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NAME OF AUTHOR/*NOM DE L'AUTEUR* PURUSHOTTAM GARBADBHAI PATEL

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NAME OF SUPERVISOR/*NOM DU DIRECTEUR DE THÈSE* DR. B. L. DERWING

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DATED/*DATÉ* April 25, 1974 SIGNED/*SIGNÉ* P. G. Patel

PERMANENT ADDRESS/*RÉSIDENCE FIXE* 51 BIRCH AVE
OTTAWA ON
K1K 3G5

NL-91 (11-73)

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AN ANALYSIS OF THE NOTION 'STRUCTURAL AMBIGUITY'

by

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A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled "An Analysis of the Notion 'Structural Ambiguity'", submitted by Purushottam Garbadbhai Patel in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

Bruce L. Derwing
Supervisor

Co-supervisor

Date April 18, 1974

ABSTRACT

The notion 'structural ambiguity' is analyzed, especially in relation to the methodological and metatheoretic claims associated with it in transformational-generative grammar (henceforth TGG). In TGG the notion is utilized to connect the theoretical constructs of linguistic competence, descriptive adequacy and deep syntactic structure with the native speaker. The analysis of structural ambiguity presented in this study shows that the justification of these claims by transformational-generative grammarians depends upon their (a) assumptions about the process of disambiguation, (b) taxonomy of the types of ambiguity, and (c) abstract-to-concrete unidirectional definition of grammatical transformations. There are serious difficulties involved in these claims on both internal and external grounds. The objective of this dissertation is to analyze these problems and present a preliminary background for an alternative approach to structural ambiguity.

A revised taxonomic perspective is suggested and the process of disambiguation is considered from the point of view of perceptual paraphrase. It is emphasized that grammatical descriptions can only provide structural types with a potential for ambiguity; whether the potential of a given type is realized in its individual tokens is a semantic question. An attempt is made to formulate some operational tests to distinguish structural ambiguity from content vagueness. It is shown that it

is possible to analyze the cases cited as examples of deep syntactic structure ambiguity in TGG literature in terms of the morphological and surface syntactic characteristics of English.

The consequences of the analysis of structural ambiguity offered in the present study bear upon the nomological network of TGG. It seems that the weakness of TGG in the sense suggested by the mathematical studies of Peters and Ritchie (1969) and Peters (1970) can be explained, in part, in terms of the problems involved in the TGG approach to structural ambiguity. The epistemic correlation between linguistic competence and structural ambiguity is untenable. Within the present framework of TGG, the external adequacy criterion of structural ambiguity is only a formal device and the nature of the link between descriptive adequacy and structural ambiguity is not clear. Also, the connection between an autonomous level of deep syntactic structure and structural ambiguity is unjustifiable on both internal grammatical and external psycholinguistic grounds. It is suggested that the nature of the triple relationship between surface syntactic ambiguity, paraphrase and grammatical transformations be explored for an alternative perspective on structural ambiguity and its relevance to linguistic theory.

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CHAPTER ONE

INTRODUCTION

0.0 The Problem

The native speaker's response to ambiguous sentences, especially the problem of the linguistic parameters and processes involved in disambiguation, has implications which are crucial to linguistic theory. Although the problem of ambiguity has been approached by almost all the major schools of linguistics, it is only in Noam Chomsky's transformational-generative theory of grammar (henceforth TGG) that it has a methodological and a theoretical status with far-reaching consequences.

In transformational-generative linguistics a grammar of a language is treated as a descriptive model which says something about the linguistic intuition (competence) of the native users of the language in question. The degree of success of a given TG grammar depends upon the extent to which it can reflect the native speaker-hearer's intuition. Grammars, in other words, are connected with native speaker-hearers in TG grammatical theory. The epistemic correlations are specified in terms of certain observable properties of natural language expression, such as grammaticality, structural ambiguity, paraphrase relations, coreferentiality, etc. It is assumed that these properties provide external (psychological) indexes of native linguistic intuition (competence).

The level of adequacy achieved by a grammar is determined by the nature of those specific natural language properties it can account for. The lowest level of adequacy that a grammar is required to attain is grammaticality. Structural ambiguity, paraphrase relations, etc. are stipulated for the higher level of descriptive adequacy, which requires 'strong generative capacity'. One of the major methdological requirements

for a proposed grammar is that it fulfill the external adequacy criterion of structural ambiguity, that is, be able to identify structural ambiguities and assign structural descriptions to the different readings involved in an ambiguous sentence.

Structurally ambiguous sentences, thus, form a crucial part of 'primary linguistic data' in TGG. These data are analyzed in a certain way, that is, by using a specific descriptive mechanism. It is then assumed that this descriptive mechanism is an inherent property of the data and must be recognized as an essential primitive in grammatical theory. It is in this sense that the necessity for an autonomous level of deep syntactic structure is justified from the point of view of structural ambiguity. The position of structural ambiguity in the nomological network of TGG can be stated as follows:

GRAMMAR (FORMAL) — LINGUISTIC COMPETENCE (UNOBSERVABLE CONSTRUCT)

DEEP SYNTACTIC STRUCTURE (UNOBSERVABLE CONSTRUCT)

STRUCTURAL AMBIGUITY (OBSERVABLE PROPERTY)

The legitimacy of the interpretive links between an observable property like structural ambiguity and the primitives (linguistic competence and deep syntactic structure) is an important question with respect to the conceptual and methodological foundations of TGG.

