CHAPTER 1 AN INTRODUCTION TO CROSS-REFERENCE

0. Introduction. The subject of cross-reference has in recent years become the focus of much linguistic discussion. Nonetheless, accounts of cross-reference differ, often markedly, in the sense accorded to its central terms -- among them, "referential", "referent", and "coreference". This divergence can be attributed in part to differences in the assumptions and aims of the particular studies and of the theoretical approach to which they defer. The present chapter provides an extended preface to a definition of cross-referential relation. For the moment, it may be loosely rendered as:

> (CR) In a given text, an occurrence of a phrase, $\underline{a}_1$, cross-refers to an occurrence of a phrase, $\underline{c}_1$, with respect to a rule of paraphrase or consequence R if and only if application of R to the text with replacement of $\underline{a}_1$ by $\underline{c}_1$ yields a paraphrase or consequence of the original text.

Proceeding from an intuitive recognition of cross-references in various sentences and texts, the opening sections (sections 1-4) develop some general principles and concepts incorporated in the definition, e.g., replacement, rules of paraphrase and consequence. These lead in a step-by-step fashion to the explicit definition presented in section 5.4. In the course of working out this definition I attempt to make explicit the bearing of certain theoretical assumptions, e.g., in respect to the concept of sentence, upon various

explications of cross-reference and introduce some distinctions which should prove useful in evaluating both the present and other approaches to this subject.

The succeeding sections (sections 6-11) attend to a variety of topics pertinent to any examination of cross-reference. These include such matters as agreement (section 6) and the distinction between anaphora and epiphora (section 7).

The definition of referential relation given here is intended to account for -- in a unified manner -- the variety of intuitively recognized relations of cross-reference, as when it is said that on one reading of:

(1) Susan discovered that she had misplaced a notebook.

she refers back, i.e., is anaphoric, to Susan, and that in:

(2) Yugoslavia jailed several dissidents. This is an outrage.

this cross-refers to the preceding fragment. The occurrences of she and this (in (1) and (2), respectively) will be called "referentials" and the phrases to which they refer "referends". Use of the latter term signals a departure here from the now more frequently employed "referent". The reasons for this departure are addressed in detail in section 3.

Some other referential relations are exhibited below:

(3) Ararat is located in eastern Turkey. I've never seen THE MOUNTAIN.

(4) Sid, WHO loves a good time, can never be found at home.

(5) Fred doesn't expect that an invasion of some country is being planned, though Judith thinks SO.

(6) IT must be admitted that glycolysis is an interesting subject.

(7) Amphibians appear in the fossil record before birds DO.

In examples (3)-(7) the referential phrase is indicated in capitals and its referend by underlining (a convention adopted for many of the examples here). In (3) the referential phrase consists of the definite article, used anaphorically, together with a classifier of the referend -- mountain. Reference to Sid in (4) is made by means of the relative pronoun (specifically -o of who). (5) and (6) involve cross-references to sentential complements; it in (6) is epiphoric, i.e., refers forward, to its referend. DO in (7) is referential to the preceding verb along with its complement. The adequacy of the proposed definition in accounting for these and other cross-references is tested by an analysis of cross-reference in a research article (noted below as "Influenzal") of cellular immunology (chapters 4 and 5).

1. Sentencehood; Ambiguity. A distinction often appealed to in discussions of cross-reference is one between sentence and discourse (or: text). Thus, some studies note that cross-reference is to be considered only within the bounds of a sentence. In precise investigations, however, an often tacit reliance on acceptability judgments must yield to some specification of sentencehood. Judgments of acceptability are not always secure and not all concepts of sentence

demarcate the same set of utterances (section 1.1). Assessing possibilities of cross-reference is frequently a matter of delicate judgments. These assessments could be made more accurate (and, likely, more reliable) with the assistance of some further distinctions (section 1.2).

1.1 Concepts of 'Sentence' and Referentials. There are several concepts of sentence which are of possible interest here. Two of these are essentially linguistic in provenience. One refers to particular combinational regularities of word occurrences and identifies, to a first approximation, sentence boundaries as those recurrent points in an effective stochastic process describing word sequences of a discourse. Inasmuch as (a) the procedure is stated on word-class sequences, i.e., in terms of nouns, verbs, etc., and (b) pro-forms (such as the pronoun he) are not distinguishable at the level of word-class (cf. section 2.1), the procedure will recognize sequences describing utterances which contain proforms as sentences, e.g., She is a persistent advocate of reform.[1]

Hoenigswald (1960:1 fn. 1) presents another concept of sentence in the following passage:

> "Sentence" in many languages is a convenient name for a stretch such that its intonation occurs over discourses as well and also such that it cannot be cut without residue into smaller stretches of which the same is true. In other words, sentences are the segments marked by minimum free intonations.

Intonation and other "prosodic" features play an important, albeit little examined, role in the patterns of cross-reference

in English.[2] For example, Harris has suggested that in careful speech an utterance (such as (8) below) containing an epiphoric referential is 'read' not with a characteristic sentence-final drop in tone (after piano in (8)), but with a level ("colon") intonation:

(8) TWO SONATAS represent the sum of Prokofiev's writing for violin and piano. The F Minor Sonata was assigned an earlier opus number than the D Major Sonata though it was the second to be completed.

Generative grammars, such as that outlined in Syntactic Structures, aim at providing an inductive definition of sentencehood for a given language. Within this framework a variety of positions have been adopted as to the status of utterances containing, e.g., pronouns (Wasow 1979 presents a survey of these).[3]

Other concepts of sentence devolve from work in semantics. One, stemming from Stoic logic,[4] is akin to that of Frege (1956) and identifies a sentence as a fragment of an utterance to which truth or falsity is assigned.[5] In this sense a fragment such as He purchased it from her is not a sentence, except with respect to a resolution of the pronouns he, it, and her. Frege would consider the fragment a function, and thus 'unsaturated' (ungesättigt), rather than a sentence. The fragment is akin to what is termed an 'open sentence' or 'sentential function (matrix)' in various systems of logic. Among the sentences of a language one might include such "open" and "closed" sentences

(Alfred purchased a book from Edith might be regarded as an instance of the latter). This distinction -- between open and closed sentences -- , however, presumes that occurrences of referentials are identifiable independently of their referends, which is questionable (cf. sections 2.1 and 10.2).

A sentence can also be considered a phrase that is a consequence of some set: the set may consist only of that phrase.[6] The fragment above -- He purchased it from her -- is, in this sense a sentence: it is a consequence of, e.g., It was purchased by him from her, or of It was from her that he purchased it.

Generally, a text, taken as a string of sentences (in any of the senses above), has a wider field of consequences than those sentences taken as an unordered set, i.e., "considered separately". From example (2) above, it follows that Yugoslavia'a jailing of several dissidents is an outrage., whereas this sentence does not follow from the unordered set {This is an outrage. , Yugoslavia jailed several dissidents.}

In respect to all of the definitions given, a question arises as to the status of utterances in moods other than the indicative -- for instance, interrogative, optative, and vocative moods. A strategy common to a number of grammatical analyses is to reduce these other forms to the indicative. The definition of referential relation presented above (and more fully in section 5.4) is formulated in terms of rules of paraphrase and consequence. Since an interrogative, for

instance, is not an acceptable argument of the consequence relation, the definition will either apply only in respect to rules of paraphrase or in respect to the interrogative as first transformed into an indicative mood.[7]

In the analysis presented in chapter 4, the text is given, as are its sentences. However, for purposes of the definition of referential relation, a text is taken as a concatenation of sentences and a sentence is regarded as any utterance that is a consequence. One would expect -- in respect to the linguistic definitions provided -- a convergence in the set of utterances defined as sentences, or, rather, a convergence with explicable residual cases, although none is so well developed as to permit an assessment. The definition of section 5.4 would then be indifferent to the particular notion of sentencehood adopted.

1.2 Ambiguity. To accurately and reliably assess possibilities of cross-reference, either in a text or a sentence, requires some further distinctions. Let us call 'a textlet in respect to a given referential' a text for which the cross-reference can be resolved.[8] In the reading of (1) Susan discovered that she had misplaced a notebook. in which she is referential to Susan, (1) is a textlet in respect to she. If she cross-refers to some occurrence of a phrase in a preceding (or, as, e.g., a literary device, in a following text) text, it is not. One should distinguish (1) considered as a sentence in abstraction from the environment of a text and (1) as a single-sentence discourse: as a

single-sentence discourse only the former reading (she cross-referring to Susan) is available. Mention of different readings for (1) points to its ambiguity.[9] The status of sentences or texts as ambiguous differs from the vantage point of the speaker and hearer: generally (1) is not ambiguous in respect to the speaker.[10] In the present work the perspective is of the text or sentence as understood.

Readings of neighboring sentences will serve to disambiguage a sentence which in isolation is ambiguous.[11] If (1) is preceded by the sentence Sally is forgetful., the referend of she is Sally; indeed, the augmented text with she referential to Susan borders on incoherence. Again, consider (9) and (10):

(9) Otto is buying a car. It is red.

~ (10) Karen drank a light brown ale. The brown was rather dark.

Neither of these texts is ambiguous -- the second sentence of (9) would be considered ambiguous if isolated from the environing sentence; both of the sentences in (10) would be ambiguous considered apart from their neighbor.

Particular readings of sentences with referentials may be distinguished as "preferred". In (11) His mother despises Lionel., the preferred reading (or: readings) is one in which his does not cross-refer to Lionel (here (11) is taken as a sentence in isolation). Preceded by Lionel is certainly obnoxious enough, but who could hate him?, the preferred reading now has his cross-referring to an

occurrence of Lionel (there may be some indecision as to which occurrence is the referend). "Preferred" readings of an ambiguous sentence containing a referential phrase might be considered those readings which do not require a supporting text. However, the notion of a 'normal' context presumed here requires further amplification and empirical controls. It may prove possible to explicate this notion only with reference to sentences which are tacitly assumed in a variety of texts (cf. section 2.4).[12]

To summarize, examination of cross-reference would be clarified if the concept of sentence employed were specified. Similarly, it appears important to distinguish between readings of a sentence (a) in abstraction from a text, (b) as a discourse, and (c) which are preferred. Notions of obligatory, optional, or excluded cross-reference (such as are discussed in Reinhart 1983) are relative to assumptions made in regard to these concepts.

2. Referentials and Referends as Occurrences of Phrases. Definition (CR) incorporates a principle which can be stated as follows:

(0c) A referential is an occurrence of a phrase in a text and its referend is an occurrence of phrase in the same text.

In this section, and in part of the next, this principle is examined in some detail. (0c) is intended to include referentials which do not occur overtly in a text (section 2.2). Similarly, referends may also occur tacitly (section 2.3).

Consideration of this latter point will lead to an important revision in definition (CR).

2.1 Occurrences. In principle (0c) a phrase is a string to which some assignment of grammatical structure is made. For example, in the sentence Irene ordered her supper., Irene and supper are assigned the grammatical category of noun, order is a verb with -ed the tense-person suffix, and her is the possessive determiner of the nominal phrase her supper which can be analyzed as she together with a possessive suffix -s. "An occurrence of a phrase in a text" is not to be confused with a token; neither a sentence nor a text is a token.[13]

Certain phrases are referential only in some of their occurrences:

(1a) Alberti distinguishes sculpting and modeling. BOTH are important in fashioning a piece of sculpture.

(1b) Both sculpting and modeling are important in fashioning a piece of sculpture.

(2a) TWO RADIOACTIVE ELEMENTS can be used to date rocks: potassium and argon.

(2b) Rocks can be dated by two radioactive elements.

In (1a) both occurs as a referential whereas in (1b) it does not. Similarly, two radioactive elements is epiphoric in (2a) in contrast with its occurrence in (2b). The same remark obviously holds for referends: potassium and argon occurs as a referend in (2a) though not in, e.g., the text Potassium and argon are used to date rocks.

One question which arises in respect to (0c) is whether an occurrence of a phrase in a text can be identified as a

referential independently of the establishment of its referend. The question is of some import. Much interest attaches to the possibility of devising some procedure which could recognize referential phrases and then delimit their referends. Again, specification of sentences as "open", i.e., containing an unresolved occurrence of a referential, presumes that referentials are independently identifiable.

A positive response might be expected for "pro-forms", e.g., he, she, him, it, so, which, it is often assumed, are referential in each of their occurrences. However, this depends on how these words are specified. As Harris (1957:409) notes, pro-forms (pro-morphemes) are not specifiable in class structural terms, i.e.,at the level of Noun, etc. In the characterization subsequently given, pro-morphemes are defined as such in respect to occurrences of their referends:

> There exist morphemes whose X-co-occurrents (for each class X in constructional relation to them), in each sentence, equal the X-co-occurrents of a morpheme (of class Y) occupying a stated position (or one of several stated positions), relative to them, in the same sentence (or sequence of sentences), and whose total X-co-occurrents in all the appearances of these morphemes equal the sum of the X-co-occurrents of all the members of the class Y (which occupies the stated position relative to them). Such morphemes will be called pro-morphemes of the class Y, or pro-Y. (Ibid. 409)

Of course, these pro-morphemes can be simply enumerated. Still, contra the assumption above, not all pro-morphemes are referentials in all of their occurrences. For instance,

he may not occur referentially in certain discussions of a deity nor is it referential in the admittedly archaic -- The poorest he has a right to live as the greatest he. (from a declamation of a Leveller). A story may speak throughout its course of a certain he -- although it may be argued that he then has the force of a proper name (cf. below). In It's raining, it is questionably a referential.[14] The referential status of it may likewise be doubted for quasi-idiomatic phrases such as live it up, laugh it up. The situation with wh- forms (who, which, where, etc.) is complicated; a review is presented in section 8.

Admittedly, these cases appear exceptional and it may be possible to demarcate a particular group of constructions in which these forms do not occur as referentials. Still, not all referential occurrences of phrases involve pro-morphemes. (3) The salesman is aggressive is ambiguous between readings in which the salesman is anaphoric and a 'generic' reading. The epiphoric referential in (4) cannot be identified as such independently of the occurrence of its referend.[15]

> (4) A THEORY caused much consternation at a recent meeting of the oceanographic society. Researchers reported that tidal waves are initiated by rapid movements of sea-lions underwater.

Further questions concern the status of proper names. Several positions are available. It might be held that no occurrences of proper names are referential (in the

sense stated in definition (CR)) or that only non-initial occurrences are. Adoption of the latter position presumes recognition of the (initially occurring) referend for identification of the referential. Another point of view would assimilate all proper names to referentials. This position, which has been forwarded by Hiż, would presumably either reduce proper names to descriptions (here, following Frege)[16] which in turn are construed as referentials or would simply take occurrences of proper names themselves as referentials. Initial occurrences of proper names, reduced to descriptions or not, could be considered as referential to a tacit sentence assumed as known (cf. section 2.4). In this work, I do not consider proper names as referentials. However, it may be noted that in the research article described here (chapter 4), proper names are typically accompanied by citation numerals which are epiphoric referentials to articles given in the bibliography. The citation might be said to be equivalent to a description of the author.

Given this survey, the general answer to the question whether referentials are identifiable independently of their referend is negative. For certain isolable groups of phrases, e.g., pro-forms, independent identification of referentials may prove possible, granted some criteria excluding particular constructions. In other cases, e.g., proper names, there are questions which must be settled before an answer can be given. It might be possible to

provide a procedure permitting identification of phrases which are "possibly referential" (indeed, such identification is presumed in noting the ambiguity in (3) above). This answer suggests that there is no a priori way of delimiting the notion of "open sentence". Further, it suggests that a procedure for resolution of cross-references will require a pre-edited text marking occurrences of phrases which are referential.

2.2 Zero-Referentials. Principle (0c) covers phrases which occur as referentials in a text only tacitly; following Hiż (1969), such occurrences are called 'zero (or: tacit) referentials'. Consider the following texts:

(5) Soldiers camped by a lake. Most/many/few were exhausted.

(6) An experiment was run on February 8th. Results were obtained 2 days later.

(7) Han's letter was mailed Monday. Franz's response is expected soon.

(8) The arbitrators forwarded two positions. There is reason to expect a compromise.

(9) A baby was found on Jan's doorstep. Noone knows who the parents are.

(10) You discussed Church's thesis in class today. What's Kreisel's opinion?

