband saw her; in the second case, the husband was drunk when he saw his wife. This kind of ambiguity falls outside the purview of Scheffler's definition.

Another definition of ambiguity, which is essentially the sentential analog of Scheffler's definition, has been discussed by Kempson (1977, pp. 40, 128). It states:

(11)   A sentence is ambiguous iff the sentence can be true in very different states of affairs.

But what is it for two sets of states of affairs to be very different? This is just the problem of divergence between two sets all over again.

Yet, even if there were a clear criterion for divergence among states of affairs, this definition would give the wrong results. Consider the following paradigmatic case of ambiguity.

(12)   Old men and women got on the bus.

This ambiguous sentence is amphibolous, since it accommodates two distinct phrase markers.

(12.1)   [Old [men and women]] are on the bus.
(12.2)   [[Old men] and women] are on the bus.

For the definition in (11) to apply, the states of affairs which render true the sentence as analyzed in (12.1) would have to be very different from the states of affairs which render true the sentence as analyzed in (12.2). Now consider the sentence:

(13)   Old men and women are men and women,

which has the same amphiboly as found in the sentence in (12), namely,

(13.1)   [Old [men and women]] are men and women.
(13.2)   [[Old men] and women] are men and women.

Again, for the definition in (11) to apply, the states of affairs which render true the sentence as analyzed in (13.1) would have to be very different from the states of affairs which render true the sentence as analyzed in (13.2). But this is impossible, since the sentence under each analysis is a logical truth.

A different approach to the problem of defining ambiguity is hinted at in the discussion of the sentences in (10), (12) and (13). There, the readings of the ambiguous sentences are correlated with their distinct structural analyses. A structural analysis is done in terms of a phrase marker. (In Generative-Transformational Grammar, a structural analysis consists in a sequence of phrase markers; but this complication can be ignored here, as it does not affect the principle of the discussion to follow.) So, the definition of ambiguity might be stated as follows:

(14)   An expression is ambiguous iff the expression can accommodate more than one structural analysis.

The sentence in (10), then, is ambiguous since it can accommodate more than one structural analysis. In particular, it accommodates the distinct phrase markers where the relevant point of difference is indicated by the difference in assignment of brackets in (10.1) and (10.2).

This definition presupposes a distinction between structural analyses, on the one hand, and expressions, on the other. An expression is a phonic or graphic form: the former has acoustic properties and the latter spatial. (See Lyons 1977, chap. 3.3 for discussion.) A structural analysis is a phrase marker. It has neither acoustic nor spatial properties: it is an abstract syntactic entity. This object consists of a finite set of partially ordered nodes one of which is distinguished as the greatest; its non-terminal nodes are assigned syntactic categories, together with other syntactic features; and its terminal nodes are assigned elements each of which comprises the address of a lexical entry and the syntactic properties associated with it, such as its (lexical) syntactic category and its subcategorization frame, if there is any. (See Higginbotham, 1985 for discussion relevant to phrase markers.) An expression can be said to accommodate a structural analysis insofar as the latter is encoded into the former. A structural analysis is encoded into a phonic expression via phonological rules. (See Chomsky and Halle, 1968 as well as Selkirk, 1984 for detailed proposals.) And a phonic expression is encoded into a graphic one by rules of phonetic transcription (unless, of course, the orthography of the language is ideographic, and not phonetic). Ambiguity, then, is a many-one relation between syntactic entities and expressions.

The idea that ambiguity consists in a many-one relation is not new; it has been the cornerstone of its treatment by both logically and

linguistically minded semanticists. On the one hand, logically minded semanticists, such as Cresswell (1973, pp. 91–92; 1988, pp. 19–20) and Montague (1970a, sect. 7; 1970b, sect. 2), hold ambiguity to be a relation between many syntactically unambiguous elements of an intentional logic and an expression corresponding to them in a natural language. (See Thomason 1974, sect. B for an exposition of Montague's treatment of ambiguity.) This view of theirs is a nearly inescapable consequence of their assumption that the semantics of natural language is compositional, as pointed out by Dowty et al. (1981, p. 254). On the other hand, linguistically minded semanticists, such as Katz (1972, chaps. 1.5–1.6; 1977, p. 93), hold ambiguity to be a relation between many semantic representations and an expression corresponding to them in natural language. While the view adopted here shares with each of these two types of semanticist the idea that ambiguity is a many-one relation; it does diverge from them, however, on what it takes to be the nature of the entities in the domain of the relation: the entities in the domain are not semantic, but syntactic, though not syntactic elements in a canonical logic.