1.1.0 Background to The Problem

The notion 'structural ambiguity' is tied up with the notion of constituent structure both in terms of its relevance and origin. In order to demonstrate the tactical difficulties with the immediate constituent analysis within the framework of an item and arrangement model,

Hockett (1954) suggests an analogy between a grammatical description and a cookbook which may be considered an operational device for the 'speaker's internal apparatus'. Hockett argues that in cooking the proportions of the ingredients can make a difference in the end-product, but the differences of sequence in most cooking operations have no discernible effect. However, "There is, in linguistics, no guarantee that different sequences of operations, performed on the same ultimate constituents, may not produce the same, or what is ostensibly the same, end product" (Hockett, 1954, p.217). Consider the historically well-known case of the construction of adjective-attribute and a nominal head - 'old men and women'. The composite form 'old men and women' can be built by two procedural sequences: putting 'old' and 'men' together and then joining the product to 'women'; or putting 'men' and 'women' together and then putting 'old' before the product. The concern here is with the converse of Hockett's grammatical description - cookbook analogy, i.e., the problem of analysing such constructions which contain differences in hierarchical sequence may result in sentences with 'structural ambiguity'. It is specifically with reference to the problem of analysing structurally ambiguous constructions that Hockett justifies considering constituent structure as a primitive and requires that "...when presented with an utterance in a language the pattern of which has been determined, the analyst should be able to state its structure (Hockett, 1954, p. 218). Hockett emphasized that the different interpretations due to differences in 'hierarchical structure' in structurally ambiguous constructions were not to be explained away in terms of differences in either individual morphemes and words or their linear arrangements. Hockett, thus, associated 'structural ambiguity' with differences in hierarchical structures in the sentences.

'Structural ambiguity' is here understood in the sense of an ambiguity in a sentence due to the grammatical organization of the sentential elements. At times it is difficult to distinguish between 'genuine' or 'inherent' ambiguity and cases of vagueness in sentences due to insufficient specification of their semiotic setting. This problem will be discussed in the second chapter.

Chomsky has introduced the term 'constructional homonymity' which he uses interchangeably with 'structural ambiguity' (1957, pp. 96-98). It is not certain whether all the varieties of structural ambiguity can be subsumed under the label 'constructional homonymity'. Chomsky's position regarding the levels of structural ambiguity has been ambiguous: "In fact, it is not clear that there are any cases of constructional homonymity purely within the level of phrase structure once a transformational grammar is developed" (1957, p. 87). The indeterminacy in Chomsky's position will be in focus when a perspective on the problem of the methodological and theoretical status of structurally ambiguous sentences in TGG is developed in the following section.

1.1.1 The Methodological and Theoretical Role of Structural Ambiguity in Transformational Grammar

The task of giving a rigorous formulation to the procedures for discovering linguistic elements and their relations turned out to be so onerous that it hardly allowed the American structural linguists to pay attention to the problem of the non-uniqueness of their results. Although they realized "that there can be more than one (non-trivial) structural statement for a given language" (Harris, 1954, p. 777), the structural linguists did not accept the question of the evaluation of their distributional statements as a major goal of linguistic inquiry. Chomsky set up a "program for linguistic theory" (Chomsky, 1957, p. 53) to shift priorities in goals. In Syntactic Structures

Chomsky (1957, p. 56) declared:

> Our ultimate aim is to provide an objective, non-intuitive way to evaluate a grammar once presented, and to compare it with other proposed grammars. We are thus interested in describing the form of grammars (equivalently, the nature of linguistic structure) and investigating the empirical consequences of adopting a certain model of linguistic structure, rather than in showing how, in principle, one might have arrived at the grammar of a language.

Chomsky's 'program for linguistic theory' proposed three major tasks: (i) to characterize the form of grammars in a general and explicit way so that actual grammars of this form can be proposed for particular languages; (ii) to state precisely (if possible, with operational, behavioral tests) the external criteria of adequacy for grammars; (iii) to analyse and define the notion of simplicity that can be used to choose grammars "all of which are of the proper form" (1957, pp. 53-54). The proposed program specified that (1957, p. 54):

> We shall continue to revise our notion of simplicity and our characterisation of the form of grammars until the grammars selected by the theory do meet the external conditions.

The plan to revise continually the form of grammars in light of the external adequacy conditions has been carried out with exemplary zeal, though notably in the absence of any crucial operational criteria for the external constraints. The results of these revisions are incorporated in the models proposed subsequent to the publication of Syntactic Structures.

The native speaker's ability to recognise and resolve structural ambiguity has been extensively used as one major criterion of external adequacy throughout the development of TGG. The ability to recognise and resolve structural ambiguity was taken as one behavioral

correlate of the native speaker's linguistic intuition. It was required that a grammatical description not only generate "all and only the sentences of the language but also reflect the linguistic intuitions of the native speaker of that language.

1.1.2 Structural Ambiguity as a Criterion of External Adequacy of Grammars

In his classic paper 'Two Models of Grammatical Description', Hockett (1954) tried to show that the item and arrangement (IA) model could not handle the analysis of structurally ambiguous sentences. On the basis of the problem of analyzing constructions involving structural ambiguity, Hockett (1954, p. 218) argues:

> a grammatical description is an operational parallel to part of a speaker's internal apparatus. If we believe that this parallel extends to the matter of order of association, so that ambiguities in the description are matched (at least in some cases) by distinct internal chains of activity which produce identical linear sequences of morphemes, then we can regard the matter of hierarchical structure as an integral part of the structure of utterances even in ambiguous cases.

When Chomsky was planning his 'program for linguistic theory', he was aware of Hockett's use of the notion of structural ambiguity to illustrate the inadequacy of the IA approach as a model of syntactic structure (Chomsky 1957, pp. 86-87; 1967, p. 441, fn 32). Chomsky first tried to apply the notion of structural ambiguity to cases of what he preferred to call 'constructional homonymity' in sentences like:

(1) Flying planes can be dangerous

which can be analyzed on the level of phrase structure, though not on any lower level (1957, pp. 86-87). Actually, he introduced the notion of 'understanding a sentence' (without realizing, of course, that 'understand' implies 'process' and not 'product') and linked it up with the notion 'linguistic level': (p. 87)

> To understand a sentence, then it is first necessary to reconstruct its analysis on each linguistic level; and we can test the adequacy of a given set of abstract linguistic levels by asking whether or not grammars formulated in terms of these enable us to provide a satisfactory analysis of the notion of 'understanding'. Cases of higher level similarity of representation and higher level dissimilarity (constructional homonymity) are simply the extreme cases which, if this framework is accepted, prove the existence of higher levels.