In (5), one can 'read' after most, many, etc. a phrase of them, where them is referential to soldiers. The quantifier here is called an 'introducer' of the referential phrase. Texts (6)-(10) all involve relational nouns serving as introducers: (6) results (from it), (7) response

(to it), (8) compromise (between them), (9) parents (of it), (10) opinion (about it).[17] Some of these nouns are nominalizations of a verb, e.g., results. In some occurrences then, the subject and various complements of a nominalized verb (or: adjective) can be established as zero-referentials. In text (6), another introducer, the comparative later, occurs (later than this).

Quantifiers, comparatives, relational nouns, and various adverbs can occur as introducers of referential phrases. The referential phrases are commonly preceded by a grammatically specifiable preposition appropriate to the introducer, although both the referential and the preposition may admit of variant forms, e.g., later than this/that in (6), opinion on/regarding/concerning it in (10).

Zero-referentials may also be taken to comprise particular occurrences of conjunctional words, e.g., thus, however.[18] For instance, in (11), however is analyable as in spite of this:

(11) The experiment was run with strict controls. However, satisfactory results were not forthcoming.

Zero-referentials also invite comparison with the various zeroing operations in an operator grammar (GEMP, chapter 3.4-5 and chapter 2.21 below). For example, it has been suggested that the reduction of, e.g., (12a) to (12c), instances of repetitional zeroing, is analyzable with respect to the tacit referentials it and does in (12b):

(12a) New York State contains more townships than New York State contains cities.

(12b) New York State contains more townships than it does cities.

(12c) New York State contains more townships than cities.

Such an extension of zero-referentials (akin to what has been called 'null anaphora') is not examined in the present study; some considerations favoring this extension are presented in section 3.3 (see also chapter 3, section 3, and chapter 5, section 2, for further discussion of tacit referentials).

2.3 Referends. As stated in (0c), a referend is an occurrence of a phrase in a text. Some texts involve a "chain" of referential relationships -- in (13), her cross-refers to his mother and his is, in turn, referential to Phil:

(13) Phil thought his mother didn't like her cousin.

In the following texts the referend is a discontiguous phrase:

(14) Flo suggested to Rose that THEY meet at five.

(15) On entering the Uffizi, a spectator came across 3 PAINTINGS. The Santa Trinita Madonna is by Cimabue. Duccio painted The Rucellai Madonna and Giotto The Ognissanti Madonna.

(15) calls for further comment. For some texts with epiphoric cross-references across sentence boundaries, a rule of consequence can be stated, somewhat schematically,

as: $S_1 \cdot S_2 \cdot \ldots S_n \rightarrow S_1$ (i.e., S_1 follows from a concatenation of S_1, S_2, etc.). Replacement of 3 PAINTINGS by its referend yields in respect to this rule a consequence of this text (an adjustment -- cf. section 5.2 -- conjoins the 3 paintings mentioned). However, replacement of the referential by any (two) of the three Madonnas likewise yields a consequence of the text, although 3 PAINTINGS is only referential to the group. The occurrence of 3 PAINTINGS in (15) can be described as a "distributive" referential -- one can account for these various consequences while preserving the definition (CR) by decomposing the referential into three referential phrases -- a painting and a painting and a painting (alternatively, the sentence containing the referential phrase is decomposable into three sentences, each with a referential). A problem for this approach is presented by referential occurrences of phrases such as several paintings which cannot be so decomposed.

Another option is to attach a condition to definition (CR) to the effect that -- there is no other occurrence of a phrase (or: phrases) d such that replacement of the referential by d yields a paraphrase or consequence of the text. This condition would rule out some of the above-mentioned consequences of (15), e.g., On entering the Uffizi, a spectator comes across The Rucellai Madonna. Rather than to amend the definition of cross-reference,

the first option is adopted here, recognizing that qualifications will be required to handle other cases, e.g., several paintings.[19]

Tacit Referends. In one reading of the following sentence, the antecedent of it does not occur overtly in the text (an instance of so-called "missing antecedents", Grinder and Postal, 1971; Hankamer and Sag, 1976):

(16) Frank hasn't seen a narwhal, but Joey has, and IT is indeed an incredible whale.

Principle (0c) covers such texts in which the referend can be grammatically reconstructed as the inverse of some zeroing operation. In (16), seen a narwhal is reconstructed as an inverse of end-zeroing under the but (cf. chapter 2, section 2.1). It has as its referend the reconstructed phrase a narwhal with Joey has seen (a narwhal that Joey has seen).[20]

An apparent exception to (0c) is exemplified by (17):

(17) Stella has distributed her leaflets. SO has Jonas.

In one of its readings, (17) has as a consequence: Jonas has distributed his leaflets. But distributed his leaflets does not overtly occur in the first sentence of (17). The "difficulty" can be resolved as follows.[21] Recall that a phrase is a string along with an assignment of grammatical structure. The occurrence of her in (17) is analyzable as a functor, call it Poss (for "possessive")

applied to an argument, Stella. Poss can be read as one's; the referend of so for the reading considered is then distributed one's leaflets. In the replacement operation, one's is adjusted to agree with Jonas. That is, the functor Poss applied to the argument Jonas yields the desired his. Such grammatical adjustments are crucial in formulating various replacements of referentials (see the discussion in section 5.2); replacement cannot be simply identified as substitution.

2.4 Implicit Sentences. The understanding of particular texts often proceeds by, or at least is assisted by, sentences "read between the lines". For instance, the cross-reference indicated in (18) is established in part by knowledge that Churchill was a Prime Minister:

(18) Roosevelt and Churchill met at Yalta. THE PRIME MINISTER looked haggard.

Similarly, an arithmetical sentence, e.g., Two is a prime (number)., is used in (19) to resolve the referential:

(19) Four and two are divisors of eight. THE PRIME is a divisor of six as well.

Section 2.42 shows in what way the definition of referential relation can be extended to incorporate the effect of implicit sentences in resolving particular cross-references. First, some other approaches to implicit sentences are reviewed.

2.41 Approaches to Implicit Sentences. One approach to implicit sentences, discussed in greater detail in

Mathematical Structures of Language (section 5.6) consists in a regularization of conjunctional sequences. The attempt here is to establish for particular conjunctions the amount of repetition in sentences conjoined by them. Simplifying somewhat, the procedure is to compare the differing acceptabilities of conjoined sentences which repeat particular phrases in the conjuncts and those which do not. It is then noted that to these latter sentences, which occur with lower acceptability, intermediate sentences can be conjoined which (a) increase the acceptability of these sentences and (b) provide the requisite amount of repetition. Thus, the low acceptability of:

(20) Turkish generals jailed trade unionists because it was raining.

is raised if a sentence repeating particular words in (20) is conjoined to it, as, for example, in (21):

(21) Turkish generals jailed trade unionists because Turkish generals are always in a bad mood when it rains.

The particular intermediate sentences which can be conjoined are not specifiable beyond their satisfying, together with the conjunctional sequence, the word-repetition requirement.

Another tack is to assume that each sentence is provided with dictionary definitions of the various words of which it is composed. This approach is suggested by Harris as a way of avoiding the inclusion of various nonsensical phonemic sequences, e.g., Ar blipstan raskers dother, among the sentences of a language.[22] However,

such sequences can also be separated out by noting that they are only interpretable via metalinguistic sentences (cf. section 4) which provide a 'translation' into familiar words, e.g. "Blipstan" means at lunch.[23]

2.42 Assumptions. The approach adopted here incorporates aspects of the two mentioned above. Consider the text given as (22):

(22) Timothy finally found an apartment. However, there is a hole in THE CEILING.

There is no evident antecedent for the referential phrase the ceiling in this text. However, from the first sentence of (22) and the general sentence -- Apartments have ceilings -- the sentence The apartment that Timothy finally found has a ceiling can be concluded, which does contain a referend. Principle (0c) and the definition of cross-reference can thus be extended to:

(0c') A referential is an occurrence of a phrase in a text and its referend is either --

(a) an occurrence of a phrase in the same text, or

(b) an occurrence of a phrase in a consequence (by a rule of consequence (R_C) of (i) some sentence of the preceding text, i.e., the text up until the sentence (or: sentence-fragment) which contains the unresolved referential, and (ii) an unordered set of standard assumptions, A.

The set A mentioned in (0c') calls for some specification. The sentences which comprise the unordered set A of assumptions may be restricted to those which contain only intra-sentential cross-references, if any. Many of the sen-

tences in A are general sentences, such as Apartments have ceilings above. Furthermore, the assumptions invoked in any particular application of a rule of consequence repeat -- perhaps in altered form -- certain words of the text which precedes the sentence containing the referential to be resolved, e.g., apartment in (22).[24]

The set A consists of what is referred to in (0c') as "standard assumptions". For instance, it may well be that there are apartments without ceilings, say, during renovations. But unless there is an explicit assertion to that effect in the text, the standard assumption -- that they have ceilings -- applies.[25] One might more broadly define A to consist of all of the preceding text along with its standard assumptions and its consequences. In this case the set A expands as the reading of the text proceeds. This broadened definition would presumably need to provide a description of the way in which in certain texts contradictory assumptions are sometimes alternately and provisionally adopted in the course of argumentation.

A notion, akin to "standard assumptions", is that of background (or: common) knowledge", appealed to in some work in pragmatics. This notion is too loose for a description of cross-reference. A minimal requirement on the set A is that it be consistent; if it were not, any sentence could be concluded. It is dubious whether all of

"common knowledge" satisfies even this restriction. In respect to a particular text not all background knowledge is invoked, but rather a specific portion of it. A restriction to particular background assumptions is more prominently the case with a scientific sublanguage (cf. chapter 2). In scientific sublanguages, assumptions often pertain to "prior sciences", i.e., sciences whose results are assumed in the course of investigating a particular problem. For example, statistics is assumed in geographical ecology, various laboratory procedures are assumed in cellular immunology.

Various refinements and controls are needed to establish for a given text the relevant set A. For instance, to determine what constitutes a "contra-indication" to use of a standard assumption is a major problem. Nonetheless, prospects for resolving these issues appear more tenable in considering a scientific sublanguage. It is of interest in any event to note those cases in which a cross-reference is resolved by use of assumptions and to set out the resolution procedure explicitly so that this concept can be elaborated.[26]

2.5. Same Text. It should finally be noted that Principle (0c) and its emendation (0c') states that any given referential relation is within the same text. Of course, within a given text there may be citations from other discourses or sentences of other texts may play the role of

assumptions. For reasons made explicit in section 4, statement of a cross-referential relation requires that the material in a given text is linearly ordered. And this is not the case for material in different discourses. One can accommodate typically epiphoric footnote numerals as well as bibliographic citations as linearly ordered interruptions stationed at specifiable positions of the text (see chapter 3, section 1).

3. Reference and Cross-Reference. The preceding characterization of a referential relation as one between occurrences of phrases stands in a marked contrast to a more commonly accepted statement of co-reference[27], presented schematically below as strong co-reference, (SC):

(SC) A phrase a corefers with a phrase c if there is an object b such that a refers to b and c refers to b.[28]

In this section the aim is to render explicit some distinctions presented by these two formulations and to address some consequences of (SC) insofar as it is used in a description of (part of) what is termed 'cross-reference' above.

A distinction which underlies those of section 3.1 is one between weak and strong semantics.[29] A weak semantics studies the extent to which various semantic relations among texts (and sentences), e.g., consequence, paraphrase, negation, generalization, are characterizable in terms relating to the composition and arrangement of

texts, i.e., syntactically. Thus, it relates phrases to other phrases in its descriptions of these relations. In a strong (or: stronger) semantics, concepts such as truth and denotation are used which relate, in one way or another, linguistic elements and 'the world' ('the world' in some studies may be a set-theoretic model). (SC) is formulated in respect to the (possibly primitive) notion of reference and is a part of some strong semantics. The discussion which follows is intended to be largely independent of particular theories of reference.[30]

Philosophic as well as linguistic interest attaches to the weak semantical definition of referential relation provided in the present essay.[31] In section 3.3, I suggest that concepts of strong semantics need not enter into a description of cross-reference and consider some difficulties attendant upon that position, e.g., in respect to deixis.

3.1. Strong Co-reference. (SC) requires some elaboration. In the scheme either the phrase a or the phrase c is often termed a "referential"; one of the phrases is generally distinguished as a definite pronoun, e.g., he, she, it, or a reflexive form, e.g., himself.[32] A referential in this usage descending from philosophical examinations of logic, is a phrase which 'has reference', e.g., a denotation. These referentials are generally restricted to particular nominal phrases -- proper names and "definite

descriptions" -- which in philosophical parlance are 'singular terms', and so-called mass nouns. Collectively, these are termed "referring expressions" by some authors.[33] In the case of singular terms (and, for some philosophers, "mass" nouns as well), "refers" in (SC) can be specified as "denotes"; 'b', termed the "referent", is the thing denoted. The character of these things varies with differing philosophical doctrines, e.g., concepts, monads, sensations. Chomsky (1981:102), for instance, includes among R(eferential)-expressions nominal phrases which are not singular terms nor mass nouns, e.g., the abstract noun sincerity (a nominalization of sincere); such phrases are said "in some intuitive sense 'potentially referential'". If referentials in this sense are extended to certain occurrences of pluralized noun phrases, e.g., the occurrence of pandas in Pandas are nearly extinct, classes are then among the referents; the relation of reference is sometimes called 'signification'.[34]

A more cautious formulation of (SC) would restrict the term 'referential' to occurrences of phrases. In a sentence such as Cortez sought the fountain of youth, Frege, for instance, would distinguish the ordinary (gewöhnlich) occurrence of Cortez and the oblique (ungerade) occurrence of the fountain of youth (Quine speaks of purely referential or designative occurrences and opaque contexts). Frege provides another reason for such a restriction: in Francis sings well but is no

Chaliapin., Chaliapin occurs not as a proper name, but (in Frege's terms) as a concept-word.[35]

The concept of referential forwarded in definition (CR) and in section 2 is perhaps more aptly called 'cross-referential' as it relates occurrences of phrases. By way of contrast, the notion of 'referential' addressed above can be characterized independently of co-reference (or: cross-reference). A referential in (SC) -- unlike a cross-referential -- is usually restricted to particular nominal phrases (cf. below). Most discussions do not consider an extension of this concept to other grammatical categories, e.g., considering the denotation of the verb sketch as a set of ordered pairs.[36]

A 'referent', as noted above, is an extra-linguistic entity. Some studies identify a referend as a 'discourse referent'. It is important to clearly distinguish referends and referents. Whether a term denotes one entity, many entities, or no entity is not properly a matter for linguistic investigation, but a matter of fact. For Mill, it seems, denotation is defined in respect to truth: a name denotes the things of which it is affirmable in true propositions.[37] Referends and not referents are "antecedents" of other occurrences of phrases: linguistic operations, such as substitution are properly applicable to referends and not to referents.

Similarly, one should distinguish 'interpretation' in the sense in which it is equivalent to 'reading'

(section 1.2) and as an assignment of a referent to a phrase. A related distinction is that between 'context' in the sense of 'text' (section 1.1) and as an extra-linguistic situation. Again, indeterminacy in determining the referent of a phrase is more aptly an instance of vagueness rather than ambiguity. Failure to observe these distinctions is a source of occasional obscurity in linguistic discussion.

3.2. Co-Reference and Cross-Reference. Granted these distinctions, what is the status of (SC) in respect to a description of cross-reference? It should first be noted that co-reference is a relation which is symmetrical in respect to the phrases a and c -- thus, (SC) does not discriminate between anaphora and epiphora (cf. section 7). Secondly, in a sentence such as:

(1) Before SHE retired, Callas sang at Carnegie Hall.

(SC) requires that the pronominal phrase she independently refers to an object, i.e., without respect to the phrase Callas. This appears counter-intuitive: an evaluation of whether she and Callas refer to the same object presumes a recognition that she cross-refers to Callas. Co-reference, i.e., reference to the same entity, as an interpretation of a cross-reference (in the sense of (CR)) might be called 'weak co-reference'. That she in (1) refers independently to an object suggests to some authors that the relevant notion in (SC) is

'intended reference'.[38] Such a notion assumes the perspective of the speaker in contrast with the perspective here (section 1.2).

In comparison with the notion of cross-reference, (SC) applies to a restricted range of cases (cf. below). Even within this range, an evaluation of (SC) presumes an explicit ontology. In (2) and (3), sameness of referent makes sense only given a prior elucidation of the ontological status of the putative referents:

(2) The Great Depression hit America in 1929 while IT arrived later in Europe.

(3) Lions, who love meat, get IT every day.

The notion of 'same referent' may be credited with some initial plausibility given the generally restricted inventory of examples cited on its behalf. These examples typically turn upon pronouns, e.g., he, his, her, and names of particular persons, as in:

(4) Ben is an absolute scoundrel in his office.