It is important to observe that standard linguistic notation is equivocal with respect to this distinction between expression and syntactic analysis. In particular, it does not distinguish between words as phonic or graphic expressions, on the one hand, and words as syntactic labels of terminal nodes of phrase markers, on the other. While this practice is notationally convenient, it is theoretically misleading, as I shall show below. To avoid confusion here, I shall modify the standard notation by enclosing the standard labels for terminal nodes of phrase markers in angle brackets.

One asset of the definition of ambiguity given in (14) is that it is completely general. In the paradigmatic case where the expression is either a phrase or a sentence, the structural analysis is non-trivial, namely, a phrase marker consisting of more than one node; in the case where the expression is a word, the structural analysis is a trivial structural analysis, namely, a phrase marker consisting of a single node, which includes, among other things, the lexical address of a lexical entry. So, by this definition, a word is ambiguous if, and only if, it can accommodate more than one trivial phrase marker. And trivial phrase markers are distinct if, and only if, the lexical addresses of their lexical entries are distinct.

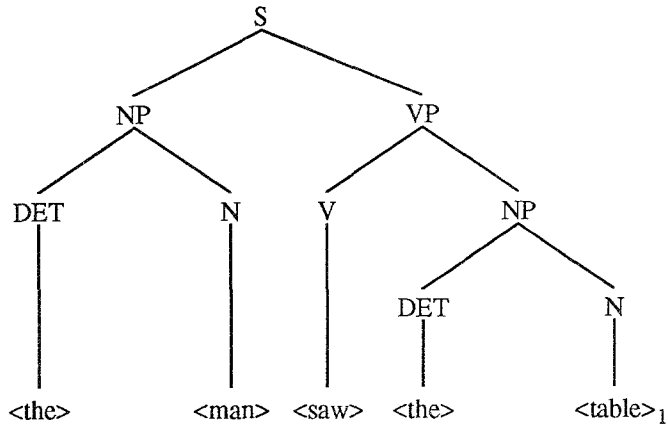What is a lexical entry? It consists of a sequence, each co-ordinate

of which contains information about the various grammatical aspects of a word. (See Lyons, 1977, chap. 13 for discussion.) The exact number of co-ordinates and the precise content of each are matters of current research; nonetheless, much is agreed upon and is indeed taken over from actual lexicographical practice. Thus, the phonological structure of a word must be given in some co-ordinate; the syntactic category, as well as other syntactic information such as inflectional class, say, must also be provided in some co-ordinate. Naturally there must be a co-ordinate providing the semantics of a word. While theoretical treatment of the phonology and syntax of words has moved forward (see, for example, Aronoff, 1976), the same cannot be said of the theoretical treatment of the semantics of words. However, regardless of how the meanings of words turn out to be handled in the lexicon, no one expects that the standard practice of giving words with different meanings different entries will be abandoned. And this practice guarantees that words with distinct meanings will have distinct trivial phrase markers.