The necessity of the transformational level was justified on the same grounds. In "Three Models for the Description of Language" and Syntactic Structures, Chomsky attempted to expose the inadequacy of the model of phrase structure grammar to analyze sentences like:

(2) The shooting of the hunters was terrible

(3) I found the boy studying in the library

(4) John was frightened by the new methods.

He explained the ambiguities in these sentences by showing the differences in their transformational histories, i. e., they would be derived from different sets of kernels.

Since the justification of the phrase structure and transformational rules was based in part on the notion of structural ambiguity, Chomsky adopted SA as a condition of external adequacy for grammars. The motivation underlying the choice of the notion of structural ambiguity as a criterion of external adequacy was twofold:

(i) to test the adequacy of a given grammar; (ii) to test the adequacy of the linguistic theory underlying the grammar in question. Chomsky's initial theoretical rationale is stated explicitly in the following quotation from "Three Models for the Description of Language" (Chomsky, 1956, p. 23):

> If the grammar of a language is to provide insight into the way language is understood, it must be true, in particular, that if a sentence is ambiguous, then this sentence is provided with alternative analyses by the grammar. In other words, if a certain sentence S is ambiguous, we can test the adequacy of a given linguistic theory by asking whether or not the simplest grammar constructible in terms of this theory for the language in question automatically provides distinct ways of generating the sentence S. It is instructive to compare the Markov process, phrase-structure, and transformational models in the light of this test.

As the above quotation indicates, initially Chomsky required grammars simply to show how structurally ambiguous sentences were transformationally derived from different sets of kernels. Since the native speaker is generally able to provide paraphrases of the n-readings involved in a SA sentence, it is possible to determine the transformational origins of the different interpretations of such a SA sentence making reference to the paraphrastic relations. The structural ambiguity criterion could be applied in a straightforward way in this framework.

The situation changed when Postal (1964) made the minimum requirements for grammatical descriptions rigid and explicit. He added that the grammar must not only enumerate all and only the

well formed strings of a language but also automatically assign to each sentence a structural description. The structural description of a sentence, Postal insisted, "must provide an account of all grammatical information in principle available to the native speaker" (1964, p. 3). Postal's changes did not affect the first external condition that the grammar discriminate sentences from nonsentences, i. e., generate all and only the well-formed sentences of a language. But the requirement that the grammar assign a structural description to each sentence introduced complications which removed the behavioral basis of the structural ambiguity criterion, i.e., it no longer remained 'external' in any crucial way. When Chomsky adopted Postal's suggestion to revise his theoretical framework, he tightened up the SA criterion (Chomsky, 1964, p. 71):

> ...if it is true that the interpretation of a sentence is determined by the structural descriptions of the strings that underlie it (as is supposed in the theory of transformational grammar), then the degree of ambiguity of a sentence should correlate with the number of different systems of structural description underlying it.

As Prideaux (1973) points out, "the correctness of the structural descriptions in a sense is decided by the grammar itself." Since the testability of a grammar depended upon its capacity to assign each sentence a distinct structural description which could determine the unique interpretation of a given sentence, the SA criterion became vacuous from the point of view of its external, behavioral relevance (see chapter 3 for discussion).

1.1.3 Structural Ambiguity Criterion and Descriptive Adequacy

As it has been shown in 1.2.0, Chomsky's 'program for

linguistic theory' set up two conditions of external adequacy for grammars: (i) the grammar must discriminate between sentences and non-sentences and generate all and only the sentences of a language, and (ii) the grammar must characterize the intuitions of the native speaker with respect to grammaticality, sentential relations and structural ambiguity. During the initial period (Chomsky, 1957), no distinction was made between the two conditions in terms of their relative importance in justifying a given grammar. When the theoretical perspective was modified in Aspects of the Theory of Syntax (Chomsky, 1965), a distinction was made between the two conditions of external adequacy in terms of their relative status. The two conditions were given new names and a third condition was added and a strict order was assigned in terms of the observational, descriptive and explanatory levels of adequacy. Observational adequacy was essentially the same as the condition of the enumeration of all and only sentences. On the level of descriptive adequacy a grammar was to be justified "to the extent that it correctly describes its object, namely the linguistic intuition - the tacit competence - of the native speaker" (Chomsky, 1965, p. 27). The first two levels of adequacy, thus, in principle, relate the grammar to the native speaker.

The observational level of adequacy tests a proposed grammar in terms of its ability to generate all and only the sentences of a language; similarly, the higher level of descriptive adequacy checks if a given grammatical description characterizes the linguistic intuition (tacit linguistic competence) of the native speaker by way of its handling of structural ambiguity, coreferentiality, paraphrase, etc. As for the level of explanatory adequacy, a grammar could be

justified "to the extent that it is a principled descriptively adequate system, in that the linguistic theory with which it is associated selects this grammar over other, given primary linguistic data with which all are compatible" (Chomsky, 1965, p. 27; italics added).

It is obvious that the methodological function and theoretical status of the structural ambiguity condition are not the same in the 'Standard Theory'. In the initial stages of Chomsky's 'program for linguistic theory' the motivation for the structural ambiguity criterion was twofold: (i) test the adequacy of a grammar, and (ii) test the adequacy of the linguistic theory underlying the grammar in question. If a grammar fulfilled the structural ambiguity criterion, among others, the linguistic theory guiding the form of the grammar was declared adequate; it did not have to wait for any higher level condition. Within the 'Standard Theory' setup, it is assumed that there can be several descriptively adequate grammars, that is the native speaker's intuitions can be characterized in several ways: the structural ambiguity criterion can be fulfilled by several grammatical descriptions of a given language simultaneously (Chomsky, 1965, p. 35). The implication, then is clear that structurally ambiguous sentences can be analyzed in several ways. Out of the several descriptively adequate grammars, the evaluation measure selects only one at the level of explanatory adequacy. It is the descriptive apparatus of the grammar ultimately chosen by the evaluation measure that is supposed to decide how structural ambiguity should be resolved. This raises the question of the nature

of the evaluation measure, that is, if it has any empirical relevance.