Matters are otherwise in scientific texts where there is often an interest in describing regularities among classes of individuals or events. Consider the cross-reference indicated in the following passage from an article on cellular immunology:

(5) On the 10th day agglutinins were found in the ear tissue on the injected side but not until the 12th day did THEY appear in the nodes of the uninjected side.[39]

Previous sentences of the text establish that the nodes and ear tissue are obtained from different mice sacrificed on different days following injection of an antigen. Thus there is no question in (5) of agglutinins and they having the same referent.[40] Such cases are by no means exceptional.

3.3 Elimination of Reference. Clearly it would be advantageous if a description of what has been termed "cross-reference" could proceed without making use of the concept of reference. I suggest that this is in principle possible. Some evidence on behalf of this contention is presented in section 3.31. Section 3.32 addresses the thornier issues posed by deixis. The gain in eliminating reference as an independent primitive in linguistic theory is that grammatical inquiries can be made in abstraction from difficult questions in ontology, e.g., concerning individuation of entities. Moreover, to the extent that ontology is deemed relevant, individuation is not generally considered contentful absent a way of differentiating among entities which can be rendered in linguistic form. An examination of cross-reference is plausibly relevant in respect to these concerns.

3.31. Some Considerations. Strong co-reference (SC) is clearly neither necessary (6) nor sufficient (7) for cross-reference:

(6) The lawyer who charges his clients too much is hardly worse than the lawyer who charges THEM somewhat less.

(7) If Evert met the author of "It Tastes like Chicken", then Evert met Willard Van Orman Quine.

Similarly, it is generally acknowledge that (SC) is irrelevant in the following cases:

(8) If a dentist is nervous, HE should take the day off.[41]

(9) When you first come upon THEM, alligators seem rather fierce.

(10) Every machinist has his bad days.

(8) and (9) do not pose any problems for the definition of cross-reference whereas for (10) it is not clear in what manner the replacement operation can be effected (cf. sections 5.4 and 10). Certainly under some construals of quantification the question of reference reemerges. However, contra Quine, it appears to be possible to sever the matters of existence and quantification.[42] An adequate description of cross-references such as that in (10) requires in any case an examination of how quantification operates in English (section 10). Cross-reference, finally, houses instances of referentials to verbs, complements of verbs, and sentences, which can questionably be accommodated in terms of (SC).

Is principle (0c') and definition (CR) adequate to those cases covered by(SC)? The answer appears to be positive. Indeed, the notion of weak coreference forwarded

above -- as an interpretation of a cross-referential relation -- strongly suggests that coreference is eliminable, i.e., no descriptive work is performed by it.

Weak coreference might be thought necessary to account for sentences such as the following:

(11a) Gertrude discovered that SHE had lost a watch.

(11b) Gertrude discovered that Gertrude had lost a watch.

It might be claimed that replacement of the referential she by Gertrude yields (in respect to an identity transformation) the sentence (11b) in which the Gertrudes are not the same, whereas to state that she refers to whatever entity Gertrude refers to avoids this problem. (11b) is nonetheless acceptable in the reading where only one Gertrude is at issue. Whether (11b) is a paraphrase or a consequence of (11a) is a more difficult question. There appears to be a change in nuance in such sentences -- cf. Oscar thinks Oscar is a fool. In (11b), the second occurrence of Gertrude might be said to have the sense of "the public Gertrude", "Gertrude as she believes others see her". These cases might also be handled by extending the formulation of replacement to include a "resumptive antecedent"; in section 5.4, this is termed 'quasi-replacement'. Quasi-replacement would add the referend as a qualification or elaboration of the cross-referential -- in (11a), this would yield:

(11c) Gertrude discovered that she (Gertrude) had lost a watch.

The extended referential phrase she (Gertrude) could be rendered as "she, that is Gertrude".[43]

Sentences such as (12) pose greater difficulties for the elimination of reference:

(12) Men came and went.

In one reading of (12), the same men came and went; in another reading, no. Here one might make use of the suggestion that some operations of zeroing be analyzed in respect to zeroed-referentials (section 2.2). (12) in respect to the first reading is analyzable as Men came and they went with a zeroing of they; in respect to the second reading, (12) would be obtained from Men came and men went.[44]

3.32. Deixis. Eliminating the concept of reference appears most difficult in respect to the variously called "deictic", "demonstrative, "egocentric", or "indexical" uses of particular phrases which are characteristically said to "indicate objects in the context (or: situation)", usually different objects on different occasions. Thus, an utterance containing an occurrence of I will name different people when said by myself and another reader of this work. The list of "deictics" also typically includes you, we, he (and other personal pronouns), this, that, tense, and such adverbs as here, now, tomorrow.

Deixis itself is a poorly understood area. Deictic occurrences of phrases are sometimes associated with gestures (e.g., pointing) which are themselves questionably describable in terms of the discrete elements of grammar. The discrete character of linguistic elements is introduced by considering in a linguistic description those properties of utterances which are invariant under repetition. Thus, a grammar will abstract from, e.g., particular intonations of sarcasm, in describing an utterance.[45] In this connection it is of interest to note that (11a) above with she used deictically is markedly different in intonation from (11a) where she cross-refers to Gertrude. Is one a repetition of the other? The answer is not clear, which again may point to the "borderline" character of deixis, i.e., its connection with gestural features not accommodated within particular linguistic descriptions.[46]

Given this state of affairs, any discussion of deixis is likely to raise more questions than it answers. The intention here is merely to prompt some doubts toward a too-ready appeal to reference and to outline an alternative approach in line with cross-reference.

Clearly, some deictic phrases enter into cross-references -- as, for instance, she in (11a) and this and I in:

(13) Pierre sermonized constantly. THIS angered Norman.

(14) Thoraf said to Ingrid, "I should leave Oslo".

Other deictic occurrences can be assimilated to referentials (within the definition (CR)) by assumption of a tacit sentence in which there is a referend phrase (cf. section 2.42).[47] In the case of a deictic occurrence of she in (11a), the tacit sentence might be I am speaking of a woman or We see a woman, and she would be referential to someone or a woman (we see).[48] However, several questions can be raised concerning this approach. Firstly, there is perhaps a difficulty with misattribution -- say, in the event where the person spoken of is in fact merely a shadow (cf. Donnellan, 1966). This does not appear to be an issue for the (weak-semantical) definition of cross-reference, i.e., the tacit sentence is not characterized in respect to its truth or falsity.[49] More difficult is the apparent regress posed by the introduction of I and we in the tacit sentences. One approach would be to take such occurrences as proper names -- though, as noted in section 2.1, proper names may themselves be considered referentials to referends in tacit sentences. Another is to take these occurrences as reductions of speaker (or: speaker and audience). Whether either option suffices to eliminate the regress requires further consideration.[50] Finally, there is a question whether occurrences of tomorrow, now, here can be described as referentials. In texts with locutions such as It is a matter here of... or ...is considered below, here and below can be regarded as "meta-referentials" (section 4).

Despite these concerns, there are instances in which the 'salient feature' referred to by a deictic occurrence of a phrase is not some physical feature of the situation but appears to be only identifiable in respect to tacit sentences assumed of a speaker or held by a group. If in a discussion of Elizabethan drama someone notes "The Alchemist" is a delight and another responds His plays are rarely performed, his is aptly described as cross-referential to Ben Jonson in a tacitly assumed sentence, e.g., "The Alchemist" is a play written by Ben Jonson. Reference to situations or features of them often appears to 'lead back to' linguistic forms in terms of which they are identified or characterized.[51]

4. Metalinguistic Character of the Referential Relation. As I argued in section 3, the identification of a particular cross-reference is not dependent upon some property such as "shared referent" (especially section 3.3). In accord with definition (CR), occurrences of phrases are identified as referential and referend in a metalinguistic sentence in which these occurrences are mentioned. The possibility of so identifying cross-references is a product of two facts: (i) the material, i.e., segments, in a text can be linearly ordered, and (ii) a natural language contains one of its metalanguages. To cite the positions of the occurrences of phrases in a given referential relationship requires some means of counting the

segments of a text -- these segments being classified as to their grammatical status. The linear ordering of segments provides for the counting; that a natural language contains one of its metalanguages provides for a statement of the counting and the classification in a sentence of that language.

The distinction appealed to here -- between a metalanguage and its object language -- is precisely that made by Tarski (following Leśniewski) "between the language about which we speak and the language in which we speak" (Tarski, 1956:167). Referential phrases which are themselves metalinguistic, as the former is in (1), exemplify the point of (ii):

(1) Schneider conducted compositions by Bach and Handel. Rose preferred the former.

(compare the latter, the second mentioned, and the jocular use seen in John will buy it tomorrow. "IT" is a new stereo.). In (1) the former does not pertain to the order of Bach and Handel's appearance (Bach was born later) nor to the order of the compositions in the recital (which may have been interspersed). Rather it pertains to the order of recitation and cross-refers to compositions by Bach (together with Schneider conducted). One may consider the former as short for the former compositions mentioned. Metalinguistic adjuncts of this sort, e.g., which I have just mentioned, are encountered in the article described in chapter 4, e.g., referred to/mentioned above and can be directly incorporated into a description

of cross-reference (as in Gross, 1973). Occurrences of above, below (perhaps here, now as well) are more difficult to describe -- these are higher-order referentials relating to the overall organization of the text and will not be addressed in the description of the article.

The metalinguistic apparatus required to state a given cross-reference is quite involved. Details are presented in section 5.7 of Harris' Mathematical Structure of Language. In the analysis presented in chapter 4, this apparatus is not laid out. Instead I make use of an enumeration of the text sentences and of referential and referend phrases. What is essential to note here is that (i) and (ii) above permit a 'translation' of these notational devices into metalinguistic sentences which can be explicitly adjoined to the text and which state the referential relation obtaining between referential and referend. The notation is thus an auxiliary device which can be dispensed with in a complete analysis.

5. A Definition of Referential Relation. The informal definition of cross-reference (CR) presented in section 0 (and reprinted below) is based on the intuition that some texts with a referential replaced by its referend follow from, or are paraphrases of, the initial text.

(CR) In a given text, an occurrence of a phrase, $\underline{a}_1$, cross-refers to an occurrence of a phrase, $\underline{c}_1$, with respect to a rule of paraphrase or consequence R if and only if application of R to the text with replacement of $\underline{a}_1$ by $\underline{c}_1$ yields a paraphrase or consequence of the original text.

To gain a better understanding of (CR), consider the following text:[52]

> (1) Herzen's entrance into the world coincided with a great event in the annals of Russia and Moscow - a fact of which he was always proud - the Great Patriotic War of 1812. He was born in Moscow on March 25 of that year, just a few months before the capture of the city by the French.

The first sentence of (1) with he replaced by Herzen is a consequence of this text as well as a paraphrase of the initial text-sentence. An epiphoric referential also occurs in this sentence -- namely, a great event in the annals of Russia and Moscow. Replacing it by its referend yields: Herzen's entrance into the world coincided with the Great Patriotic War of 1812..., which also follows from (1). Along with a substitution of Herzen for he, replacement of which (with permutation of the PN-phrase) results in the consequence: Herzen was always proud of a fact. The dashes in the first sentence of (1) can be considered a variant of the relative clause (plus the constant is), i.e., which is a fact of which he was always proud, where the first which (or, more precisely, -ich) is referential to the preceding fragment. Replacement of which requires an adjustment in the referend (cf. section 5.2), a nominalization, and it is concluded that: That Herzen's entrance into the world coincided with a great event in the annals of Russia and Moscow is a fact of which he was always proud. The second text-sentence contains an

occurrence of he, replaceable by Herzen and two occurrences of referential phrases with classifiers -- that year, the city -- with referends 1812 and Moscow (the second occurrence) respectively.

Even in this rather simple text there are complications -- for instance, in the treatment of some occurrences of the definite article (section 8.4), e.g., the annals of Russia and Moscow. Still, one can list a number of sentences which follow from, or are paraphrases of, the sentences of (1). Among them: Herzen's entrance into the world coincided with the Great Patriotic War of 1812., Herzen was born in Moscow., Herzen was born on March 25 of 1812., Moscow was captured by the French.. In this sample I have proceeded informally -- the full definition of cross-reference (5.3) requires some preliminary explications of consequence (5.1), replacements and adjustments (5.2).

5.1 Concepts of Consequence. Some elaborations of the concept of consequence deserve mention here, if only for the purpose of contrasting them with the less rigorous employment of the notion in this work. One of these is the concept of provability: a sentence a is said to be provable from a set of sentences A if a can be obtained from A through a finite sequence of applications of rules of inference, e.g., in many logical systems, the rules of detachment and of substitution. Another, semantical

notion, concerns the preservation of truth. This has been developed along two lines.

5.11 Logical Consequence. In Tarski's paper "On the Concept of Logical Consequence" (article XXI in Tarski, 1956), logical consequence is defined in terms of the primitive concept, 'satisfaction of a sentential function (by a sequence of objects)', and 'model' (itself defined in respect to satisfaction). If, for a particular class of sentences L, all non-logical constants occurring in the sentences of L are replaced by corresponding variables established for L (with like constants replaced by like variables, and unlike constants by unlike variables), one then obtains a class of sentential functions. A model is then an arbitrary sequence of objects satisfying every sentential function of that class. And a sentence a is a logical consequence of a set A of sentences if a is true in every model in which all sentences of A are true.

5.12 Semantic Consequence. A concept of consequence can also be developed in a semantics in which the concept of truth is a primitive term. This semantical theory -- aletheism -- is presented in a number of recent papers of Hiż.[53] Here a central notion is that of truth set, a set of sentences taken as true. The conditions which these sets should satisfy are established as axioms of the theory. Some axioms state properties of the consequence

relation which are shared by the other concepts mentioned above.[54] Others differ from axioms established for particular deductive sciences -- they have been framed in respect to their application to natural languages, or scientific sublanguages (for example, see the discussion of the axioms of compactness and conjunction in Hiż, 1979).

Semantic consequence is defined in terms of the notions of truth set and interpretation. The concept of interpretation (and semantic consequence) is closely related to the Tarskian concept of satisfaction (and logical consequence). But whereas satisfaction is a relation between a sentential function and a sequence of objects, the relation of interpretation holds between (linguistic) phrases. Loosely, a phrase a interprets a sentence b at c means that replacement of c in b by a yields a true sentence.[55] For instance, anthology interprets the sentence Milosz edited a journal at the occurrence of journal as it is true that Milosz edited an anthology. A sentence a is a semantic consequence of a set A of sentences just when every interpretation of the set A is an interpretation of a (cf. logical consequence above). In terms of these notions, one can define the meaning of a sentence a in respect to a set A of sentences (A in certain cases could be a set of assumptions) as the consequences of A and a less those which are consequences of A itself (Hiż, 1979:351-52).

5.13 The Role of Consequence in the Analysis. In framing the definition of cross-reference given in section 5.3, no fully explicit concept of consequence is provided. A useful concept of consequence for a natural language or scientific sublanguage can be approached by stating rules of inference. I start with the elementary observation that from texts and utterances speakers of a language draw inferences. Rules of inference are (partial) descriptions of these regularities in the activities of members of a speech community; they are not to be construed as 'guiding' these activities, nor as normative (or, in some sense, pragmatic). That is, the rules do not characterize conditions under which a speaker should accept a particular inference, although acceptability of stated inferences provides a crucial test of the adequacy of proposed rules. In terms of rules of inference (and of paraphrase) the concept of referential relation can be defined, and if need be, refined. From Mathilda sat her children down in the waiting room., we conclude Mathilda's children sat down in the waiting room.; from Paul has a sweater. The sweater is blue., it is inferred that A sweater Paul has is blue. It is such rules of inference relating such sentences which I seek to establish.

The concept of referential relation makes use of such notions as that of a text -- taken as a string of ordered sentences, a set A of assumptions, and rules of inference. In this, there is an analogue though not an explicit

bridge to the concepts discussed above. As with the concept of provability and unlike the two semantical concepts of consequence, consequence as employed here does not make use of the concept of truth, and thus may be characterized as a "weak semantics" (cf. section 3). This should not be taken to suggest the elimination of semantics. The analysis of cross-referential relation, as the operator grammar and discourse analysis discussed in chapter 2, aims at rendering explicitly, in formal terms, semantic distinctions among sentences and texts. While using a restrictive semantics, i.e., not employing the concept of truth, it is closest in esprit to alethe-ism and it is into this theory that the results established here can be most naturally fitted.