Another asset of the definition of ambiguity given in (14) is that it not only provides a uniform treatment of lexical, phrasal, and sentential ambiguity, but also captures the fact that an ambiguous word occurring in a phrase or a sentence renders the phrase or sentence ambiguous. For when a sentence or a phrase is structurally analyzed, a phrase marker is assigned to it. Assigned to the terminal nodes of the phrase marker are the elements containing the lexical addresses of each word in the sentence or phrase. So, if a sentence or phrase contains a word which has distinct lexical entries, then the sentence or phrase accommodates different phrase markers, differing at least at the terminal nodes to which are assigned the lexical addresses of each of the word's lexical entries. So the sentence:
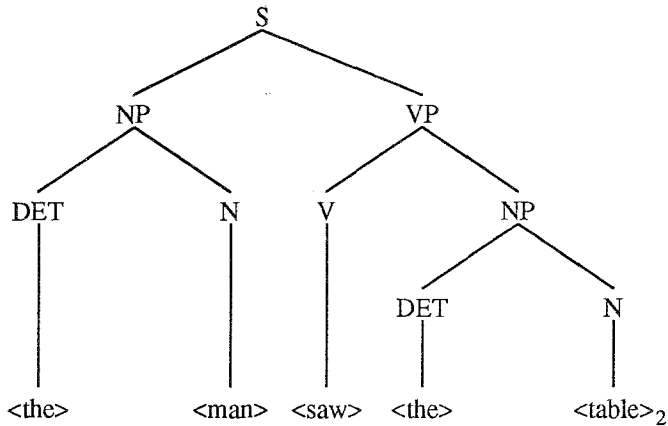
(15)   The man saw a table

is ambiguous, since it can accommodate two structural analyses which differ from one another at least at the terminal nodes to which are assigned the lexical addresses for the distinct lexical entries for the word 'table'. For example, the pair of phrase markers given below are distinct because their terminal nodes are assigned distinct elements, namely, the elements $\langle table \rangle_1$ and $\langle table \rangle_2$ which are distinguished by the fact that they have distinct lexical addresses.

(15.1)

```
                              S
                   ┌──────────┴──────────┐
                  NP                     VP
              ┌────┴────┐           ┌─────┴─────┐
            DET         N           V          NP
             │          │           │      ┌────┴────┐
             │          │           │     DET        N
             │          │           │      │         │
           <the>      <man>      <saw>   <the>    <table>₁
```

(15.2)

```
                              S
                   ┌──────────┴──────────┐
                  NP                     VP
              ┌────┴────┐           ┌─────┴─────┐
            DET         N           V          NP
             │          │           │      ┌────┴────┐
             │          │           │     DET        N
             │          │           │      │         │
           <the>      <man>      <saw>   <the>    <table>₂
```

Still another asset of this definition of ambiguity is that it captures ambiguity which arises when two distinct phonic forms are encoded into the same graphic form. In the example just discussed, the ambiguity of the word 'table' results from the fact that there are at least two distinct lexical entries having the same phonological value in their phonological co-ordinates. Here, the phonic form of the word is ambiguous. But it is important to note that ambiguity is not confined to the phonic forms. Unambiguous phonic expressions may have ambiguous graphic counterparts. Consider the graphic form of the word 'produce', which encodes both the noun (pro'-duce) and the verb (pro-duce'), whose phonic forms are distinguished from one another by stress. Each

phonic form accommodates its own trivial phrase marker, since each trivial phrase marker contains a lexical address different from the other. By the rules for English orthography, these distinct phonic forms, with distinct syntactic analyses, are encoded into the same graphic form. As a result, the same graphic form accommodates two distinct syntactic analyses.

Yet another asset of this definition of ambiguity is that it obviates a problem which might be taken as a real threat to the very possibility of providing either truth-theoretic or model-theoretic accounts of the semantics of natural language. The problem was raised by Kathryn Parsons (1973) in connection with a proposal by Davidson (1967, 1970) to reduce a natural language's semantic theory to its truth definition, in the sense of Tarski (1956). Parsons argues, contrary to the view initially espoused by Davidson (1967, p. 319), that the lexical ambiguity of words such as 'bank' cannot be ignored.

The argument, a version of which I have adapted from Lycan (1984, chap. 2.2), goes like this: A Tarski-like truth definition for a language L will, among other things, entail, for every predicate P of language L, a biconditional of the form:

(16)   For any x, R is true of x in L iff x Q

(where R is a structural analysis of the predicate P of language L and Q is its translation into the meta-language of L). Now, let L be English and let P be 'is a bank'. Then the schema in (16) instantiates into the following assertions:

(17.1)   For any x, 'is a bank' is true of x in English iff x is a financial institution.