Whether the evaluation measure, as it is currently understood in TGG, can assume any external dimension is doubtful. In his foundational analysis of the notion 'linguistically significant generalization', Prideaux (1971) shows that the level of explanatory adequacy is, at best, an internal, formal means of evaluating grammars. He demonstrates that the conditions for capturing 'linguistically significant generalizations' are essentially formal in nature. Peters and Ritchie (1969) and Peters (1970) suggest that, no matter what evaluation measure is constructed, it will equally well select any of many 'universal' bases. It has been indicated in relation to Peters-Ritchie's mathematical findings that the strategy of 'fudging' is all too available in TGG (Kac, 1973, p. 470). The following quotation from Brown (1973, p. 163) succinctly sums up the difficulties associated with the evaluation measure:

> It has not been demonstrated, and it is open to question whether it can be demonstrated, that the evaluation metric itself, or the formalism which the evaluation metric evaluates, does correctly characterize the faculté de langage of the native speaker.

As for the status of the structural ambiguity criterion in relation to the empirical (external) adequacy of a proposed linguistic theory, the fate of the theory is supposedly decided by the evaluation measure. A given grammatical description can fulfill the structural ambiguity criterion, i.e., it may be descriptively adequate; in principle, yet it can still fail at the level of explanatory adequacy. Thus, the structural ambiguity criterion lost its theoretical status,

i.e., it no longer determined the ultimate fate of theories.

It has been pointed out in 1.2.1 that Postal's (1964) requirement that the grammar be able to assign each sentence a distinct structural description removed whatever behavioral application the structural ambiguity criterion possesed originally. The further conceptual revisions leading to the 'Standard Theory' (Chomsky, 1965) and the 'Extended Standard Theory' (Chomsky, 1972) multiplied the difficulties and turned the structural ambiguity condition into a formal measure which could be used to justify certain basic theoretical concepts (such as deep syntactic structure, linguistic competence as knowledge rather than ability, etc.).

1.1.4 Structural Ambiguity and Deep Structure

In the initial stages of his 'program for linguistic theory' Chomsky justified the motivation for the notion 'bracketing' or 'constituent structure' on the grounds that it was necessary to account systematically for 'structural ambiguity'. The same argument was put forward as a motivation for the transformational level. Chomsky (1956, p. 124) argued:

> Examples of constructional homonymity on the transformational level provide quite convincing evidence not only for the greater adequacy of the transformational conception of linguistic structure, but also for the view that transformational analysis enables us partially to reduce the problem of explaining how we understand a sentence to that of explaining how we understand a kernel sentence - or, more properly, the terminal strings, generated by phrase structure rules, which underlie the sentence in question.

When the notion of the deep structure level was introduced and the

definition of 'transformation' was modified, the explanation of structural ambiguity in terms of different kernel sets was no longer valid. A new approach to 'constructional homonymity on the transformational level' had to be proposed. In fact, Chomsky tried to prove the existence of the deep structure level by reference to the problem of structural ambiguity.

Since the conception of Aspects of the Theory of Syntax, the native speaker's ability to detect and resolve structural ambiguity, and to perceive paraphrase and grammatical relations have been taken as the empirical correlates of his "knowledge of a language, a certain cognitive system that has been developed" (Chomsky, 1970, p. 428). It is claimed that the surface structure in itself gives very little indication of the different interpretations hidden in a structurally ambiguous sentence. Let us look at Chomsky's approach to the sentence

> I disapprove of John's drinking (Chomsky, 1970, p. 431)

> Our internalized grammar assigns two different abstract structures to 'I disapprove of John's drinking', one of which permits the extension to 'I disapprove of John's drinking the beer', the other of which permits the extension to 'I disapprove of John's excessive drinking'. But it is only at the level of deep structure that the distinction is represented; it is obliterated by the transformations that map the deep structures into the surface form...(Italics added)

The deep structure resolution of structurally ambiguous sentences is explained by attributing the system of rules to the person who knows the language, as one aspect of linguistic competence.

Chomsky's justification of the motivation for the level of deep structure in the context of structural ambiguity is as follows:

The various transformations that produce ambiguous surface structures partially obliterate the system of grammatical relations and functions that determine the meaning of sentences. It is assumed that grammatical relations are defined in a general way in terms of configuations within phrase-markers and that semantic interpretation involves only those grammatical relations specified in deep structures ("although it may also involve certain properties of surface structures") (Chomsky, 1970a, p. 12). The n-readings involved in a structurally ambiguous sentence cannot be determined without first determining the n-deep structures underlying it. The number of the readings perceived by the native speaker in a structurally ambiguous sentence is determined by the number of the deep structures that he can assign to it.

1.2.0 Statement of the Thesis

The problem of the validity of the interpretive definition of deep syntactic structure in terms of structural ambiguity will be examined in this study from three points of view. First, the crucial examples will be reanalyzed using only the surface structure information which will provide an alternative for descriptive analysis. Second, it will be shown that there are serious internal difficulties associated with the deep syntactic structure model in relation to structural ambiguity. It will also be demonstrated that these difficulties cannot be circumvented without making allowances which

are embarrassing in the context of the basic assumptions underlying TGG. Third, the available psycholinguistic evidence on the process of disambiguation will be considered to show that the construct of deep syntactic structure has no behavioral relevance.