The point of departure for the analysis is a text in a sublanguage of cellular immunology and not a formalized language for which concepts of provability and logical consequence can be framed. Some semantical theories attempt to translate the sentences of a natural language into a formalized one for which axioms and rules of inference are stated. For instance, a concept of consequence akin to that of Tarski has been elaborated for fragments of English by Montague (1974) and his successors. Some doubts can be stated regarding the adequacy of such model-theoretic programs for a description of cross-reference. It is, firstly, not clear in what way the concepts provided in model-theoretic accounts can be

extended to texts. The concept of translation is itself problematic. Among the problems is that a natural language lacks an external metalanguage; it is doubtful whether one can construct a substantially rich metalanguage in which, e.g., rules of inference, can be stated (Bestougeff and Descles, 1977:8-17, and Hiż,1983:42-52 note other problems regarding translation). Moreover, the concept of satisfaction, crucial to these accounts, involves that of reference which it would be preferable to avoid (section 3).[56] The rules of inference provided in the description of the article are thus stated in respect to categories established in a transformational grammar of English.

5.14 Consequence and Paraphrase. The exact relation between the concepts of consequence and paraphrase requires further study. Many of the rules of paraphrase here are adopted from an operator grammar of English (GEMP). Certain steps in an operator grammar derivation (analysis) of a sentence can be regarded as consequences of that sentence -- for instance, some component sentences of (2) Frank swims in the afternoons at a pool in Brooklyn are consequences of this sentence, e.g., Frank swims., Frank swims in the afternoons. In some cases determining whether a relation between sentences is one of paraphrase or of consequence may prove difficult. For instance, it is unclear whether a cleft-sentence, e.g., It is Sal who

drank too much chianti, is to be taken as a paraphrase or consequence of its non-cleft counterpart, e.g., Sal drank too much chianti.

One may adopt the following hypothesis concerning the relation between consequence and paraphrase:

> (Hyp) A sentence a is a paraphrase in respect to a set A of assumptions of a sentence b if Cn (a,A), i.e., the consequences of a in respect to A, coincide exactly with Cn (b,A).

This hypothesis, forwarded by Hiż in "Aletheic Semantic Theory", is implicit in Frege's Begriffschrift:[57]

> ...the contents of two judgments may differ in two ways: either the consequences derivable from the first, when it is combined with certain other judgments, always follow also from the second, when it is combined with these same judgements, and conversely, or this is not the case. The two propositions "The Greeks defeated the Persians at Plataea" and "The Persians were defeated by the Greeks at Plataea" differ in the first way.

In "Aletheic Semantic Theory" (1969:446), Hiż presents another hypothesis relating these two concepts which directly bears upon the examination of cross-reference:

> a is a consequence of b iff either a is a paraphrase of b or else there is a c such that a · c is a consequence of b.

The '·' is taken to be either a period between sentences or a corresponding intonation pattern. For example, in sentence (2) above, Frank swims in the afternoons at a pool in Brooklyn can be taken as b with Frank swims. = a and He does it in the afternoons at a pool in Brooklyn. = c. As Hiż notes, the hypothesis requires a restriction on a

prohibiting epiphoric referentials across sentence boundaries. Otherwise, in (2), a can be taken as Here is what Frank does in the afternoons (with c = He swims at a pool in Brooklyn.) which is not a consequence of b. An examination of referential relations might lead to a revision which would account for epiphoric references of the sort described.

5.2 Replacements and Adjustments. The simplest cases of replacement involve substitution of the referend for the referential phrase. For instance, in (3) Alice writes short stories. She likes it well enough., the occurrence of she is replaceable by Alice. The replacement operation can be written 'Repl (b; a_i/c_i)' for replacement of referential a_i by referend c_i in text b. That replacement is not equivalent to substitution can be seen by considering the replacement of it in (3). The referend of it is either writes short stories or the first sentence. Substitution of the first possible referend would yield the ungrammatical She likes writes short stories well enough. Replacement in this case requires an adjustment of the referend to the nominal grammatical category of the referential -- for example, a weak nominalization -- writing short stories. In the second case, two adjustments are required -- the first a nominalization, e.g., Alice's writing of short stories, and the second an adjustment of Alice to the accusative form her. Re-

placement thus yields She likes her writing of short stories well enough.

Many adjustments are automatic, i.e., morphophonemic, operations. To replace they in Vic drives a Volvo. They get 38 m.p.g. requires that the referend, Volvo, be pluralized. In (3) Noah as a rule divulges his secrets when I do., do is referential to the preceding verb along with its complement. Two adjustments are involved in the replacement: one alters the verb so that it is in agreement with I, i.e., to divulge; the other alters the possessive his (which can be written as Poss(Noah)) so that it too agrees with I: Poss(I) = my.

Other adjustments involve a change (including zeroing) of a preposition: in (4) A gin-and-tonic is prepared in the following way. Gin is poured in a glass and tonic is added., replacement of the epiphoric referential the following way requires in addition to the nominalizations a change of the preposition in to by: A gin-and-tonic is prepared by pouring gin in a glass and adding tonic. A preposition, of, is zeroed in the replacement of them in (5) Sturtevant and Bridges studied fruit-flies. Both of them made decisive contributions to genetics.

Replacement of referentials is generally made one-by-one, i.e., independently, for each given referential relation, and not successively -- that is, to the resultant of a prior replacement, nor simultaneously. Simultaneous

replacement would often result in unwieldy sentences if the sentence contained several referentials. The possibility of successive and simultaneous replacement of referentials in certain situations is noted in section 5.5.

The definition of cross-reference does allow for what can be called a "double replacement" in the case of particular referential relations. Double replacement seems to be only applicable in the case of intra-sentential cross-references. In (6) for instance:

(6) When Caravaggio was about twelve, HE was apprenticed to Simone Peterzano.

he is replaceable by the referend Caravaggio, and the referend by he in respect to a rule of paraphrase: When S_2, $S_1 \longrightarrow S_1$ when S_2. Double replacement results in:

(6') Caravaggio was apprenticed to Simone Peterzano when he was about twelve.

There are only a few adjustment operations which are employed in the "Influenzal" article in chapter 4. In order that the article as transcribed not be burdened with a surfeit of notation, the notes to the description are prefaced by a list of adjustments: the notes mention each case in which the adjustments are applied. In several cases, the replacement of referentials is more complex -- some discussion can be found in sections 5.5, 8, and 10.

5.3 A Definition of Referential Relation. In a text b, an occurrence a_1 of a phrase a is a referential for (i.e.,

cross-refers to) an occurrence $\underline{c}_1$ of a phase $\underline{c}$ (and $\underline{c}_1$ is a referend of $\underline{a}_1$) with respect to a set of assumptions A and a rule R if and only if:

(1) $\underline{b}$ is a text

(2) A is a set of assumptions

(3) $\underline{a}_1$ is an occurrence of $\underline{a}$ in $\underline{b}$

(4) $\underline{c}_1$ is (i) an occurrence of $\underline{c}$ in $\underline{b}$, or (ii) an occurrence of $\underline{c}$ in a sentence $\underline{d}$ which follows by a rule of consequence R_c from the preceding text (i.e., the text up until the sentence containing $\underline{a}_1$) and the set A

(5) R is a rule of paraphrase R_p (case i) or a rule of consequence R_c (case ii) such that for some grammatical adjustments f, g, the application of R_p or R_c to $\underline{b}$ with

Repl $(\underline{b};\underline{a}_1/f(\underline{c}_1))$ or

Repl (Repl $(\underline{b};\underline{a}_1/f(c_1))$; $\underline{c}_1/g(a_1)$)

yields a text $\underline{e}$ containing

Repl $(\underline{b};\underline{a}_1/f(\underline{c}_1))$ or

Repl (Repl $(\underline{b};\underline{a}_1/f(\underline{c}_1))$; $\underline{c}_1/g(\underline{a}_1)$)

which is a paraphrase (case i) or a consequence (case ii) of $\underline{b}$.

5.4 Some Illustrations.

Example A. In the first text-sentence of (1), call it (a)--

> Herzen's entrance into the world coincided with a great event in the annals of Russia and Moscow - a fact of which he was always proud - the Great Patriotic War of 1812.

a paraphrastic identity transformation is applied with

Repl ((a); he/Herzen), resulting in:

> Herzen's entrance into the world coincided...- a fact of which Herzen was always proud - the Great Patriotic War of 1812.

which is a paraphrase (a).

Example B. In (7):

> In Goya's Sad presentiments of what will happen, he shows an elderly man in a gesture of despair.

a paraphrastic transformation is applied which permutes the initial PN-phrase to the end of the sentence. With the double replacement Repl((Repl(7);he/Goya);Goya/Poss (he)), this transformation yields the paraphrase --

> Goya shows an elderly man in a gesture of despair in his Sad presentiments of what will happen.

Example C. A rule of consequence is applicable to the first text-sentence of (1) above (see example A) which detaches it from the text: $S_1 \cdot S_2 \rightarrow S_1$. With Repl ((1); a great event in the annals of Russia and Moscow/ the Great Patriotic War of 1812), detachment results in the consequence of (1):

> Herzen's entrance into the world coincided with the Great Patriotic War of 1812 - a fact of which he was always proud.

Example D. The dashes in the above-mentioned consequence (example C), (c), can be regarded as a variant of which is. The consequence itself can be written: S_1 wh(S_1) $S_2(-S_1)$ where S_1 is, in the terms of section 8 below, the primary sentence, S_2 the secondary, wh(S_1) the appropriate wh-form of S_1, and $S_2(-S_1)$ is the secondary minus the S_1 phrase. A rule of consequence detaches the secondary sentence. Application of this rule to the sentence noted above (with 'Nom' = nominalization) with Repl((c);which/Nom (Herzen's entrance into the world coincided with the Great Patriotic War of 1812)) results in a consequence of (c) -- also of (a),

That Herzen's entrance into the world coincided with the Great Patriotic War of 1812 is a fact of which he was always proud.

Example E. A rule of consequence applied to the second text-sentence (d) of (1) in section 5 omits the appositive modifiers in that sentence. Application of this rule with Repl((d);he/Herzen) results in, e.g., Herzen was born in Moscow.

5.5 Open Questions. A number of questions are left outstanding by the definition of referential relation presented in section 5.3. According to the definition, the second occurrence of the phrase about in

(8) Clausius wrote about the foundations of thermodynamics. The axioms of thermodynamics were to be independent of hypotheses about matter.

is referential to the first occurrence of that phrase: detachment of the second sentence of (8) with replacement of the second by the first occurrence of about results in a consequence of (8). The definition fails to accord with intuition here. A possible solution would be to prohibit instances of replacement which involve no overt alterations in the text-sentences. However, this appears to be too restrictive. In (9) the second occurrence of went to the store is plausibly a referential to the first:

(9) Rud went to the store. He went to the store to purchase some seltzer.

The second occurrence could be considered part of an elaboration of the first sentence and so referential to the previous

occurrence. A similar issue arises in the description of the "Influenzal" article where many sentences in the Discussion section repeat or "nearly repeat" sentences which occur in the Introduction and Results sections (see chapter 5, section 5.2 for further discussion).

Other questions are raised by referentials whose putative antecedents are phrases with a quantifier:

(10) Every employer demands that HE be obeyed.

Substitution of every employer for he results in a sentence which is neither a consequence nor a paraphrase of this reading of (10). Replacement in such sentences requires an examination of how general sentences (not all of which contain a "quantified noun phrase") are related to their particularizations, i.e., substitution instances (cf. section 10).

Another matter raised by quantificational expressions is exemplified in the following sentence, taken from a research article in immunology:[58]

(11) MANY AND DIVERSE SITES OF ANTIBODY FORMATION have been implicated by DIFFERENT INVESTIGATORS.

This sentence starts a paragraph in the article; many and diverse sites of antibody formation and different investigators are epiphoric referentials to phrases in the succeeding sentences. Separate replacement of each referential would yield incorrect results; both referentials are to be replaced simultaneously.

Successive or simultaneous replacement also appears to be an option in:

(12) A child is troubled by the feebleness of his means, i.e., by his state of inexpressiveness. HE may not know how to draw a house, but HE knows that the house HE draws is not what HE sees.

If an identity transformation is applied to the second sentence of this text, there are three multiple replacements of he which yield a paraphrase of this sentence -- replacement of the first two occurrences, of the last three occurrences, and of all of the occurrences of he.[59]

Finally, the statement of replacement is problematic in sentences such as the following:

(13) June may do HER graduate work.

(14) John washed HIMSELF.

(15) In 1820, Waverly was at the height of ITS popularity.

Note that according to the definition it is not required that replacement take place in respect to, e.g., an identity transformation, only that there is some rule of paraphrase or consequence which when applied to a text with replacement yields a paraphrase or consequence. The problem in (13)-(15) is the availability of such a rule. A cleft transformation applied to (13) with replacement of her by June results in the marginal It is June who may do June's work. In (14) himself is replaceable by John if the intonation pattern is altered, but the resultant is marginal (except as a response to the question John washed who?). Passivization of (14)

with a double replacement yields the more acceptable: John was washed by himself. The definition could be extended in the event that no rules of paraphrase or consequence are at hand to include "quasi-replacement". Quasi-replacement would consist in the parenthetical addition of a (perhaps adjusted) referend after the referential phrase. In (13)-(15) quasi-replacement in respect to an identity transformation would result in:

(13') June may do her (June's) graduate work.

(14') John washed himself (John).

(15') In 1820, Waverly was at the height of its (Waverly's) popularity.

As noted in section 3.3, (13') for instance can be read -- June may do her, that is, June's, graduate work.[60]

6. Agreement Phenomena. It is often supposed that in English a referential and its referend are "required" to agree in person, gender, and number. Cross-reference in English touches upon other agreement phenomena as well. Some referential relations may have restrictions in respect to tense -- for example, the text Claire biked to work. So does Ruth. is unacceptable as does does not agree in tense with biked (did in the place of does results in an acceptable text).[61] Other languages may have differing requirements -- in respect to tense, aspect, honorifics, etc. Even with person, number, and gender in English, some cases of agreement are not as hard-and-fast as is sometimes suggested.

6.1 Person. Agreement requirements are rather straightfoward in respect to person: comparing I did my work and I did your work, an anaphoric relation to I only obtains in the former sentence. There are some instances which are more questionable: contrast these sentences noted by Jespersen (Essentials of English Grammar: 1964:147) -- Some of us lost their heads and Some of us lost our heads.

In place of a personal pronoun in agreement with its antecedent the definite article is often used in prepositional phrases which refer to names of body parts -- for instance, Gareth struck Bert in the (his) face.[62] The first and second person pronouns may themselves be considered as referential in certain of their occurrences -- for example, the direct quotation in Arnold told Cindy: "I have a headache".

6.2 Gender. Agreement in respect to gender is far more labile, displaying evidence of detailed selection. Thus, there is considerable variation in, e.g., the use of it, she, and he in regards to animals and infants, and various cultural artifacts -- ships, autos, the "virtues" (for a survey, see Jespersen, 1964, chapter XXIX). There is a "generic" usage of, e.g., one, man, anaphorically referred to by he, his, and their other case-forms. Various means are available to avoid the perhaps suggested reference to males -- as in the use of the disjunctive he or she in Nobody can study as much as he or she wants or the use of

a plural pronoun (which is then not in agreement with the antecedent in number), e.g., Everyone in the factory were at their machines., Before anyone chanced to open their mouths, Edith delivered a sermon.[63] It may be noted in passing that this situation, i.e., of shifting selection and competing forms, is in accord with an operator-grammar analysis: agreement is a "late" reduction, the domain of which is subject to variation and change (cf. chapter 2.1).

6.3. Number. The situation as regards number is of greater interest in relation to the description of cross-reference in the "Influenzal" article. A referring pronoun requiredly specifies singular and plural -- generally it is in agreement with the usually prior occurrence of the referend, although there is some variation in respect to nouns such as people which has a plural role and portion and aggregate words, e.g., a number, bunch, group (GEMP 5.13).

Some proforms are of the same form whether their antecedent is singular or plural -- for instance, who and which. Others are only singular, e.g., each, or plural, as in the relic "dual" both.[64] Quantifiers which occur as announcers of zero-referentials (section 2.2) involve complicated restrictions as to the number of the referend. For example, in some occurrences all announces a plural referential (all of them). The referend in this case may carry a "bare" plural (photographers in Photographers worked in journalism);

it may have greater than two "components" (Adams, Bourke-White, and Lange) or may specify ("imply") a number greater than two (Three/Several photographers), cf. many, few.