(17.2)   For any x, 'is a bank' is true of x in English iff x is a side of a river.

These two assertions yield the clearly false consequence that

(18)   For any x, x is a side of a river iff x is a financial institution.

It is instructive to consider how an analogous argument fares for a sentence which is phrasally ambiguous. Presumably, it would be a consequence of a truth definition for English that

(19.1)   "Each old man and woman left" is true in English iff each old man left and each woman left.

(19.2)   "Each old man and woman left" is true in English iff each
          old man left and each old woman left.

But this yields the false consequence that

(20)   Each old man left and each woman left iff each old man left
          and each old woman left.

This argument is fallacious, since the structural analyses required for
the truth of each of the claims in (19.1) and (19.2) are distinct. The
notational equivocation underlying this fallacy is obviated by the use
of standard linguistic notation, since the syntactic entity $[_S [_{NP} [_{DET}$
each] $[_N [_{AP}$ old] $[_N [_N$ man] $[_{CONJ}$ and] $[_N$ woman]]]] $[_{VP}$ left]] is distinct
from the syntactic entity $[_S [_{NP} [_{DET}$ each] $[_N [_N [_{AP}'$ old] $[_N$ man]]
$[_{CONJ}$ and] $[_N$ woman]]] $[_{VP}$ left]]. (Labelled brackets, used here, are
equivalent to phrase markers, used in (15) above.) The same fallacy,
it turns out, underlies the reasoning about the claims in (17). However,
this time the equivocation is not obviated by a simple shift to standard
linguistic notation, since it itself is equivocal for reasons set out earlier.
Yet, if one adopts the revised notation suggested above, the equivo-
cation comes to light, since the structural analysis of the predicate in
(17.1), namely, $[_{VP} [_V \langle is \rangle] [_{NP} [_{DET} \langle a \rangle] [_{NP} \langle bank \rangle_1]]]$, is distinct from
the one in (17.2), namely, $[_{VP} [_V \langle is \rangle] [_{NP} [_{DET} \langle a \rangle] [_{NP} \langle bank \rangle_2]]]$. (See
Gillon, 1990 for discussion of other problems alleged to accrue to
Davidson's view of truth theoretical semantics.)

   In the foregoing, a definition of indeterminacy and three definitions
of generality were adduced. The first two definitions of generality (see
(4) and (6) above) were found to be inadequate and misleading. An
improved definition (see (7) above) is given. However, both the im-
proved definition of generality and the definition of indeterminacy,
while affording a good characterization of their respective phenomena,
do not succeed in bringing them within the ambit of the formalized
part of linguistic theory, for they both rely on the pre-theoretical notion
of connotation.

   In addition, four definitions of ambiguity were examined: the first
(see (2) above) is formulated in terms of meaning, the second and third
(see (8) and (11) above) are formulated in terms of the divergence of
denotation and states of affairs respectively, and the fourth (see (14)
above) is formulated in terms of structural analyses. The first definition
suffers from the drawback that what it is formulated in terms of, namely

meaning, is itself understood only pre-theoretically. Hence the defi-
nition fails to link ambiguity with any formalized part of linguistic
theory. The second and third definitions, though partly formulated in
terms which are a formalized part of linguistic theory, namely in terms
of sets, are also partly formulated in terms which are not a formalized
part of linguistic theory, namely in terms of divergence; and to the
extent that divergence is made precise, the definitions so formulated
are wrong. The final definition, however, is formulated in terms which
are fundamental to current, formalized linguistic theory, namely in
terms of structural analyses (i.e., phrase markers or sequences of phrase
markers); the definition thereby brings the pre-theoretical notion of
ambiguity within the ambit of the formalized part of linguistic theory
– clearly a step forward. Thus, unlike the first definition which defines
one pre-theoretical notion with another, the last definition defines the
pre-theoretical one with a theoretical one. All other things being equal,
the latter definition is to be preferred. Moreover, unlike the second
and third definitions which run counter both to what linguists take as
examples of ambiguity and to what linguists take as examples of non-
ambiguity; the last definition does not. The definition in (14) also
provides a unified account of lexical, phrasal, and sentential ambiguity
and their connection with one another. The other definitions imply
nothing about their interconnection. Finally, the definition advocated
here obviates an otherwise fundamental problem for either truth-theo-
retical or model theoretical semantics – something which the competing
definitions appear unable to do.