As it has been pointed out in 1.1, it has been possible for transformational (generative) grammarians and the psycholinguists who follow the same paradigm to support obviously conflicting theories from the point of view of structurally ambiguous sentences. The reason for the current state of the art is, it seems, that the notion has not been clarified in terms of its (i) types, (ii) operational linguistic criteria for (i), and (iii) its relationship with the observable properties of paraphrase and sentence relations which seem to be connected with it on both the psychological and descriptive levels.

It is suggested that a clarification of the notion of structural ambiguity and the claims associated with it will reveal the following:

1. There are non-trivial problems associated with the use of the notion of structural ambiguity as a criterion of external adequacy for grammars.
2. It is not possible to justify the level of deep syntactic structure on the grounds that it is necessary to systematically account for structural ambiguity.
3. The problems involved in (1) and (2) are inherent in the linguistic paradigm, especially in reference to the definitions of 'transformation', 'derivation', 'structural

description' and 'underlying logical relations'.

4. The triple relationship between structural ambiguity, paraphrase and transformations which is observable in the behavior of the native speaker is the clue to the problem of disambiguation. This relationship has been widely used in transformational (generative) analysis on a heuristic basis; there are crucial implications for the problem in the works of Harris (1968), Hiz (1964, 1970), Smaby (1971) and Prideaux (1972a, 1972b).

The organization of the chapters is as follows:

In Chapter Two, the taxonomy of the types of ambiguity adopted in TGG will be considered. A few examples representing the lexical, surface structure and deep structure types will be examined. It will be shown that the cases cited in the TGG literature as examples of deep structure ambiguity can be analyzed in terms of the morphological and surface syntactic characteristics of English. It will be suggested that the potential for structural ambiguity can be realized only if the underlying semantic structure of the relational terms allows it. The significance of the distinction between structural ambiguity and content vagueness will be stressed, and a groundwork for a taxonomic perspective will be provided.

In Chapter Three, questions bearing upon the external adequacy criterion of structural ambiguity will be discussed. It will be shown that within the methodological framework of TGG the criterion has no external relevance. The nature of the link between descriptive adequacy and structural ambiguity is not clear. An attempt will be made to con-

struct a battery of operational tests to distinguish structural ambiguity from content vagueness in English. It will be argued that the weakness of TGG in the sense suggested by the mathematical studies of Peters and Ritchie (1969) and Peters (1970) can be explained, in part, in terms of the TGG approach to structural ambiguity.

In Chapter Four, the epistemic link between structural ambiguity and deep syntactic structure will be examined. It will be suggested that what has made it possible for Chomsky to justify the ontological status of deep syntactic structure from the point of view of disambiguation is the unidirectional abstract-to-concrete definition of 'grammatical transformation'. The argument against an independent level of deep syntactic structure will be motivated from the point of view of both internal and external considerations. If deep structure is accepted as a medium of disambiguation, there are several internal problems for TGG; the consequences of such an approach raise serious questions concerning some of the basic assuptions of the theory. Some psycholinguistic findings bearing upon the issue will be discussed.

In Chapter Five, the nature of the process of disambiguation will be considered within the framework of natural language understanding. The commonly observed fact that ambiguous sentences cease to be so in discourse context says something about the linguistic parameters and contextual variables which enable native speakers to resolve structural ambiguity. The importance of the notion 'hyper-syntax' in understanding the problem of disambiguation will be stressed, and suggested that the process of disambiguation be treated as a problem in 'perceptual paraphrase'.

The implications of the approach to disambiguation adopted in this study will provide a preliminary basis for an alternative approach.

CHAPTER TWO

A TAXONOMIC PERSPECTIVE

2.0.0 Preliminary Remarks

In TGG, the types of ambiguity are usually described in terms of the levels of linguistic description. For example, the first line of taxonomic demarcation is drawn between the lexical and the grammatical levels, hence, the types 'lexical' and 'grammatical'. The taxonomy of the types of ambiguity at the grammatical level is assumed to be on a one-to-one relational basis with the surface and deep levels of syntactic structure. Chomsky uses 'constructional homonymity' and 'structural ambiguity' as synonyms and assigns them a scale of gradation in terms of the surface and deep structure levels. If the ambiguity in a given sentence is identified as 'surface structure ambiguity', it is resolved in terms of distinct bracketings at that level; if the ambiguity in a given sentence is determined to be of the 'deep structure ambiguity' type, n-deep structures are postulated, one for each of the n readings.

The objective of this chapter is to examine the TGG approach to the taxonomy of the types of ambiguity and to outline the background toward a coherent perspective on structural ambiguity. It will be shown that the TGG taxonomy of the types of ambiguity in natural language expression is untenable. The typical examples discussed in the TGG literature to justify the level of deep syntactic

structure can be accounted for in terms of either distinct labellings or distinct bracketings which are actually surface structure phenomena. These examples, in fact, raise questions which focus on the nature of the sources of ambiguity and the necessity to distinguish it from content vagueness. Morphological and syntactic operations simply provide a potential for ambiguity. Whether the potential for ambiguity will materialise or not in a specific case depends upon the semantic parameters governing it.

The purpose of the chapter is to lay the groundwork for a discussion of the metatheoretical claims associated with the notion of structural ambiguity in TGG.

2.1.0 Types of Ambiguity in TGG

The motivation underlying the taxonomic framework of the types of ambiguity in TGG is largely guided by its approach to the problem of disambiguation. The theory of language which guides the assumptions underlying the TG forms of grammar revolves on the concept of "knowledge of language, a certain cognitive system..." (Chomsky, 1970c, p. 428). An optimal grammar is required to fulfil certain primary empirical claims at the level of descriptive adequacy. It is claimed that the native speaker-hearer's 'knowledge of the language' is reflected in his response to 'constructional ambiguity'. According to Katz and Fodor (1963, p. 486), within the TGG framework discourse is interpreted only so far as the interpretation of a sentence depends upon

> ...grammatical and semantic relations which obtain within and among the sentences of the

> discourse, i.e., it (the theory) interprets discourses as would a fluent speaker afflicted with amnesia for nonlinguistic facts but not with aphasia (italics added).