There are cases of cross-reference in which the referential is in the plural and the referend is singular. This occurs for example with so-called "split antecedents": in

(1) Prieto agreed with Negrin in calling for a regular army. THEY stood opposed to the C.N.T.

the plural referential they has as "components" of its referend Prieto and Negrin of the preceding sentence (in replacing they, an adjustment conjoins the two components with and). Epiphoric referentials may also have split referends (cf. section 2.3).

Another situation in which plural referentials have singular referends is exemplified in:

(2) Henry has a Volkswagen. THEY are fine cars.

where they is referential to the occurrence of Volkswagen (meaning the kind of car). If in place of a Volkswagen, (2) contains the phrase four Volkswagens, there is an ambiguity between a reading concerning the type of auto and one in which they has the antecedent four Volkswagens (together with Henry has). A distributive and non-distributive reading of the plural should be distinguished in particular sentences: Rabbits have ears vs. Rabbits have tails. In the "Influenzal" article, sentence 193.3.3 displays this ambiguity:

(3) McMaster and Kidd had demonstrated an antiviral principle...following the endermal injection of active vaccine-virus into the ears of rabbits.

It is not evident in (3) whether both ears or only one ear of each rabbit under study received an injection.

The converse case -- a singular referential with a plural referend -- has been less often noted. This situation is illustrated by text-sentences 200.2.2-3 of the article:

(4) ...the weight of the lymphnodes began to decline. At about the 4th or 5th day, the entire surface of THE NODE showed very fine irregularities....

In the second sentence of the excerpt, the node is referential to the occurrence of the lymphnodes and has the meaning "any node in the class", cf. the colloquial case in The school has 4 Volkswagens. It is a fine car.

Number agreement with the verb can serve to determine the referend of a referential as in the following pair:

(5) Agnes plays instruments which annoy me.

(6) Agnes plays instruments which annoys me.

Further questions concerning number agreement arise in specifying zero-referentials -- these are addressed in chapter 3, section 3.

7. Anaphora and Epiphora. Anaphoric and epiphoric cross-references are distinguished by the position of the referend in respect to the referential: if the referend precedes the referential in order of occurrence in a text,

the cross-reference is anaphoric; if it follows the referential, it is epiphoric.[65] There are, importantly, cross-references which are neither anaphoric nor epiphoric -- section 8.3 discusses the self-referential that which seen in They accede to that which corporate interests demand.[66]

In many examinations of cross-reference, anaphoric relations are customarily accorded pride-of-place; referential phrases, for instance, are often termed 'anaphors'. Particular instances of epiphora are discussed as cases of 'backward anaphora'.[67] There appear to be several reasons for this situation. Firstly, anaphora and epiphora are not distinguished in respect to the notion of strong co-reference adopted in some studies (section 3.2). Similarly, there is no way to differentiate between anaphora and epiphora when certain referential relations are analyzed in terms of bound variables (section 10.2). Secondly, the restriction in some studies to referential relations within the bounds of a sentence has suggested to some linguists that these relations can be analyzed in respect to phrase-structural configurations without mention of 'precedence'.[68] Referential relations across sentence boundaries require recognition of the linear ordering of segments in a text. However, even in respect to discourses, the hypothesis has been advanced that purported instances of intra-sentential epiphora are, in fact, cases of anaphora, the antecedent occurring in some earlier sentence. This hypothesis, to

which there are many counter-examples, is referred to as the "Forwards Only" hypothesis; it receives an extensive discussion in Carden's article, "Backwards Anaphora in Discourse Context".

It does appear that certain cases of epiphora are uniformly reducible to anaphora. Consider the following groups of sentences:

(1a) After machinists DID SO, pilots negotiated a contract.

(1b) Pilots negotiated a contract after machinists DID SO.

(1c) Pilots DID SO after machinists negotiated a contract.

(2a) In spite of common faith in IT, psychoanalysis has questionable scientific standing.

(2b) Psychoanalysis has questionable scientific standing in spite of common faith in IT.

(2c) IT has questionable scientific standing in spite of common faith in psychoanalysis.

(3a) If Nikos didn't believe IT, Theo wouldn't claim that Dante was Greek.

(3b) Theo wouldn't claim that Dante was Greek if Nikos didn't believe IT.

(3c) Theo wouldn't claim IT if Nikos didn't believe that Dante was Greek.

Generally, in constructions where two sentences are conjoined by a subordinate phrase (or a reduced form of such a phrase), a referential may precede its referend in the other conjunct only if the referential occurs in the sub-

ordinate clause (see the a-sentences). In the c-sentences, a cross-reference between the referential and the underlined phrase is dubious in (1), whereas in (2) and (3), it is possible under particular intonational contours. The cases of epiphora in the a-sentences are reducible to cases of anaphora by transposing to the end of the primary sentence the conjunction along with the subordinated sentence. The result is the paraphrastic b-sentences. Double-replacement in respect to an identity transformation (section 5.2) also results in anaphoric paraphrases of the a-sentences: for example, the resultant for (1a) would be After machinists negotiated a contract, pilots did so.

Two qualifications should be noted. The restriction on epiphora in sentences with subordinate clauses cited above is too strong, cf.:

(4) SHE was widely known as a debator though June rarely argued.

(5) HE'll bother all his friends before Jack will try to tackle a problem alone.

which are acceptable with the cross-reference indicated.[69] Secondly, the domain of the transposition effecting a reduction to anaphora needs to be specified.

Though in the description of the "Influenzal" article there is no attempt to reduce epiphoric to anaphoric referentials, the question of reduction is of considerable interest for the study of the consequence relation. Following Hiż (n.d.), a text $T = S_1 \cdot S_2 \cdot \ldots \cdot S_n$ is called a

"file of sentences" if it has among its consequences S_1, $S_1 \cdot S_2$, and $S_1 \cdot S_2 \cdot \ldots \cdot S_m$ (for every $m \leq n$); it is a "reverse file" if it yields S_n, $S_n \cdot S_{n-1}$, and $S_{n-1} \cdot \ldots \cdot S_{n-k}$ ($k < n$) as its consequences. A text may be regularized -- paraphrastically transformed -- so that there are no epiphoric cross-references among its sentences and may then be a file, or else the anaphoric relations may prove eliminable and the text may be a reverse file.

The "disparagement" of epiphoric cross-reference in linguistic studies is likely related to its relatively low incidence in discourse. Its importance is highlighted by the following considerations.

(i) In some cases an anaphoric cross-reference across sentence boundaries is reducible to an epiphoric one within a sentence:

(6a) Felix arrived. IT astonished us.

(6b) IT astonished us that Felix arrived.

(7a) Whales respond well to classical music. THIS I dispute.

(7b) I dispute THIS: (that) whales respond well to classical music.

The b-sentences are, apart from a change in focus, paraphrases of their respective a-counterparts. Jespersen incidentally notes (Essentials of English Grammar, section 16.2_4) that whereas this is generally epiphoric, that is typically anaphoric. This in point of fact occurs often as an anaphoric referential (see (7a)); that -- apart from

the special that which construction discussed in section 8 -- does appear to be largely restricted to anaphora.

(ii) In the following examples, an anaphoric occurrence of a referential (8a) is related to consequences in which the referential is epiphoric (8b-c):

(8a) The Lisbon earthquake killed thousands of people. Such an event is long remembered.

(8b) An event such as the Lisbon earthquake is long remembered.

(8c) Such an event as killed thousands of people is long remembered.

The referend of an epiphoric referential phrase often is an enumeration or illustration of a classifier:

(9) Terry despises THREE TRAITS: intolerance, obnoxiousness, and arrogance.

(10) OTHER CONSIDERATIONS dictate caution. Police agents often infiltrate dissident groups.

(iii) Footnote-numerals and citations are frequently epiphoric. Indeed, anaphoric usage appears to be derivative of an initial epiphora. Parallel to metalinguistic referentials such as above and before, there are epiphoric referentials below, later. Of especial importance is the definite article which participates in both anaphoric and epiphoric cross-references (section 8.4).

Five other articles from a corpus of material in the sublanguage of cellular immunology were reviewed in order to obtain a better picture of the operation of cross-reference. Chapter 5, section 4 presents an extensive dis-

cussion of epiphoric cross-reference. It appears that epiphoric cross-references are especially important in organization of argumentation and in metalinguistic reference to the organization of the articles themselves.

8. Wh- Proforms and the Definite Article. An account of the definite article and the wh- proforms is central to a description of cross-reference in English. The wh- proforms are referentials in the relative clause construction (8.1), which serves in an operator grammar as a source of modifiers, e.g., adverbs, attributive adjectives. Sections 8.2 and 8.3 examine connections between these forms as referentials and their occurrence in interrogatives and other constructions, e.g., extraction sentences (What Jane likes is theater). The definite article, with its fairly wide range of uses -- anaphoric, epiphoric, and "generic" is surveyed in section 8.4. Much of the discussion which follows is cast in terms of an operator grammar of English; a sketch of this grammar is presented in chapter 2, section 2.1.

8.1 Relative Clause. The relative clause construction has as one of its main components referential occurrences of wh- proforms (who, which, where, etc.). Replacement of which in:

(1) Selita liked The Leopard, WHICH Lampedusa wrote.

yields, in respect to a paraphrastic identity transformation, two sentences, a primary -- Selita liked The Leopard,

and a secondary -- The Leopard Lampedusa wrote, conjoined by semicolon. A transposition (or: relinearization, cf. GEMP 3.1) of the replaced phrase in the secondary sentence, i.e., to Lampedusa wrote The Leopard, may be considered an adjustment in the replacement operation or an independent transformation which results in a 'conventional' linear order. The semicolon intonation which conjoins the two sentences is here regarded as a variant form of wh-; thus -ich is actually the referential. A shorthand description which will prove convenient in recording sentences with relative clauses is taken from Robbins' The Definite Article in English Transformations. Sentence (1) is written as: S_1 (N_1) wh- proN_1 S_2 (-N_1), where S_1 (the primary sentence) contains N_1, The Leopard, S_2(-N_1) is the secondary sentence minus that phrase, and proN_1 the relevant proform (-ich).

Replacement in sentence (1) retraces certain steps in the analysis of an operator grammar (GEMP 3.2). This is not the case for the restrictive relative clause in (2):

(2) The law allows statements that are false.

While replacement of which along with a consequence operation detaching the 'apparent' secondary sentence results in a consequence of this sentence, i.e., Statements are false., (2) is not paraphrastic to:

(2') The law allows statements; statements are false.

As described in an operator grammar analysis (GEMP 3.24), (2) is composed of three sentences: The law allows some-

thing; said something is statements; said statements are false. From these component sentences, one can derive, successively,

(2a) The law allows something; said something is statements which are false.

(2b) The law allows something which is statements which are false.

(2c) The law allows statements which are false.

In this somewhat simplified derivation, said abbreviates a metalinguistic sentence identifying word-occurrences; the identified phrases are reducible to wh- proforms. In obtaining (2c) the indefinite something which is is zeroed (details are in GEMP 3.24).

The formation of the relative clause is subject to many detailed restrictions which are not immediately relevant to the description of cross-reference in the "Influenzal" article (a thorough discussion is provided in the Robbins' book cited -- chapter 3 and in GEMP -- chapter 3). The form of the referential indicates its grammatical standing in the secondary sentence in which it occurs: -o is subject, -om is object, -ere, -en, -y, and how are adverbials (or subordinate clauses). The wh- proform which is in various occurrences referential to phrases of differing grammatical categories:

> to a noun (in subject and object positions), as in, e.g., Myron brought back pizza, WHICH Bernice craves.
>
> to an adjective, as in, e.g., Robin is perceptive, WHICH Miles is decidedly not.

> to a verb along with its complement, as in, e.g., The committee should revise the program, WHICH they probably will.
>
> to a sentence, as in, e.g., A poacher killed a black rhino, WHICH prompted an official inquiry.

While for certain referential forms, it has proven difficult to state restrictions which specify the position of the referend, restrictions are perhaps easier to state for the wh- proforms. As noted above, the wh- proforms occupy positions of specifiable grammatical status in the secondary sentence. Phrases of time are referred to by -en, those of manner by -ow (how), -y refers to those of reason, and -ere is referential to phrases pertaining to condition or place (GEMP 3.23). The referend generally immediately precedes the wh- form; in some sentences there is an intervening preposition, e.g., It is a problem for which there is no general solution.[70] There are exceptions as with the "detached" relative clause,

(3) My sister left, WHO is always in a hurry.

or in stylistic permutations:

(4) ...even if, WHICH I do not for a moment believe, this island or a large part of it were subjugated and starving, then our Empire...would carry on the struggle. (Churchill, in The Second World War, p. 104, cited in Carden 1982:372)

Ambiguities in respect to the referend are possible. Thus, which may refer to the entire preceding NPN phrase in:

(5) Lois resolved the argument in the discussion which Hal provoked.

or just to the discussion.

In (6):

(6) Oistrakh recorded a concerto which we know that Prokofiev composed.,

that is ambiguously referential either to a concerto or a concerto which we know.

8.2 Wh- Interrogatives. Wh- forms in interrogatives have several connections with referentials. Wh- interrogatives, at least those which are questions (What do you require for the task?), can be described as epiphoric in that they call for an answer.[71] Answers to these questions are often systematically related to the wh- proform. In Hiż's description of these interrogatives, a 'questioner' function q applies to phrases which are short answers and forms from them a wh- phrase, e.g., q(in Wisconsin)=where or in which state; q(about jazz)=about what.[72] In an operator grammar analysis, what, who, etc. in interrogatives are regarded as pronouns of disjunctions. The disjuncts in simple cases, i.e., where the domain of arguments is finite and known, include the answer among them. In other cases, e.g., What did Julius win?, the pronominal -at is formed as a disjunction of indefinites, e.g., some one thing or something else.[73]

Yet another line of approach would describe, for example, who in Who came? as a referential to its answer, e.g., Judy. Replacement of who by Judy yields -- with an alteration in intonation -- Judy came which is a consequence of the question-answer pair Who came? Judy. This

seems to be a promising approach -- it would elide the difficulty mentioned earlier (section 1.1) that a question is not an acceptable argument of the consequence relation, and it clearly (that is, most easily) accommodates short answers -- full answers present complications. Still, extending the analysis beyond the simplest cases entails complicated adjustments (section 5.2) which requires further consideration. Connections between referentials and wh- interrogatives are examined again in section 9.

8.3. Other Wh- Constructions. A more extensive discussion of the wh- proforms would require consideration of (a) their occurrence in complements of various verbs and adjectives, e.g., I know where Sally went/what to do., (b) what in "extraction" sentences, e.g., What Ronald wants is to become king, A bike is what Caroline most desires, and (c) the that which form as in, e.g., I will eat that which Barbara cooks. All of these constructions has some connection to referential occurrences of wh- proforms. The sentences in (a) are paraphrastic to I know the place where Sally went/the thing (act) for me to do, in which there are determinative occurrences of the definite article (section 8.4). In (b), what is analyzable as a reduced form of that which (GEMP, sections 1.5 and 8.1); that which is itself obtained from two occurrences of the

indefinite that, e.g., A bike is that; that Caroline most desires (cf. the derivations in section 8.1). The analysis of (c) treats that which as self-referring: it is obtained as follows:

(i) I will eat something; said something is the same as a thing mentioned; said thing Barbara cooks.

→(ii) I will eat something; said something is that, which Barbara cooks.

→(iii) I will eat something which is that which Barbara cooks.

The indefinite something which is is zeroable as in the analysis of the restrictive relative clause, resulting in I will eat that which Barbara cooks. A replacement procedure for the referentials in such sentences is not clear. This is because of the self-reference involved; in (i) said thing is referential to the preceding thing, while mentioned in turn refers epiphorically to thing in the third component sentence.[74] Some possibilities of replacement are discussed below in relation to determinative occurrences of the.

8.4. The Definite Article. In terms of the preceding discussion the analysis of the definite article the is more easily understood. Here the is obtained as a reduction from that which (or: one who) is N. The definite article thus has an apposition to it the noun (N) which is a modifier of that. The reduction points to, although it is not based upon, the historical relation of the to a

demonstrative form. The is treated as a noun -- that -- and is obtained upon zeroing which is (GEMP 5.36).

In the case of the anaphoric use of the, that is referential to a previous occurring phrase. In (7)

(7) They forwarded a motion. THE MOTION was rejected.

that (in that which is a motion) has as its antecedent a motion (which they forwarded). The noun in apposition to the is often a classifier of the referend. For instance, in

(8) A warbler rested on a long branch. Then THE BIRD flew off.

bird is a classifier of warbler (A warbler is a bird).