2.2. *Tests of Ambiguity*

I have stated that tests and definitions are distinct, the former providing
prima facie evidence and the latter necessary and sufficient conditions.
The definition of ambiguity proposed above is clearly rooted in gram-
matical theory, suggesting, as it does, that ambiguity is essentially a
many-one relation between syntactic entities and their expressions.
How the tests for ambiguity relate to this definition is the question
which now arises. A number of tests have been proposed, and these
have been surveyed and discussed by Zwicky and Sadock (1975). I
cannot explore the connection of all of them with the above definition;
so, I shall confine my attention to the most widely recognized test,

namely, 'the test of contradiction', as Zwicky and Sadock (1975, pp. 7–8) call it. It can be stated as follows:

(21)   For a given state of affairs, the sentence can be both truly affirmed and truly denied.

To see how this test works, let me apply it to a sentence which is regarded as ambiguous:

(22)   Ferrell has a drink each night before going to bed.

So, one needs to specify a state of affairs in which the sentence in (22) can be both truly affirmed and truly denied. Imagine, then, this state of affairs: Ferrell has a medical problem which requires that he consume no alcoholic beverages but that he have a glass of water each night before going to bed. One person knows only that he does not consume alcoholic beverages; another knows only that he has a glass of water each night at bedtime. The latter person can truly affirm the sentence in (22): "Ferrell has a drink each night before bed". But the former person can truly deny it: "Ferrell doesn't have a drink each night before bed; in fact, he doesn't drink at all these days".

Observe that the test in (21) does not diagnose the source of ambiguity in a sentence determined by it to be ambiguous. For that, the definition of ambiguity and other theoretical assumptions are needed. Thus, for example, the next sentence is diagnosed as ambiguous by the test in (21).

(23)   Chunka hit a man with a stick.

For given the state of affairs in which Chunka uses his fist to strike a man armed with a stick, one can truly affirm the sentence, since a man with a stick was struck by Chunka, and one can truly deny it, since Chunka did not use a stick to strike the man. To diagnose the source of ambiguity in the sentence in (23) requires supplementing the definition of ambiguity with some assumptions about the syntactic structure of English. One assumption is that an English noun phrase can have complementary prepositional phrases.

(24)   [$_{NP}$ A man [$_{PP}$ with a stick]] was executed.

A second assumption is that an English verb phrase can contain just a verb and prepositional phrase (acting as an adverbial modifier).

(25)   Judy Garland [$_{VP}$ [$_V$ sang] [$_{PP}$ with a passion]].

One now has enough of a syntactic analysis of English to show that the sentence in (23) can accommodate two structural analyses, namely,

(26.1)   Chunka [$_{VP}$ [$_V$ hit] [$_{NP}$ a man [$_{PP}$ with a stick]]]].
(26.2)   Chunka [$_{VP}$ hit [$_{NP}$ a man [$_{PP}$ with a stick]]]].

By the definition in (14), the sentence in (23) is ambiguous.

As stated earlier, a test provides only prima facie evidence, and not necessary and sufficient conditions, for that of which it is a test. It clearly does not provide necessary conditions, for there are ambiguous expressions, such as words, phrases, and non-declarative sentences, which cannot be both affirmed and denied, and yet which are clearly ambiguous. Consider, for example, the following command and question, which any linguist will say is ambiguous.

(27)   Fetch me a pike.
(28)   Did the man see his wife drunk?

Indeed, even declarative sentences which are ambiguous can fail to be both affirmable and deniable, for example, any tautology or contradiction. An ambiguous contradiction is given below.

(29)   The bank is muddy and not muddy.