Hence, In Katz and Fodor (1963) disambiguation of polysemy is a sentence-internal operation; it is supposed to be guided by the native speaker-hearer's linguistic competence which does not allow combinations of readings violating selectional restrictions.

It ought to be emphasized that in TGG the disambiguating parameter of 'knowledge of language' has a purely linguistic basis. Following Monod (1970), Chomsky (1971, pp. 10-11) suggests that it has "implicit biological content". In the cognitive process of disambiguation, Chomsky claims, 'the biological given' of 'competence' is reflected in the native decoder's ability to induce "the semantically significant grammatical relations" from the surface structures of constructionally ambiguous sentences. It is assumed that it is the deep structural logical relations that provide the clues without which the native speaker-hearer cannot disambiguate a major portion of constructional homonyms.

It is assumed in TGG that there is a clear dichotomy between the lexical and syntactic levels in regard to the hearer's ability to resolve the various types of ambiguity. The types 'lexical', 'surface' and 'deep' imply that the different paraphrasal readings of ambiguous sentences can be attributed to the level of linguistic representation suggested by the type under which the sentence in question is classified. If an ambuguity in a given sentence is identified as 'deep structure ambiguity' type, it is assumed that the different interpretations in the sentence cannot be

obtained without intuiting all the possible categorial configurations of the logical relations in it. Underlying all the claims associated with the notion of structural ambiguity in TGG is the assumption that all the different varieties of multiple ambiguity associated with syntactic structure are amenable to formal analysis within the framework of TGG.

2.1.1 Lexical Ambiguity

In TGG, a sentence is considered to be lexically ambiguous "if a word or sequence of words has two distinct meanings and no differences at the other grammatical levels" (MacKay and Bever, 1967, p. 193). The typical examples often cited in the TGG literature are:

(7) The soldiers like the port.

(8) We are confident that you can make it

(9) Tom's aunt couldn't bear children.

MacKay and Bever (1967) and Ulatowska (1971) suggest that"...lexical ambiguities can be divided into two types based on the nature of the relation between the two meanings of the ambiguous lexical item" (MacKay and Bever, 1967, p. 196). For instance, they argue, in the sentence

(10) The bark frightened him

the bark of a tree has no obvious connection with the bark of a dog. Although the different interpretations of some lexically ambiguous sentences are semantically distinct, the different meanings of the lexical items are "conceptually related". In the sentence

(11) The marine captain liked his new position

the two readings of position are related. Accordingly, MacKay and Bever (1967) classify lexical ambiguities as related or 'systematic' and unrelated or 'unsystematic'.

The systematic - unsystematic lexical ambiguity distinction in itself hardly sheds any light on the problem of the taxonomic criteria for ambiguity. As a matter of fact, MacKay and Bever's (1967) dichotomy between systematic and unsystematic ambiguity sidetracks the crucial issue of the distinction between lexical ambiguity and infinite polysemy. Even though Weinreich is not certain if 'an absolute distinction between true ambiguity and mere indefiniteness' (Weinreich, 1966, pp. 411-412) can be maintained in light of the problem of its operational basis, he considers them homophonous, i.e., n-lexical items with the same phonological form. It ought to be emphasized that Weinreich's apprehension about the distinction between lexical ambiguity (homophony) and infinite polysemy is motivated by the issue of empirically validating it within the framework of a comprehensive semantic theory.

Lexical ambiguity (homophony) can be identified in terms of a definite list of lexical items which are incompatible with each other in their semantic representations, i.e., they are not synonymous with each other. For example, in the sentence

(12) The soldiers took the port at night

the lexical homophony, i.e., the two readings of port can be paraphrased as

(13) The soldiers stormed the port at night

(14) The soldiers drank the port at night.

That (13) and (14) are not paraphrases of each other shows that port is a case of lexical homophony (ambiguity). Infinite polysemy, on the other hand, cannot be represented in terms of a determinate list of semantically incompatible readings without any interpretational residue which gives rise to vagueness.

The second major weakness in the TGG treatment of lexical ambiguity is the question of keeping it distinct from syntactic ambiguity. Certain cases which are treated as higher level ambiguity in the TGG literature can be resolved by simply substituting lexical items. For example, in the sentence

(15) They kept the car in the garage

the ambiguity can be shown by the following lexical paraphrases:

(16) They retained the car in the garage

(17) They stored the car in the garage.

If the two readings are extended as follows:

(18) They retained the car in the garage, but sold the one in the yard

(19) They stored the car in the garage, but took it out later to wash it

the basis of the two disambiguating paraphrasal readings will be obvious. In the TGG literature, the ambiguity in (15) is attributed to the reduction of the relative clause as in

(20) They kept the car which was in the garage.

As Prideaux (1972) suggests, the ambiguity in the crucial example

(21) The police stopped drinking

can be resolved by an appropriate choice of lexical items as in:

(22) The police forbade drinking

(23) The police ceased drinking.

However, the lexical disambiguation of (21) clearly indicates the structural basis of the ambiguity in (21) in that it depends upon the selection of verbs which are synonymous with the verb stop, but which belong to different grammatical classes; the verb forbid in (22) is transitive, while the verb cease in (23) is intransitive.

In the absence of any criteria to separate lexical ambiguity from structural ambiguity, the transformational (generative) grammarians determine the type of the ambiguity involved in individual examples in terms of convenience to support their hypotheses. As it has been pointed out in 1.2.4, Langendoen (1966) considers the ambiguity in

(24) John's proof of the theorem ...

to be syntactic in nature, while Chomsky (1970a, p. 18, fn 7) treats it as a case of lexical ambiguity. Langendoen (1966) refrains from adopting a full lexicalist position on account of the problem raised by such ambiguities; Chomsky (1970a) argues that "one might just as well suppose that a lexical ambiguity is involved, analogous to the ambiguity of such words as book, pamphlet, etc., which can be either concrete or abstract..."