Another use of the, I will -- following Robbins (1968) and others -- call "determinative". In its determinative use the precedes a noun to which a right adjunct is attached, for instance:

(9) The artist who had been exiled from Spain returned.

where who had been exiled from Spain is the right adjunct adjoined to artist. (9) is obtained as follows:

(i) One is an artist; said artist had been exiled from Spain.

⟶ (ii) One is an artist who had been exiled from Spain. (by reduction of said artist to who)

(iii) Someone is one mentioned; said one is an artist who had been exiled from Spain.

⟶ (iv) Someone is one who is an artist who had been exiled from Spain. (one who is akin to that which discussed in section 8.3)

⟶(v) Someone is the artist who had been exiled from Spain. (one who is an artist is reduced to the artist)

(vi) Someone - said someone is the artist who had been exiled from Spain - returned.

⟶(vii) Someone who is the artist who had been exiled from Spain returned. (by reduction of said someone to who)

⟶(viii) The artist who had been exiled from Spain returned. (by zeroing of someone who is)

As is readily seen, the derivation of (9) is quite involved. The zeroing of someone who is in the last step accounts for the restrictive effect, i.e., the reference to that particular artist. From step (iv) it can be seen that the definite article with following noun in (v) the artist is epiphoric to its right adjunct -- who had been exiled from Spain (see below).

Two other uses of the definite article should be noted. One, termed "unique" (Robbins' "indexical"), comprises such occurrences as the sun, the Eiffel Tower. The The other is the "generic" use seen in:

(10) The aardvark is an often maligned animal.

In both cases the is a reduction from that which is N. This analysis accounts for the fact that in:

(11) The falcon threatens to become extinct.

no one falcon so threatens but the class (indicated by that).[75]

In GEMP (section 5.36) it is suggested that "unique" occurrences of the can be analyzed as instances of the

determinative use, e.g., that (unique thing) which is a tower which is called Eiffel → the tower called Eiffel (→ the Eiffel tower). A like analysis may be given for the "generic" use, e.g., that which is a species which is called aardvark → the species called aardvark (the aardvark). If such analyses are supportable, then the in (nearly) all of its occurrences is referential.

In Beverly Robbins' The Definite Article in English Transformations, it is proposed that anaphoric occurrences of the are derived from determinative ones. Replacement of anaphoric the in (7) They forwarded a motion. The motion was rejected yields, in respect to a rule which detaches the second sentence, the sentence:

(12) The motion which they forwarded was rejected.

The replacement can -- omitting details -- be written: $S_1(N_1)$. $(S_2(\text{the } N_1)\ S_2(\text{the } N_1 \text{wh-pro}N_1\ S_1(-N_1))$. A text consisting of They forwarded a motion followed by (12) has the occurring determinatively. In Robbins' analysis anaphoric the is obtained from the determinative use by repetitionally zeroing the adjunct (in (12) which they forwarded).

Other referentials can be related to, or are special cases of, the definite article in its determinative use. Those can be regarded as epiphoric to its right adjunct in:

(13) People who smoke distrust those who don't.[76]

Such is analyzable as of the sort (or: kind) in:

(14) The law of value is not a natural law such that govern physical phenomena.

In certain positions, e.g., before a complement introduced by that or as, so can be considered a reduction of for the purpose (or: reason) --

(15) One works so (=for the purpose) that one may eat.

The personal pronouns (he, she, it, him, her, etc.) in their referential occurrences are -- as has often been noted -- definite, and do not occur with determiners and modifiers, e.g., there is no the it or young he. Robbins (1968:section 4.3) proposes that these referential pro-forms are substitutes for an anaphoric the N_1 in constructions of the form: $S_L(N_1)$ Conjunction $S_R(proN_1)$ where in the left conjunct N_1 is preceded by a (and an optionally occurring adjective) and may be followed by a right adjunct. Thus he in:

(16) An old wizard came to the door when he heard a loud knock.

would be derived from an anaphoric the old wizard.[77] This analysis might be extended to include proper names or quantificational expressions as referends by use of classifiers, e.g., Ted Williams was well-known when he (= the man called 'Ted Williams') was quite young; Anyone can fool Arthur if he (= the person) tries hard enough. Some such use of classifiers is presumed in sorting out various proper names as typical of those belonging to men (he) or women (she).

In analyzing cross-reference in the "Influenzal" article, I do not consider determinative occurrences of the definite article. There remain several problems to be confronted in respect to this usage. The decision as to whether a particular occurrence of the in the article is, e.g., anaphoric or determinative, has been made semantically, i.e., in respect to consequences of the sentence containing that occurrence. One cannot simply say that phrases of the form the N are anaphoric, whereas those of the form the N + Adjunct are epiphoric. In sentence 193.1.6 of the article, it is stated that Cellular antigens were injected into the pad of the rabbit's hind foot...; this sentence is the referend of the injection of antigen in the succeeding sentence. Again, after mention of the endermal injection of active vaccine-virus in 193.3.3 the authors speak of multiplication of the virus introduced (in 193.3.5) where the is felt to be anaphoric to active vaccine-virus. One question is then the provision of a syntactic criterion or procedure by which occurrences of the in its different uses could be distinguished. Another question is the statement of replacement in epiphoric (determinative) instances of the. In The man who phoned left, the man is epiphoric to the adjunct who phoned; however the adjunct cannot be simply substituted for the referential. As noted in the derivation of (9) before, the difficulty is related to the self-referential one who (or: that which): One who is a man who phoned left. Hiż

has suggested that an adjustment of the referend to *someone who phoned* would allow for an acceptable replacement: *Someone who phoned left*. This replacement would have the advantage of isolating the contribution of *the* in *The man who phoned left*, here 'particular in respect to the modifier'. Further study is needed.

Other occurrences of *the* in the article cannot be taken as anaphoric nor immediately as determinative. For example, in sentence 198.2.2, *the heart* occurs with no evident antecedent. Rather than setting up such occurrences as "unique" the definite article is considered an "announcer" of a zero-referential, e.g., *of the animal*. Here *the animal* is anaphoric and the announcer *the* is determinative. Another line of analysis would be to assume a tacit sentence, e.g., *Rabbits have hearts* from which one can derive a sentence with an available referend. In this case *the* in *the heart* is assimilated to anaphora.

9. *Referentials and Grammatical Categories*. The present section briefly notes some connections between referential pro-forms and the grammatical categories of the phrases to which they refer. Phrases of a particular grammatical category may be referred to by a number of pro-forms. As well, some proforms are referential in different occurrences to phrases of differing grammatical categories. In section 9.1, a rather partial survey of

these relations is presented. Referential phrases themselves are analyzable as functors in terms of a categorial grammar; this option is noted in section 9.2. Finally, section 9.3 examines the relation between the grammatical categories of phrases which can be questioned by various wh- forms and those categories to which cross-references are made.

9.1. Survey. (A) Nouns and noun phrases are referends of particular occurrences of one, the definite personal pronouns he, she, it and their possessive and reflexive counterparts, this, that (the plural forms these, those), who, which, and other forms. Definite personal pronouns were discussed in the preceding section as were the relative pronouns.

One cross-refers to a noun -- along with its modifier if it is not carrying one itself:

(1a) Gary sold a blue Mercedes while Efram bought ONE.

(1b) Gary sold a blue Mercedes while Efram bought an orange ONE.

More precisely, one cross-refers to the nominal phrase in the selection ('meaning') it has in the sentence containing it. In (2):

(2) Wilson has a chair and Terence has ONE.,

either Wilson and Terence are well-established professors or both are owners of furniture, but not Wilson one thing

and Terence another. The form one also occurs as a numeral, often serving to introduce a plural zero-referential, e.g., Paul purchased several roses and offered Hilda one (of them).

In Judith despises her husband, the possessive determiner her does not belong to the same grammatical category as its referend (Judith). However, as noted earlier, her can be analyzed as a possessive functor applied to, e.g., she.

(B) Verbs along with their complements are referred to by occurrences of do, do so, so do, and it, as well as by these forms with, e.g., negations do not. In (3):

(3) Victor parachuted and Wendy did it too.,

there may be some question as to the referential status of did: did could be considered a tense carrier with it referential (to the verb) replaceable by (a bit of) parachuting. It in the previously noted:

(4) Alice writes short stories. She likes IT well enough.

has as its referend either writes short stories or the entire preceding sentence. Replacement of it in either case requires a nominalization -- writing short stories and her writing of short stories (alternatively, that she writes short stories) respectively.

Sentential and infinitival complements are cross-referred to by it, that, and this:

(5) I regret IT that you can't come to our picnic.

(6) IT is a pleasure to hear Brendel.

(7) Evert wants to go hunting. He likes THAT.

It should be noted that the argument indicator that seen in:

(8) Franz hypothesized that the moon is made out of cut glass.

devolved historically from a referential occurrence.[78]

(C) Occurrences of this, that (these, those) as well as such, so, and which are pro-adjectival as in:

(9) Sue is delirious, WHICH Babs is not.

(10) Willy bought a slender volume. He adores SUCH volumes.

(11) Large explosions shatter glass. THESE explosions should be reduced.

(D) The pro-forms there and where can have as antecedents locational PN-phrases as in:

(12) The soldiers were billeted at an inn, WHERE they dined on venison.

Then and when cross-refer to temporal PN-phrases --

(13) Rosie woke up in the early morning. It was THEN that she felt most active.

In (14), so is referential to a manner adverbial:

(14) Heifetz played the last movement in a spriteful manner; he played SO, as the score was marked vivace.

(E) Pro-sentential referentials include which, this, that, and it, e.g.:

(15) The bombing had left many homeless. THIS didn't bother the colonel.

(16) Ray stormed around the room, WHICH in turn angered Jane.

The conjunctional particles thus, therefore, and so can in certain positions be taken as composed of a conjunction together with a preposition plus a pro-sentential referential:

(17) Terry was performing Saturday. (So (= because of THAT) Rudolf came to the concert.

Certain of the above-mentioned proforms cross-refer in various occurrences to phrases of different grammatical categories. It for example refers to noun phrases, verbs, and sentences (cf. this, that, so, which). The occurrence of this and that (also these and those) as both pro-nominal and pro-adjectival may be explained in some instances as the effect of zeroing a noun, e.g.,

(18) Waldo stationed a large bible on the edge of a shelf. Later THIS (large bible) fell.

9.2. Referentials as Functors. The discussion of grammatical categories (g.c.s) up to this point has been informal, making use of traditionally acknowledged terms. Chapter 2 discusses the grammatical categories established in an operator grammar of English (section 2.1) as well as those constructed for a sublanguage of cellular immunology. An operator grammar -- as presented in GEMP -- can be considered as a restricted form of a categorial grammar.[79] Lehrberger presents another way of establishing the g.c. of a referential phrase in Functor Analysis of Natural Language. In this work, a structured text is an assignment

of functors and arguments (some categories are perhaps regarded as primitive) to the strings of a text; groupings are indicated by numerals written under the grammatical assignment. (19) is an example (somewhat simplified) of a structured text:

(19) Cynthia visited Pittsburgh.

N	(S;N_N)	N
1	3 1 2	2

In the example, 'N' stands for noun, and '(S;N_N)' for a functor which forms a sentence out of two nouns (tense is ignored here). In Lehrberger's analysis referentials are functors. Thus, a sentence containing a referential whose antecedent is in another sentence is an open sentence. The string she as it occurs in text (20):

(20) Cynthia visited Pittsburgh. SHE thought Pittsburgh was rather small.

is assigned the g.c. (N;N). That is, it is a functor which takes a noun argument (indicated to the right of the semicolon), namely its referend -- Cynthia and forms out of it a nominal phrase, i.e., she (Cynthia). The grammatical category of so in:

(21) Cynthia thought Pittsburgh was small. I thought SO as well.

would be -- again, simplifying for purpose of illustration --(S;S): the referend of so is Pittsburgh was small of the grammatical category S. The sentential phrase formed, i.e., so (Pittsburgh was small), is in turn an argument of the functor thought in the second sentence of (21).[80]

9.3. Interrogatives and Referentials. There appears to be a close connection between the grammatical categories of phrases which can be question by wh- interrogatives and the grammatical categories of phrases which can serve as referends. This is briefly illustrated in (22)-(26) where the underlined phrase can be referred to by the referential beneath it and questioned by the interrogative form to the right:

(22) John (HE) produced a masterpiece (IT) — Who;What

(23) Ethel worked in the cellar. (THERE) — Where

(24) Because he needed to eat, Bill worked. (SO (as in He needed to eat. So Bill worked.)) — Why

(25) Janis fished in the morning. (THEN) — When

(26) Alex played the cello in a soft manner. (SO) — How

The correspondence does not hold for all grammatical categories. That is, there are referentials to phrases of grammatical categories for which there is no direct wh- interrogative. In English, adjectives can be normally questioned only by way of a classifier, e.g., classical in Tom prefers classical music is questioned by What kind/sort/type (of music). The adjective in this sentence can have the proform such which, as mentioned in section 8.41, can be related to of that kind. As well, there is no direct questioning of verbs; verbs can be quesioned in some cases via a nominalization, e.g., Anton is working at an auto

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plant (What is Anton doing?). Sentences can only be questioned by such forms as What happened/occurred?, whereas there are several referential forms with sentential antecedents.

Interestingly, there are a number of linguistic forms and grammatical categories which are not referred to by pro-forms and which cannot be questioned directly by wh-interrogatives. Thus, prepositions and conjunctions (and, or, although, etc.) by themselves, there and it as in There is a tree, It's raining, and semantically weak verbs (occurs, takes place) are not directly questioned by wh-forms (these forms might be questioned intonationally in echo-questions). Nor are these forms (and phrases of these categories) referred to by particular pro-forms, except by recourse to metalinguistic referentials, e.g., the second word. The (partial) listing given above roughly coincides with that given by medieval logicians of 'syncategoremata'.[81] In modern logic, such expressions are often referred to as 'improper symbols'. This result recalls the Tractarian position of Wittgenstein that logical constants cannot be pictured but only shown.

10. Referentials and Variables. A number of grammatical analyses identify various occurrences of referential phrases with variables. Koster (1979:1) states that "anaphoric expressions are variables the identity of which is determined by the linguistic and/or non-linguistic context". In Montague's model-theoretic semantics, free

variables feature in "contexts of use" which treat indexical forms, e.g., demonstratives, whereas other occurrences of proforms are considered bound variables.[82] Within the generativist tradition there are several differing accounts which focus on occurrences of referentials interpretable as bound variables.[83] Rather than to examine each of these proposals in turn, the present section first "isolates" particular features of variables in respect to logical systems where their character is most clearly defined and then scrutinizes their connection to cross-reference in a natural language (English).

10.1 Variables in Systems of Logic. Within various systems of logic, several features of variables are identifiable. A grammar for a particular logic will assign to variables as they occur in a formula certain grammatical categories (g.c.s). For instance, to 'x' as it occurs in the formula -- x + 9 = 11, one may assign the g.c. N. There may also be functional variables in the system, i.e., variables for which functors are substitutable salva grammaticae, e.g., 2 f 9 = 11, for which a functor, '+', is substitutable. There are variables only for such expressions as are assigned a grammatical category; thus, there are no variables for, e.g., the parentheses used as grouping devices. Some systems of logic have for each phrase of a particular g.c. a variable of that g.c.[84] Generally, only one grammatical category is assigned to a

variable. In that case, its spectrum is said to be one: "the grammatical spectrum of a variable as it occurs in a formula is the set of g.c.s in which the variable occurs" (Hiż 1967:115).

Associated with each variable in a given logical system is a range of substitution. For a particular variable in a formula any phrase of the same g.c. as that of the variable may be substituted yielding a well-formed formula. That is, the range of substitution is coextensive with the g.c. of the variable. While 'range of substitution of a variable' is thus a syntactic concept, the justification of the rule of substitution is semantic, i.e., substitution must preserve truth.

'The range of values of a variable' is a different semantic notion. The range consists of those entities which are named (denoted, designated, etc.) by phrases of the g.c. of a given variable.