The test does not provide sufficient conditions either, for there are unambiguous expressions which can be both affirmed and denied. Here, I have in mind sentences whose truth depends on how the deictic features of the sentence are construed with respect to the situation in which it is uttered. Consider the following situation. A one year old child is playing with the doors of a fragile cabinet. Two adults in the room with the child are afraid that he will damage the cabinet by repeatedly opening and closing the doors. Shortly after one of the two adults leaves the room, the other does and reports to the first:

(30)   I have tied them together, so he can't open the doors any-
         more.

If the second adult appears non-plussed, it is because he has taken 'them' to denote the child's hands, and not the handles on the doors of the cabinet. The sentence in (30), which can be both affirmed and denied in such a case, can be both affirmed and denied, not in virtue

of the ambiguity of the third person plural pronoun, but by dint of the relativization to context of the construal of deictic expressions. (See Cresswell, 1973, Kaplan, 1978, and Lewis, 1972 for the formal treatment of such relativizations.)

A further complication of the test by contradiction is the fact that the English adverb 'not' is itself ambiguous. Grice (1967) pointed out that negation in English can be used to reject either the truth of a sentence or its assertability. A similar observation was made by Dummett (1973, pp. 328–30), who distinguished between negation being used to assert the contradictory of a sentence and negation being used to express an unwillingness to assent to it. English negation is not alone in evincing such ambiguity; negation in French is also ambiguous in the same way, a fact remarked upon and discussed by DuCrôt (1972, 1973). The ambiguity has been most recently treated in Laurence Horn's comprehensive study of negation. There, Horn (1989, chap. 6.2) distinguishes descriptive negation, used to assert the contradictory of a sentence, from metalinguistic negation, used to reject any of a number of features of a sentence, including its phonetic or syntactic form, its register, its focus, and its implicata – just to mention a few. The latter usage is illustrated below in example sentences adapted from him.

(31.1)   You did not catch two mongeese; you caught two mongooses.
(31.2)   Ben is not a black man; he is a man who is black.
(31.3)   Some men are not male; all men are male.
(31.4)   This was not written for piano and violin; it was written for violin and piano.

Each sentence in the paradigm above consists of a pair of clauses, the first is an appropriate form of the negation of a sentence containing objectionable material and the second is a reformulation of the sentence so that the objectionable material of the first has been replaced with unobjectionable material. As Horn (1989, chap. 6.2) notes, the objectionable material and its reformulation receive contrastive stress.

Interestingly, this ambiguity is confirmed by a version of the test of contradiction. Suppose, with regard to a refrigerator containing exactly thirteen eggs, someone says:

(32)   There are twelve eggs in the refrigerator;

to which someone else replies:

(33)   There are not twelve eggs in the refrigerator; there are
        thirteen.

Read with neutral intonation and stress, the sentence in (33) is a
contradiction, for the second clause of the sentence implies that there
are twelve eggs in the refrigerator, which contradicts the first clause.
However, read with contrastive stress on 'twelve' and 'thirteen', the
sentence is no longer contradictory; for the negation in the first clause
does not reject the truth of the very same clause without the negative
adverb, rather it rejects the implicature occasioned by the noun phrase
'twelve eggs', to the effect that there are *only* twelve eggs. Thus, the
sentence in (33) has both a contradictory and a non-contradictory read-
ing, resulting from the two readings associated with the negative adverb
'not'. (See Horn, 1989, chap. 6.3 for further details.)

The test for ambiguity suggested above must be distinguished from
the criterion for vagueness, first suggested by C. S. Peirce (1901) and
recently developed by Alston (1964, chap. 5). An expression is vague
inasmuch as there are cases in which no definite answer exists as to
whether or not it applies. Vagueness is well exemplified by such words
as 'city'. Though a definite answer does exist as to whether or not it
applies to Montreal or to Kingsville (Ontario); nonetheless, no definite
answer exists as to whether or not it applies to Red Deer (Alberta) or
Moose Jaw (Saskatchewan). Nor is the lack of an answer here due to
ignorance (at least if one is familiar with the geography of Western
Canada): no amount of knowledge about Red Deer or Moose Jaw will
settle whether or not 'city' applies. Any case in which further knowledge
will settle whether or not the expression applies is simply not a case
evincing the expression's vagueness; rather it evinces the ignorance of
its user. So, for example, multiple sclerosis does not evince the vague-
ness of the word 'curable' for it is ignorance of its etiology which
precludes a definite answer as to whether or not the word applies to
multiple sclerosis. Vagueness is not alleviated by the growth of knowl-
edge, ignorance is.