The cases usually discussed under 'lexical ambiguity' can, in fact, be divided into three categories:

(a) Lexical Homophony

(b) Infinite Polysemy

(c) Indeterminate: Lexical or Syntactic

2.1.2 Surface Structure Ambiguity

Ambiguity at the level of surface structure in TGG involves the possibility of more than one distinct grouping of adjacent words in sentences. The n different interpretations resulting from an ambiguous sentence depend upon the n distinct hierarchical structures which are exemplified by the n possible bracketings. For example, there are two hierarchical structures in the phrase

(25) fashionable ladies' hats

which can be demonstrated by the following two groupings:

(26) (fashionable ladies') hats

(27) fashionable (ladies' hats)

Surface structural ambiguity is a case of genuine syntactic homonymy. Its resolution depends upon distinct labelings and bracketings. Bar-Hillel and Shamir (1960, p. 161) rightly suggest that Chomsky "does not seem to have been aware of the ability of finite state grammar to discriminate homonymities by constructional methods." In the following section, it will be shown that the cases treated as examples of 'deep structute ambiguity' in TGG can be resolved in terms of surface structure information.

2.1.3 Deep Structure Ambiguity

Deep structure ambiguity, it is claimed in TGG, involves "neither a change in meaning of individual words, as in lexical ambiguity, nor a change in the apparent grouping of words, as in surface structure ambiguities, but only a change in the logical relations between words" (MacKay and Bever, 1967, p. 193). It is suggested that in the sentence:

(28) The mayor will ask the police to stop drinking

the ambiguity is claimed to be at the underlying level; the logical relations between police and drinking are not clear at the surface level in (28). The two interpretations,

(29) The mayor will ask the police to forbid drinking

(30) The mayor will ask the police to cease drinking

according to Chomsky (1966), MacKay and Bever (1967) and others, can be determined only by deep structural disambiguation.

In order to grasp the problems and issues associated with 'deep structure ambiguity', it is necessary to examine the typical examples discussed in the TGG linguistic (Chomsky, 1964, 1965, 1972b; Katz, 1971; Jackendoff, 1972, etc.) and psycholinguistic (MacKay, 1966; MacKay and Bever, 1967; MacKay, 1969; Ulatowska, 1971; Foss, 1971; Foss, Bever and Silver, 1968; Garrett, 1970; MacKay, 1970; Carey, Mehler and Bever, 1970) literatures. The examples cited in the literature contain ambiguities arising mostly out of the various kinds of nominalizations, restrictive and non-restrictive relative clauses, restrictive and appositive adnominal complements, the scope of negation and quantifiers, indefinite NPs, referential opacity, and genericity. Within the framework of the form of TGG proposed in Katz and Postal (1964) and Chomsky (1965), it was claimed that the ambiguities arising out of all these areas could be resolved on purely syntactic grounds at the level of deep structure. The assumption underlying the claim was that the key logical relations and the contextual restrictions necessary to systematically account for these ambiguities could be specified at the deep structure level.

As a result of the recent modifications in the form of TGG, largely due to the questions raised by the alternative form of grammar prescribed by the theory of language which motivated 'generative semantics' (Lakoff, 1970; McCawley, 1968, 1971), it is now maintained that the semantic interpretation of the scope of negation and quantifiers, indefinite NPs, genericity, and referential opacity has nothing to do with functional structure (Chomsky, 1972b; Jackendoff, 1972). In his paper "Deep Structure, Surface Structure and Semantic Interpretation," Chomsky (1970 b, p. 113) points out:

> it seems that such matters as focus and presupposition, topic and comment, reference, scope of logical elements, and perhaps other phenomena, are determined in part at least by the properties of structures of K other than deep structures, in particular, by properties of surface structure.

Ambiguities arising out of these areas, therefore, cannot be classified as of the 'deep structure' type in view of the form of grammar proposed in 'interpretive semantics'. The ambiguities in the following examples, then, need not be considered from the point of view of deep structure disambiguation:

(31) Fred wants to meet a voluptuous blonde
(Indefinite NP)

(32) A unicorn is a dangerous beast
(Genericity)

(33) I didn't persuade Bill to date many girls
(Scope of negation and quantifiers)

(34) John thinks that the book that was burned was not burned.
(Referential opacity)

It would be impossible to treat every example of 'deep structure' ambiguity individually in this study. But what can and will, be done is to classify such examples into various distinct types.

Then each type, with a few crucial examples, will be examined. The examples of 'deep structure ambiguity' in the TGG linguistic and psycholinguistic literatures which need to be accounted for are the following:

(35) The police stopped drinking

(36) He hit the man with the stick

(37) I disapprove of John's drinking

(38) Jack likes Sally more than Susan

(39) They are flying planes

(40) The shooting of the hunters was terrible

(41) We are surprised at the colonel's appointment

(42) They claimed that he was quick to please.

Before considering the issues involved in each example, it is necessary to understand the nature of grammatical homonymy.

There are two ways in which what Chomsky calls 'constructional homonymity' (1957, p. 86) can occur. It is frequently the case that an element in a given sentence can be classified under more than one grammatical class (Lyons, 1968). For example, in the sentence

(45) Please make her dress fast

dress can be both a nominal and a verbal. Zandvoort (1961, p. 10) suggests that in English the 'plain infinitive' (verb stem) is used in a verbal, never in a nominal function. The simultaneous presence of the nominal and verbal functions in the element dress renders the sentence homonymous, i. e., it carries two functional structures. The ambiguities in the sentence

(46) They can fish

can be accounted for by classifying can and fish in different ways

(Lyons 1968, 212). In English, can and fish are used as a modal auxiliary or transitive verb and an intransitive verb or a noun, respectively. The paradigms for the various grammatical classes in different languages are at times asymmetrical. The homonymy at the level of the distribution of grammatical classes depends upon the morphological characteristics of individual languages.