Finally, essential to the concept of a variable is that it can be bound by an operator. In familiar systems of logic quantifiers are the only operators. Other systems may include the definite description operator ('?'), the abstraction operator ('λ'), etc. In the systems of Leśniewski, viz. ontology and protothetics, the quantifiers themselves are not assigned to a particular g.c. One reason for this is that a quantification and the formula within the scope of the quantificational operator are both of a sentential g.c. independently of the level of

the quantified variable, e.g., individual-, functional-, or sentential-phrases.[85]

Quine, in many of his writings, has stressed the pronominal character of variables.[86] The focus on pronouns as opposed to other pro-forms is tied to his endorsement of first-order logic in which there is one kind of variable which has as its range of values the ontological category of individuals. Quine (1962:67) renders the rather verbose sentence (1):

(1) Whatever number you may select, it will turn out, whatever number you may next select, that the latter is less than, equal to, or greater than the former.

as:

(2) whatever_1 number (whatever_2 number ($\text{it}_2 < \text{it}_1 \cdot \text{v} \cdot \text{it}_2 = \text{it}_1 \cdot \text{v} \cdot \text{it}_2 > \text{it}_1$))

It is noted that the device of subscripts of different letters is rendered in English by means of the former, the latter, or in some cases by the first, the second, etc. As he later (p. 70) states "the variables have no meaning beyond the pronominal sort of meaning which is reflected in translations...; they merely serve to indicate cross-references to various positions of quantification", something which is graphically noted in the device of curved lines (Ibid., p. 70).

10.2. A Comparison of Referentials and Variables.

10.21 Open Sentences. Earlier (section 1.1) it was suggested that certain sentences containing pro-forms, e.g.,

He is a boy, be regarded as open sentences, i.e., sentences with an occurrence of a free variable. Thus, the sentence above would be rendered as : x is a boy. Much as x + 2 = 11 is not evaluable as to its truth or falsity until x is specified, it is said that he requires specification to evaluate He is a boy. Such specification, say as Evan, determines then a 'closed' sentence.

It is not clear whether this position, i.e., that English, for instance, contains sentences with free variables, can be sustained. The distinction between open and closed sentences in logical systems presumes the statement of a domain, which is generally fixed but may be extended under particular conditions. Moreover, as noted in section 2.1, in certain cases the recognition of a phrase's referential status assumes recognition of its referend (in He who steals my purse steals trash, he requires no specification; the phrase he who has the sense of "whoever"). The tendency to assimilate certain sentences with pro-forms to ones containing free variables may derive from the assumption that certain phrases are referential in all of their occurrences. A related abstraction of sentences apart from their occurrences in discourses might reinforce this tendency.

10.22 Variables and Grammatical Categories. The 'range of substitution' associated with variables bears contrast with a feature of pro-forms -- namely, that their range of

co-occurrence, i.e., selection, is equal to the sum of the co-occurrence ranges of all members of the grammatical category to which they belong. For instance, "the sum of V-co-occurrences of he, she, it equals the sum of the V-co-occurrences of all N" (Harris, 1957:419). Note however that this does not state that for a given pro-form one can substitute any phrase of the same grammatical category as that pro-form. Moreover, for certain occurrences of pro-forms, e.g., she, one can substitute only a particular subclass of N, i.e., a feminine subclass. Perhaps the disjunction of, e.g., he, she, it, will jointly allow for substitution of any N. Still, differently from variables which do not permit any overlap in their range of substitution, he, she, and it can overlap in extension (cf. section 6.2).

The situation is yet more complicated in the case of phrases which are not of a nominal grammatical category. For forms such as do so there are considerations of tense not encountered in variables. For pro-sentences, substitution requires a deformation, e.g., a nominalization of the sentence.

Notwithstanding these complications, a comparison of referentials and variables in respect to range of substitution poses questions of substantial grammatical interest. One is the general availability of pro-forms for phrases of particular grammatical categories in given sentences

(addressed briefly in section 9). Another is to determine for various referentials the conditions of their replacement by referends.

10.23. Rule of Substitution. Another point of comparison between referentials and variables is provided by the rule of substitution. In accord with this rule, if a substitution is made for one occurrence of a variable, then that substitution is made for all of its occurrences within the scope of the operator, e.g., a quantifier. The situation in English differs: in

(3) Every woman knows that her marital status and her education will be questioned by her prospective employer.,

one cannot -- assuming some formulation of the substitution rule -- readily substitute, e.g., Jane, for all occurrences of the putative variable, e.g., Jane knows that Jane's marital status and Jane's education will be questioned by Jane's prospective employer. Moreover, as stressed above, replacement of a referential often requires an adjustment in grammatical categories, for instance, the alteration of a sentential referend into a noun phrase via a nominalization. Finally, unlike ordinary logics, English has referential pro-forms which have a 'grammatical spectrum' greater than one -- for example, it, this, and which (cf. section 9.1). In sentence (4), it occurs as referential to phrases of different grammatical categories in its various occurrences:

(4) IT_1 was a surprise that the amendment$_2$ had thirty senators voting against IT_2.$_1$

Combinatory logic may afford a more adequate basis for comparison -- here phrases can belong to more than one grammatical category and a replacement procedure can be stated in which not all occurrences of a variable are simultaneously replaced.[87]

10.24. Referentials as Bound Variables. A number of authors have suggested that certain pro-forms -- for instance, his, she, and himself in (5)-(7) -- have a reading in which the pro-form is interpretable as a bound variable (rendered in (5')-(7')).

(5) Every poet bothers his mother.

(6) Some actress passed a screentest she had dreaded.

(7) Every adolescent dislikes himself.

(5') (every x: x a poet) (x bothers x's mother)

(6') (some x: x an actress) (x passed a screentest x had dreaded)

(7') (every x: x an adolescent) (x dislikes x)

In (5) his is regarded as bound by the restricted universal quantifier seen in (5'); in (6) she is bound by a restricted particular quantifier of (cf. (6')). Both (5) and (6) have readings in which his and she cross-refer to some preceding phrase, e.g., Frank's, Luci, respectively. (7) only has the reading which is rendered in (7').

A 'bound variable reading' has also been proposed for sentences such as:

(8) Max aggravates his customers and so does Ralph.

where (8) has as a consequence: Ralph aggravates his customers ((8) also has a reading from which Ralph aggravates Max's customers follows). (8) would then be rendered as:

(8') (λ x)(x aggravates x's customers) (Max) and (λ x)(x aggravates x's customers) (Ralph)[88]

Use of the abstraction operator ('λ') here is in line with the suggestion made earlier (section 2.3) that in sentences like (8) reference can be made to a functor, Poss, in abstraction from its argument. Note that the two readings are also distinguishable in respect to the order of replacement: in the first one mentioned, so does cross-refers to aggravates his customers; in the second, his is replaced (Poss(Max)) and so does refers to aggravates (Poss(Max) customers.

Sentences such as (5)-(7) pose a problem in respect to the definition of referentials in section 5.3. Simple substitution of, e.g., every poet for his in (5) yields a sentence -- Every poet bothers every poet's mother -- which is neither a paraphrase nor a consequence of (5). A replacement procedure for his and other 'bound' proforms is not readily available.

Quantification in English is not only rendered by quantifying phrases which are modifiers of noun phrases. In English (and other Indo-European languages) quantifica-

tion is often effected by temporal adverbs, e.g., A poet always bothers his mother., cf. Russell's use of this in his Principles of Mathematics and in Principia. Certain manner adverbials serve as quantifiers, e.g., as a rule in Robins are as a rule builders of nexts (cf. typically, exclusively). Plural suffixes are also a means of rendering quantification: Parents are late-risers. With plurals, as was noted (section 6.3), collective and distributive usages are to be distinguished -- only the latter use as in Whales are mammiferous corresponds to quantificational logic: a class logic corresponds to the collective use in Falcons are becoming extinct. Quantifiers such as wherever, whatever, somehow and quantification as in Every crossing of the Atlantic had its difficulties argue against any simple scheme of first-order logic.

The focus on quantificational noun phrases (every pianist, each sparrow) in the literature might suggest that quantifiers are to be understood by attribution, i.e., as elements in a model. While Montague (1973) has shown for some quantifiers the semantic equivalence of their status as noun phrases and as sentence operators, it isn't clear whether a reduction to noun phrases is performable in all of the cases given above. Even were a reduction possible, there would remain the question whether it was not arbitary.

Rather than as elements in a model, quantifiers are arguably understood in respect to the laws which govern them.

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Quantification in English is not only rendered by quantifying phrases which are modifiers of noun phrases. In English (and other Indo-European languages) quantifica-

tion is often effected by temporal adverbs, e.g., A poet always bothers his mother., cf. Russell's use of this in his Principles of Mathematics and in Principia. Certain manner adverbials serve as quantifiers, e.g., as a rule in Robins are as a rule builders of nexts (cf. typically, exclusively). Plural suffixes are also a means of rendering quantification: Parents are late-risers. With plurals, as was noted (section 6.3), collective and distributive usages are to be distinguished -- only the latter use as in Whales are mammiferous corresponds to quantificational logic: a class logic corresponds to the collective use in Falcons are becoming extinct. Quantifiers such as wherever, whatever, somehow and quantification as in Every crossing of the Atlantic had its difficulties argue against any simple scheme of first-order logic.

The focus on quantificational noun phrases (every pianist, each sparrow) in the literature might suggest that quantifiers are to be understood by attribution, i.e., as elements in a model. While Montague (1973) has shown for some quantifiers the semantic equivalence of their status as noun phrases and as sentence operators, it isn't clear whether a reduction to noun phrases is performable in all of the cases given above. Even were a reduction possible, there would remain the question whether it was not arbitary.

Rather than as elements in a model, quantifiers are arguably understood in respect to the laws which govern them.

A view stemming from Peirce (1933) regards sentences with quantifiers as equivalent to the infinite product ('$\wedge$') of infinite sum ('V') of their particularizations, i.e., substitutional instances. Where the domain is finite and listable, particularizations are readily stated: the particular quantifier corresponds to a finite sum of the particularizations, the universal quantifier to the (finite) product. For instance, in a school class consisting of Henrietta, Bob, and Anthony, the sentence Some student in the class lost his lunchbag is equivalent to a disjunction of three sentences: Henrietta lost her lunchbag, Bob lost his lunchbag, Anthony lost his lunchbag. The domains involved in normal usage are generally finite and, if not listable, understood. Some elaboration of this equivalence (to particularizations) may provide a replacement procedure for 'bound variable' readings, e.g., someone could be considered a disjunction over some finitely specifiable domain.[89]

Another question to be considered in respect to quantification is the scope of the quantifier. Natural language differs from quantificational logic in several respects: (a) in the former, cross-references under some quantificational operator are not symmetrical as they are in the latter, (b) whereas variables are identified by use of the same letter under the same operator, natural languages (e.g., English) makes use of metalinguistic referentials (section 4), e.g., the former/latter, the fourth mentioned, a point

noted implicitly by Quine.[90] Most important perhaps is the fact that quantifiers in English have different scope properties than those in logic, and are not restricted to sentences, e.g.,

(9) Someone walked across the stadium. He was carrying a torch.

where he can be taken as bound by someone in the preceding sentence.[91]

11. Assertion. A topic of some interest, addressed by Karttunen in his paper "Discourse Referents", concerns the relation of cross-reference to assertion. Many cross-references are sensitive to whether sentences -- or, distinguished parts of them, which contain the referential and referend -- are asserted or not. Consider (1)

(1) Do you have a bike? I need IT/THE BIKE.

In (1), it or the bike cannot cross-refer to a bike (you have) as you have a bike is not asserted in the text. Similarly, if the phrase a weasel is interpreted non-specifically in (2), i.e., as "any weasel":

(2) I doubt Francesca bought a weasel. IT/THE WEASEL is furry.,

it (or: the weasel) cannot be construed as referential to a weasel (Francesca bought); under the (higher operator) doubt with subject I, the sentence Francesca bought a weasel is not asserted.[92] By way of contrast, cross-reference is possible if the first sentence of (2) is followed by I saw ONE yesterday or by THEY make rather odd pets.

The subject of the higher operator (doubt in (2) above) is relevant to the possibility of cross-reference, as is illustrated by texts (3) and (4):

(3) Wilfred doubts Francesca bought a weasel. But I saw IT.

(4) Wilfred doubts Francesca bought a weasel. But he saw IT in the garden yesterday.

(3) and (4) permit a cross-reference between it and a weasel (Francesca bought); my seeing the weasel that Francesca has bought is consistent with Wilfred's doubts. Text (4) is not an instance of inconsistency if one supposes that the second sentence of the text occurs under a zeroed higher operator, the performative I say (GEMP 2.6). Tense is also relevant:

(5) I doubted Francesca bought a weasel. But she brought IT around yesterday.

In the present work, these questions of assertion are not taken up; indeed, the topic is not particularly well understood. As far as can be discerned, these questions appertain to the scope properties of referentials (contrast the behavior of it and one, they above) and operators which relate to assertion, e.g., tense, the interrogative I ask, negation, and not, for instance to referents (in the sense of section 3.1): similar observations could be made if a weasel in the sentences above were replaced by, e.g., a round square. What appears to be at issue is a general requirement on the consistency of texts. If the

question in (1) is followed by Do you need IT? or the first sentence of (2) by IT would have to be domesticated., it can be construed as referential. In the first case, there is an "agreement" in mood; in the latter, use of the subjunctive is in accord with the operator doubt. It may be suggested that texts under such higher operators are acceptable when consistent with the assumptions supposed of a speaker or held in a prior science. However, 'consistency in respect to assumptions' is less an answer to these questions than an orientation which may prove useful in further work.[93]

12. Summary. The present chapter provides some of the background needed for the description of cross-reference in the "Influenzal" article (chapter 4). In the opening sections a referential relation is characterized as one which obtains between occurrences of phrases (section 2) and not by route of extra-linguistic reference (section 3). The identification of these cross-references is stated in a metalinguistic sentence (section 4). The definition of referential relationship in section 5.3 makes use of the notions of paraphrase and consequence (5.1) and of replacement (5.2) -- loosely, an occurrence of a phrase (a referential) cross-refers to an occurrence of another phrase (its referend) in a text if replacement of the former by the latter in respect to a rule of paraphrase or consequence results in a paraphrase or consequence of the text.

These introductory sections (sections 1-5) considered as well sentencehood, ambiguity, and the role of extra-linguistic reference in relation to a description of cross-reference. Some details of cross-reference in English are presented in succeeding sections with particular emphasis on topics, e.g., epiphora, which have received scant attention in the literature. Agreement phenomena are taken up in section 6, the distinction between anaphora and epiphora in section 7. Section 8 presents a description of the definite article and the wh- pro-forms in various constructions. The next three sections approached some more general concerns -- the relation of referentials to grammatical categories (section 9), to variables in logic (section 10) and to assertion (section 11).

FOOTNOTES CHAPTER 1

1. This procedure is set out in some detail in Z. S. Harris, Mathematical Structures of Language (New York: Wiley Interscience, 1968)(hereafter cited as MSL), section 3.6, and in N. Sager, "Procedure for Left-to-Right Recognition of Sentence Structure", TDAP 27, University of Pennsylvania, 1960.

2. For instance, intonations of pause are often cited as among the features which may distinguish restrictive and unrestrictive clauses. Hiż (1974:341) notes that in When he was eighty years old, Russell wrote a book, stress on he precludes an otherwise possible reference to Russell unless the sentence is, e.g., followed by but when I am eighty, I will be senile. Contrast -- for example between he and I in the extended text above -- appears to be closely related to cross-reference. Remarks on these "suprasegmental" features is episodic in the present work. Some discussion may be found in Bolinger, 1979, and Ladd, 1980.

3. The recent government-and-binding theory of Chomsky represents a departure from this characterization of sentencehood, see Chomsky, 1981:11-14. For some discussion on the reasons for the departure, see Gross, 1979, and Ryckman, in progress, chapter 4.

4. The stoic characterization of a sentence as that which is true or false is addressed in Michael Frede, Die Stoische Logik. Abhandlungen der Akademie der Wissenschaften, Göttingen. (Göttingen: Vandenhoeck & Ruprecht, 1974), especially section 11Ac.

5. This concept diverges from that of Frege, in that for Frege, truth or falsity is assigned to the thought which is the sense of a sentence, i.e., to "Sätze" (generally rendered as 'propositions'). See Gottlob Frege, "The Thought: A Logical Inquiry", 1956.

6. In regard to this definition, see the axioms of the consequence relation stated in paper V of Tarski, 1956, and those discussed in Hiż, 1979, especially pp. 345-46.

7. Note, for instance, the cross-references in:

> Was von Baer a Naturphilosoph? How shall we view HIS debate with Meckel and Oken over recapitulation? Did IT represent a clash over two philosophies or a disagreement over the interpretation of a common

framework? (p. 59) in Stephen J. Gould, Ontogeny and Phylogeny, Cambridge: Harvard University Press, 1977).