One virtue of the test for ambiguity in (21) is that generality and
indeterminacy do not permit a sentence to be both truly affirmed and
truly denied. Consider the state of affairs where Graeme's mother
resigned from the board of directors of Exxon. Someone might remark:
"Graeme's parent resigned from the board of directors of Exxon"; but
no one could coherently respond: "No, Graeme's parent didn't resign

from the board, his mother did". So, a general word does not, as such, permit a sentence to be both truly affirmed and truly denied of a given state of affairs. Nor does a word, even insofar as it fails to determine properties of entities in its denotation, permit a sentence to be both truly affirmed and truly denied. Given the same state of affairs as before, one might remark: "Graeme's mother resigned from the board of directors of Exxon"; but no one could coherently rejoin with: "No, Graeme's mother did not resign from the board; she's oriental".

Roberts (1984, pp. 299–300) proposes a test designed to distinguish generality and ambiguity from one another. He states:

> (34)   A term is ambiguous, rather than general, iff it has one meaning in some contexts and another meaning in other contexts.

The test is unsatisfactory for a number of reasons. First, it implies a number of unwanted results. It implies that a term is ambiguous if and only if it is not general. This, in turn, implies that no term can be both general and ambiguous and that no term can be neither general nor ambiguous. But autohyponymous words like 'dog', 'drink', etc. are both ambiguous and general; and words like 'laser', or 'quark' are neither ambiguous nor general. Perhaps then, it would be better to drop from the statement of the test in (31) the phrase 'rather than general' and to consider it simply as a test for ambiguity. Note that this revised version of Roberts' test is essentially Scheffler's definition of ambiguity. (See (8) above.) But it too is unsatisfactory. As Zwicky and Sadock (1987) have pointed out, the test cannot distinguish between a context narrowing the meaning of a term and a context selecting a meaning among the meanings of a term. That is, just as context helps a hearer to select the appropriate meaning of an ambiguous term, so context can help a hearer narrow the meaning of a general or indeterminate term. So, for example, in one context the ambiguous term 'pike' is to be taken to mean a kind of fish, and not a kind of weapon, but in another context it is taken to mean a kind of weapon, and not a kind of fish. But, it is also true that in one context 'parent' is taken to mean mother and not father and in another context it is taken to mean father, and not mother.

> (35.1)   Billy's parent just gave birth to another child.
> (35.2)   Billy's parent just sired another child.

Next, Margalit (1983, p. 132) propounds a test to determine whether one word is general with respect to another. The idea is that one finds a frame sentence which can be either truly affirmed or truly denied. Then, by substituting each of the pair of words into a grammatically appropriate place in the frame sentence one obtains two sentences which differ from one another only as to which of the pair of words occurs at the place of substitution in the frame sentence. Finally, one affirms both the sentence which contains the word with respect to which the other word is purported to be general and the contradictory of the sentence which contains the purported general word. The word purported to be general is general with respect to the other word if, and only if, the pair of affirmations produce a contradiction:

(36)   A word x is general with respect to a word y iff for an affirmable sentence $F(a)$, $\neg (F(a)/x) \wedge (F(a)/y)$ is a contradiction,

(where 'a' has only one occurrence in '$F(a)$' and '$F(a)/x$' is the result of substituting 'x' for 'a' in '$F(a)$'). So, consider the affirmable frame sentence.

(37)   Rick saw a building.

Suppose, now, one wants to ascertain whether 'tree' is general with respect to 'maple'. Substitute 'tree' and 'maple' for 'building' in (37) and change the one into which 'tree' is substituted to its contradictory. Finally, conjoin the result.

(38)   Rick did not see any tree and Rick saw a maple.

This last sentence is judged contradictory and so one concludes that 'tree' is general with respect to 'maple'. Conversely, consider a pair of words neither of which is general with respect to the other: 'neighbor' and 'woman'. The following sentences are not judged contradictory:

(39.1)   Ferrell did not see any neighbor and Ferrell saw a woman.
(39.2)   Ferrell did not see any woman and Ferrell saw a neighbor.

Margalit's test has been rejected as 'not well-defined' by Atlas (1984, pp. 435–36). Atlas purports to adduce a case in which the same expression is shown by the test both to be general and not to be general with respect to another expression. In particular, he claims that the

following sentence can be judged both to be contradictory and to be non-contradictory.

(40)   Jim did not cook eggs but he cooked broccoli and eggs.

'Eggs', he claims, is shown thereby both to be general with respect to 'broccoli and eggs' and not to be general with respect to 'broccoli and eggs'. But how is it that the sentence is judged to be both contradictory and non-contradictory? It is contradictory, Atlas claims, for the following reason: one can infer from (40) that Jim cooked broccoli and eggs. Hence, one can further infer that Jim cooked eggs. But one can also infer from (40) that Jim did not cook eggs. Surely, this is a contradiction. At the same time, Atlas points out, "for those with an ear for English", there is a non-contradictory interpretation of the sentence in (40), which is rendered salient through putting contrastive stress on the first occurrence of 'eggs' and the only occurrence of 'broccoli'. The idea here is that Jim did not merely cook eggs, he cooked broccoli and eggs. The implication which Atlas seems to want his reader to draw is that Margalit's test leads to an inconsistent meta-theory, wherein the same expression is both general and not general.

Now there are a number of reasons why this case of Atlas' should not be taken as an indictment of the test. To begin with, recall that generality, as defined in (7), is a semantic relation between words, and not between phrases. This is reflected in the test as formulated in (34). Atlas' case does not satisfy the conditions placed on the test. This point is not a quibble: as mentioned before, generality is the semantic relation used to express a taxonomic relation holding in parts of the vocabulary of a language (Lyons 1977, chaps. 9.4–9.5); it is not the semantic relation of class inclusion which accrues from the compositional structure of phrases of a language.

Second, as pointed out above, tests do not provide necessary and sufficient conditions, hence it is unwise to construe the connective in the test as a material bi-conditional. Third, and most importantly, what Atlas' example illustrates is not the inadequacy of Margalit's test, but the ambiguity of the English adverb 'not', discussed earlier. It can be used descriptively, to provide the contradictory of the sentence into which it is inserted, and metalinguistically, to reject some aspect of the sentence into which it is inserted, in this case, the implicature that Jim cooked *only* eggs. That this is the relevant ambiguity is unwittingly

attested to by Atlas himself, who points out that the so-called non-contradictory reading is associated with contrastive stress on the first occurrence of 'eggs', to which the offending implicature accrues, and the occurrence of 'broccoli', which supplies the correction.

Contradiction, then, turns out to be the cornerstone on the basis of which to build a test for ambiguity (21) and a test for generality (36). Given these two tests, one can discriminate among ambiguity, generality, and indeterminacy. However, these tests, like any test, must be supplemented by methodological and theoretical assumptions; but then that is routine in any scientific inquiry.

3. CONCLUSION

To summarize, I began with a distinction between tests and definitions, maintaining that a definition provides necessary and sufficient conditions while a test provides prima facie evidence, not necessary or sufficient conditions. On the basis of this distinction, I examined some well known characterizations of ambiguity. Four of these characterizations (see (2), (8), (11) and (14) above) I regarded as definitions and, as such, singled out one (namely (14) above) as superior, that is, the one in which ambiguity is taken to be a many-one relation between structural analyses and expressions accommodating them. Distinguished from ambiguity were indeterminacy (see (3) above) and generality (see (4), (6) and (7) above), for which useful, but not completely satisfactory, definitions were given. Another characterization of ambiguity (see (21) above) I regarded as a test and I showed it to properly discriminate ambiguity, on the one hand, from indeterminacy and generality, on the other. The test for generality propounded by Margalit (1983) was introduced and defended against criticisms by Atlas (1984).

NOTES

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