8. The notion of 'textlet' is adopted from Harris' 1953 paper (with C. F. Voegelin) "Eliciting in Linguistics" (paper XXXV in Harris 1970) where it refers to a text satisfying certain limitations in the distribution of elements.

9. On the notion of reading and ambiguity, see Hiż, 1964.

10. A point made by Pere Julià, Explanatory Models in Linguistics (Princeton: Princeton University Press, 1983) p. 187, footnote 5.

11. This is addressed in Hiż 1967b and a paper, "Disambiguation", TDAP 72, also pp. 124-34 in A. J. Greimas, et al (eds.), Sign·Language·Culture (The Hague: Mouton, 1970).

12. Cf. the discussion of likelihood in an operator grammar in Harris, A Theory of Language Structure, to be published by O.U.P.

13. Cf. Quine's discussion of occurrence in a formula (or: sentence) in section 56 of Mathematical Logic.

14. In section 8.2 (pp. 359-61) of Harris, A Grammar of English on Mathematical Principles (New York: Wiley, 1982) (hereafter cited as GEMP), it is considered referential in such occurrences.

15. At least epiphoric referentials cannot be identified as such straightforwardly. If the first sentence of (4) introduces a text or paragraph, there is some anticipation that the, e.g. theory, will be further specified. See chapter 5, section 4 for some related discussion.

16. P. 58 of Frege, "On Sense and Reference", 1952.

17. Relational nouns are discussed in section 12 of Hiż, "Referentials". As classifiers relational nouns may themselves occur as referentials, e.g., the occurrence of the father in Fred and his son Tim saw the Mets play. The father is a Giants fan. which cross-refers to Fred.

18. See GEMP, section 9.6 for an analysis of these and similar words, e.g., nevertheless, too.

19. Other options are of course possible, e.g., using the notion of 'refers partially'.

20. On the operation of repetitional zeroing (including end-zeroing), see GEMP, section 3.4. The reconstruction presumes a wide-scope reading of a narwhal in (16). In the narrow-scope reading, there is no need for repetitional reconstruction; the referend is the preceding occurrence of a narwhal.

21. A thorough discussion of a related case is provided in Hiz, 1973.

22. A point made in Harris, "A Theory of Language Structure", American Philosophical Quarterly, vol. 13 (1976), pp. 237-55.

23. Cf. MSL, pp. 51, 126. Note that in transformational analyses, particularly those applied to a scientific sublanguage, synonymy and other meaning relations among word-occurrences are obtained derivatively, i.e., from a paraphrastic regularization of sentences in a text. See the discussion in section 3.3 of chapter 2.

24. Cf. the discussion of regularization of conjunctional sequences above. The features of the sentences of set A cited may assist in grammatically distinguishing the text from the set A.

25. The situation is thus similar to various appropriate zeroings, where, e.g., I like wine is taken as "I like to drink wine" unless the context indicates otherwise. The idea of applying standard assumptions and the comparison with appropriateness are due to H. Hiż.

26. In the analysis of chapter 4, I do not note cases in which the assumption consists of a single classifier sentence, e.g., Influenzal virus is an antigen. Chapter 3, section 3.2 provides a listing of some of the relevant classifier relations used in the description.

27. For instance, Lasnik, 1976, and Reinhart, 1983. Koster, 1979, and Partee, 1978, make use of the vaguer notion of 'pragmatic control' which appears to be essentially equivalent to strong co-reference below. Generally, this notion of co-reference has been forwarded with greater or lesser explicitness. Thus, the remarks made here in criticism of this notion do not necessarily apply to each individual position. This section might be read again after the full presentation of cross-reference in section 5 below.

28. 'Sameness of referent' was introduced into transformational-generative grammars in connection with, e.g., the

[Please Note: No text is missing]

reflexivization transformation; if the two noun phrases in The girl hit the girl are taken as identical in reference, the second undergoes obligatory reflexivization, i.e., is altered to herself (cf. Chomsky 1965:145-47). Gross criticizes the assumption in this work that the two noun phrases subject to pronominalization (or: reflexivization) need be morphemically identical (Gross, 1973).

29. The contrast between weak and strong semantics is stated in Hiż, "The Role of Paraphrase in Grammar", p. 98, "Referentials", pp. 141-42, and other papers.

30. Some acquaintance is presumed with the theories advanced by, e.g., Frege and Russell.

31. Some of the important results in meta-mathematics concern the extent to which semantical concepts (truth, consequence, definability) are reducible to syntactical ones for various logical systems. In like fashion, the interest in this work is to see to what extent cross-references are describable without employing the concept of reference.

32. This raises the question how definite personal pronouns, etc., are grammatically distinguished as pro-forms. If such forms are to be taken (as in (SC)) as "having reference", they might be considered referentials in the sense given immediately below.

33. "Referring expressions" are considered by some to be tied to a speech act of 'referring'. The use of the term 'referential', in a sense close to (or: identical with) that of "referring expressions", is found in Partee, 1978, and Koster, 1979. For a linguistically-oriented discussion of singular terms, see chapter 2 of Vendler, Linguistics and Philosophy. The scare quotes in "definite descriptions"is intended to signal the frequent, albeit misleading use of Russell's theory as a grammar of the definite article. Definite descriptions for Russell do not refer (cf. Kaplan, 1966). Robbins (1968:47-57) compares various theories of the definite article with a transformational description. (See also Hiż, 1977, and section 8 below.)

34. R. M. Martin in Truth and Denotation (Chicago: University of Chicago Press, 1958) discusses uses of the terms 'denotation', 'designation', 'signification', etc. Wasow (1979:56ff) includes classes as referents. Some discussion of plurals in connection with co-reference is presented in chapter 5 of Chomsky, 1981, and Lasnik, 1981.

35. Frege's position is stated in "On Sense and Reference"; Quine's in various of his writings, for instance, sections 30-32 of Quine, Word and Object (Cambridge: M.I.T. Press, 1960).

36. Such an extension is suggested by the inclusion of events as an ontological category -- as in the work of R. M. Martin and Donald Davidson. An analysis of co-reference along the lines charted by these authors might not share the limitations noted in section 3.2 of (SC) as formulated here. I do not consider these possibilities.

37. This is suggested by Robbins (1968:16).

38. Relativizing the concept of referential to speaker's intentions is suggested in Lasnik (1976:6 fn. 5). The suggestion is posed in the face of problems of the following kind. Disjoint reference (related to (SC))states that a phrase a is not co-referential to a phrase c if there is no object b such that a refers to b and c refers to b. In accord with the rules which stipulate disjoint reference, she in She looks like Zelda is not co-referential to Zelda. However, mistaken assertions are possible and it may turn out that the referent of she is Zelda. In this case, the sentence is adjudged ungrammatical (Reinhart 1983:145), whereas relativizing referentials to speakers' intentions preserves the stipulated disjoint reference. The example and solution can be faulted on two counts: (1) Zelda looks just like Zelda today. is acceptable with only one Zelda at issue (thus, the rules of disjoint reference may be questioned) and (2) it is doubtful what gain there is in tying matters of grammaticality to the problematic ones of intentionality -- in particular it is not clear how such accounts are subject to empirical controls demanded of scientific theories. For similar qualms, see Ryckman, chapter 4.

39. McMaster and Hudack, "The Formation of Agglutinins in Lymph Nodes", Journal of Experimental Medicine, vol. 61 (1935) pp. 783-805, p. 789.

40. See Gregory Carlson, Reference to Kinds in English (I.U. Linguistics Club, 1977) for a model-theoretic account of similar cases.

41. Heim, 1982, considers the questions whether indefinite noun phrases refer. Strangely, Mill's position is not considered in accord with which a dentist signifies a class of dentists.

42. For instance, in asserting Every rodent has blue eyes., no assertion of the existence of rodents is made, although

such an assertion follows from the usual rendering of the sentence into first order logic with an 'objectual' reading of the quantifier. A large literature has developed around substitutional, objectual, and Lesniewskian interpretations of quantification. For a recent discussion, see Miéville, 1984, chapter 4, section 6, and references cited there.

43. The notion of 'quasi-replacement' was suggested by Lehrberger's treatment of cross-reference in Functor Analysis of Natural Language. In the philosophical literature, cases related to (ii) have been discussed by Castañeda and others. See Hector-Neri Castañeda, "Indicators and Quasi-Indicators", American Philosophical Quarterly 4 (1967), pp. 85-100, and John Perry,"The Problem of the Essential Indexical", Nous 13 (1979), pp. 3-21.

44. Cf. MSL, 142ff, where it is suggested that the notion of "individual" is replaceable in certain contexts by "counted in the same counting act". For the suggestion here, see Robbins (1968:152).

45. For a discussion of the "discreteness" of elements and its relation to the distinction between "repetition" and "imitation", see MSL, sections 2.1 and 3.1, and Harris, Structural Linguistics, p. 7, fn. 4 and chapters 3-4.

46. As Harris notes in his review of Sapir's Selected Writings, "...the question of which intonations are part of language and which are gestural sounds is simply the question of which of them can be described like the other elements of language - as combinations and sequences of phonemic elements...(T)his means that at least some of the distinction between gesture and language is a matter of the linguist's methods of analysis. This is not to say that the distinction is not important. The fact that ordinary morphemes and some intonations can be described as fixed combinations of fixed phonemic elements, while other intonations and all gestures cannot be so described, reflects a difference in the explicitness and type of use of these two groups of communicational (and expressive) activities" (Harris 1970:728).

47. This is essentially the approach forwarded in GEMP, pp. 71, 103.

48. The tacit sentences suggested here invite comparison with what David Kaplan calls "demonstration descriptions" in his article "Dthat" (1978:389). I consider the "demonstration description" as part of what Kaplan would call the "content of the proposition", thus eliding his distinction between "context" and "content".

49. Of course, cross-reference does not fully address the issues raised by Donnellan and others -- for instance, how one may succeed in saying something of someone though a description does not properly apply. However, the distinction between "referential" and "attributive" uses of definite descriptions and a characterization of where a description may "misfire" does appear to be describable in grammatical terms, see Gottfried, "Some Remarks on the Referential/Attributive Distinction", 1981, manuscript.

50. The reduction from speaker, etc. is proposed in GEMP, pp. 96, 352. That there is perhaps always recourse to tacit sentences in descriptions of texts, i.e., in order to have a text closed under all referentials (cf. section 1.2) has been put aphoristically by Hiż as "there is no first sentence". For a similar statement, see Hiż, 1971.

51. This is remarked upon in Harris, Structural Linguistics, pp. 188-89. Goodman has stressed that there is no sense to speaking of "the world" but much to speaking of systems of description; see, e.g., essay I of Ways of Worldmaking. In a text in a sublanguage, certain issues of deixis do not arise -- or are, better put -- localized. This is because we are describing a written text in which there is often greater explicitness than in conversations. Problems which arise concern cross-references to pictures and language-like tables and graphs. These are noted in chapter 3 where the article analyzed here is introduced.

52. From p. 7 of Martin Malia, Alexander Herzen and the Birth of Russian Socialism 1812-1855 (Cambridge: Harvard University Press, 1961).

53. See Hiż, 1969, 1979, 1984.

54. See the references in fn. 6 above.

55. A more precise formulation would note restrictions on the grammatical categories of the relevant phrases, see Hiż, 1969a, 1979.

56. Model-theoretic semantic accounts also are in their usual formulations unable to relate occurrences of the "same word" in different grammatical categories, e.g., total in The bill totaled $5.; I have a total of $4., It was a total fiasco., except by recourse to a profusion of meaning postulates, a solution that may be considered less than satisfactory.

57. P. 12 in J. van Heijenhoort (ed.), From Frege to Godel: A Sourcebook in Mathematical Logic 1979-1931 (Cambridge: Harvard University Press, 1967).

58. P. 158 in Charles Craddock, et al, "The Lymphocyte: Studies on its Relationship to Immunologic Processes in the Cat", Journal of Laboratory and Clinical Medicine, vol. 34 (1949), pp. 158-177.

59. The example is from an essay by Mary McCarthy, "Everybody's Childhood", p. 108 in The Writing on the Wall and other Literary Essays (New York: Harcourt Brace Jovanovich, 1970). An effect of multiple replacement in the second sentence is to increase the number of readings available for that sentence.

60. Cf. Lehrberger's analysis of referentials in Functor Analysis of Natural Language.

61. The tense restriction may, however, not be a case of agreement -- substitution of will for does in the example results in a marginally acceptable text. Observations in section 11 below may also be related to agreement.

62. This usage is discussed in Arthur Ahlgren, On the Use of the Definite Article with 'Nouns of Possession', (Uppsala, 1946).

63. Other examples are provided in Jespersen, Progress in Language, section 24.

64. Hiż has suggested that occurrences of both in texts involve anaphora. In accord with this hypothesis, one would expect that in, e.g., Both cats and dogs are companionable, there is a prior occurrence of a referend.

65. Epiphoric referentials are also termed 'anticipatory' (in Hiż, "Referentials") and 'cataphoric'. The appropriateness of the latter term in referring to this phenomena is unclear.

66. Self-reference is discussed in respect to the antinomies in Hiż, 1984.

67. The terminology is most unfortunate here (as with use of the neologism anaphor) as it mistakenly suggests that there is some systematic reduction available of epiphora to anaphora in all cases.

68. See, for example, Reinhart, 1983, section 2.2, and fn. 2, p. 56.

69. Bolinger (1979:300-305) provides more examples. Sentences violating this 'restriction' may also prove to have particular tense and "causal" relations between the

component sentences apart from the question of the particular subordinating phrase.

70. The ability to specify positions of the referends for wh- pro-forms in relative clauses helps circumvent the need for an extensive addressing system in the grammar, see section 4, and GEMP, section 2.51. Thus, wh- pro-forms are "bound" in the sense of Harris, 1957, section 2.6, i.e., the antecedents occupy determinate positions in respect to them.

71. The distinction between the semantic notion of question and the syntactic one of interrogative stems from Jespersen, Philosophy of Grammar; not all interrogative forms are questions, e.g., "rhetorical" questions, nor are all questions of interrogative form.

72. For details, see Hiż, "Difficult Questions", in the volume edited by him, Questions, pp. 211-26.

73. Harris, "The Interrogative in a Syntactic Framework" in the volume cited in fn. 72, especially pp. 8-9; also GEMP 7.23.

74. The analysis of (i) given assumes a reading in which a thing mentioned does not cross-refer to an occurrence of a phrase outside of the text-sentence.

75. Robbins notes the connection between the various occurrences of the in respect to their being related to conjunctions (1968:54).

76. In line with this analysis, those is not referential in such occurrences to the prior occurrence of a noun as modified.

77. Robbins' discussion here bears comparison with later proposals, e.g., Gareth Evans, "Pronouns", Linguistic Inquiry, vol. 11, (1980), pp. 337-62, and Heim, 1982, section 1.4. Robbins presents a discussion of the theories of Mill, Frege, and Russell regarding definite descriptions; in section 1.7 of the book, these theories are contrasted with a transformational analysis.

78. Jespersen, A Modern English Grammar, vol. 3, chapter 8.

79. 'Operators' in GEMP could equally well be called 'functors'. In the operator grammar presented in GEMP, there are notably no functor-forming functors.

80. Lehrberger (op.cit.) calls the resulting phrases, e.g., she (Cynthia) "referential phrases" differently from the usage in this work.

81. Kretzmann, "History of Semantics", 1967, p. 373.

82. As in Montague, 1974.

83. See, for example, Wasow, 1975, Lasnik, 1976, Higginbotham, 1980, and Reinhart, 1983.

84. As in the logical systems of Leśniewski, see reference cited in fn. 41.

85. See section 1.2 of chapter 3 and section 6 of chapter 4 in Miéville, 1984.

86. For instance, in The Ways of Paradox and Other Essays (rev. ed.) papers 27 and 28; section 28 of Word and Object.

87. See Curry and Feys, 1958, chapter 2D.

88. Partee, 1978, Reinhart, 1983, especially section 7.2.

89. Cf. Harris, "Transformational Theory", section 5.23, paper XXVII in Harris, 1970. Hiż has noted that Montague demonstrated for some quantifiers a semantic equivalence between their status as noun-phrases and sentence-operators in respect to valuation; a proof of the equivalence of those quantifiers to their particularizations is not yet available for those systems.

90. Cf. MSL, pp. 202, 204.

91. See the paper by Richard Smaby, "Ambiguous Co-reference with Quantifiers".

92. Discussion of operators (higher and lower) presumes an acquaintance with operator grammar, see chapter 2, section 2.1 below for a sketch.

93. A related discussion of "correctives" appears in Hiż, "Information Semantics and the Antinomies".