What is described as 'surface structure ambiguity' in TGG is the second type of grammatical homonymy. As Hockett (1954) observes, elements having the same phonemic form and lexical meaning, occurring in the same order, may give rise to different total contents according to whether they have one functional relationship or another. The possible n bracketings of the constituents are constrained semantically in most of the cases. In the construction

(47) beautiful girl's dress

there are no semantic constraints to suppress the ambiguity which arises out of the possibility of the following two distinct groupings:

(48) beautiful (girl's dress)

(49) (beautiful girl's) dress

However, in the construction

(50) fresh fruit market

the question of the two bracketings

(51) fresh (fruit market)

(52) (fresh fruit) market

does not arise, even though the grammatical structure in (50) and (47) is the same. The semantic structure of (50) does not permit more than one interpretation. The type of syntactic structure in the sentences:

(53) The man who was seen by the girl was shot

(54) The man who was seen by the door was shot

is susceptible to ambiguity; it is not realised in all of its tokens. For example, the ambiguity of (53) can be shown by the following readings:

(55) The man who was seen alongside the girl .

(56) The girl saw a man and the man was shot

(54) does not allow the following interpretations:

(57) The man who was seen alongside the door was shot

*(58) The door saw a man and the man was shot.

It is obvious that whether a given type of grammatical structure can be ambiguous or not for the native speaker-hearer in a given language depends upon both the grammatical and the semantic structures of the language in question.

Ziff (1965) points out that grammars can only specify the types of morphological and syntactic structures whose tokens can be ambiguous in certain contexts. The crucial variable which determines whether a token of a given type of grammatical structure can be assigned more than one interpretation or not is its semantic state of affairs. As Ziff (1965, p. 145) explains:

> For the realization of a morphological potential for ambiguity an appropriate context is required. But for the realization of a syntactic potential, both an appropriate morphemic constitution and an appropriate context are required. A token of the type I saw the shooting of the children is ambiguous only if the token occurs in an appropriate context. It can be ambiguous because given its morphemic constitution its syntactic potential for ambiguity can be realized. On the other hand, a semantically nondeviant token of the type I saw the shooting of the elephants cannot be ambiguous. But the reason is simply that such a token's potential for ambiguity cannot be realized owing to the nature of its morphemic

constitution. From the fact that a sentence-type is not ambiguous, it does not follow that either the type or its tokens cannot sensibly be said to have a syntactic potential for ambiguity.

The number of the types for the morphological and syntactic potentials for ambiguity depends upon the grammatical structure of an individual language. With reference to the nature of the ambiguity in the sentence

(38) Jack likes Sally more than Susan

Hankamer (1973, pp. 64-66) argues that it is a case of 'accidental homophony' of the preposition than and the conjunction than. He points out that "in many languages there are two types of comparative construction, one involving a conjunction which introduces an embedded clause, and one involving a preposition, post-position, or case marking with a single NP." In Gujarati, for example, there are two distinct constructions for (38)

(1) Jackne Susan kərətā Sally wədhu gəme če

To Jack Susan than Sally more likes.

(2) Sally Jackne gəme če ena kərətā Susanəne

Sally to Jack likes it than to Susan

wədhu gəme če

more likes.

The potential type which carries two relational structures in English does not exist in Gujarati, even though both English and Gujarati are analytic Indo-European languages. The grammatical homophony of than in (38) becomes obvious when Gujarati (1) and (2) are translated into English:

(59) Jack likes Sally more than Jack likes Susan

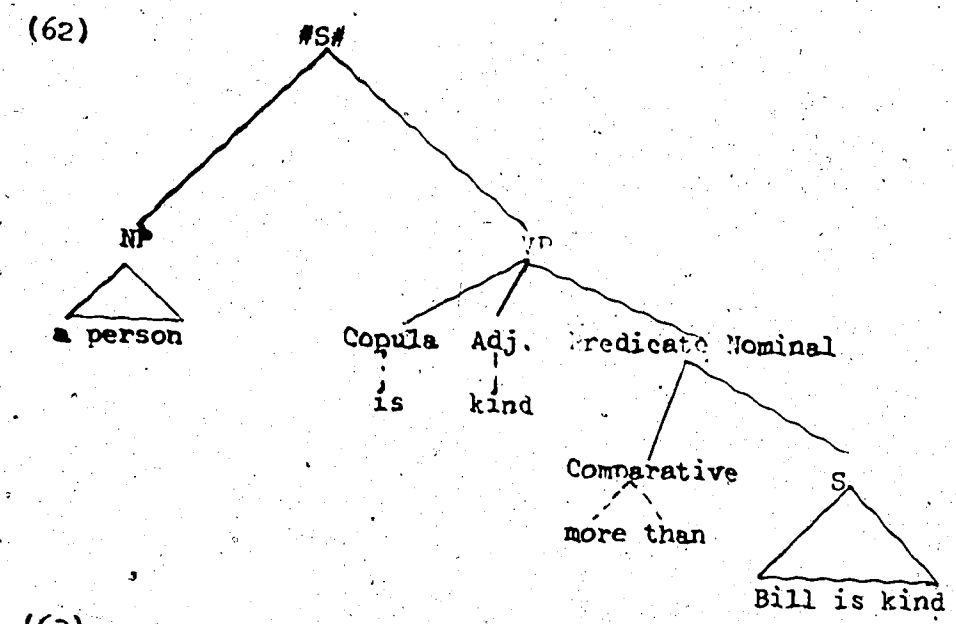
(60) Jack likes Sally more than Susan likes Sally.

The type of ambiguity in (38) discussed above is treated in terms of deep structural disambiguation in both the TGG linguistic and psycholinguistic literatures. Katz (1971, pp. 77-83), for example, analyses the second NP in the sentence

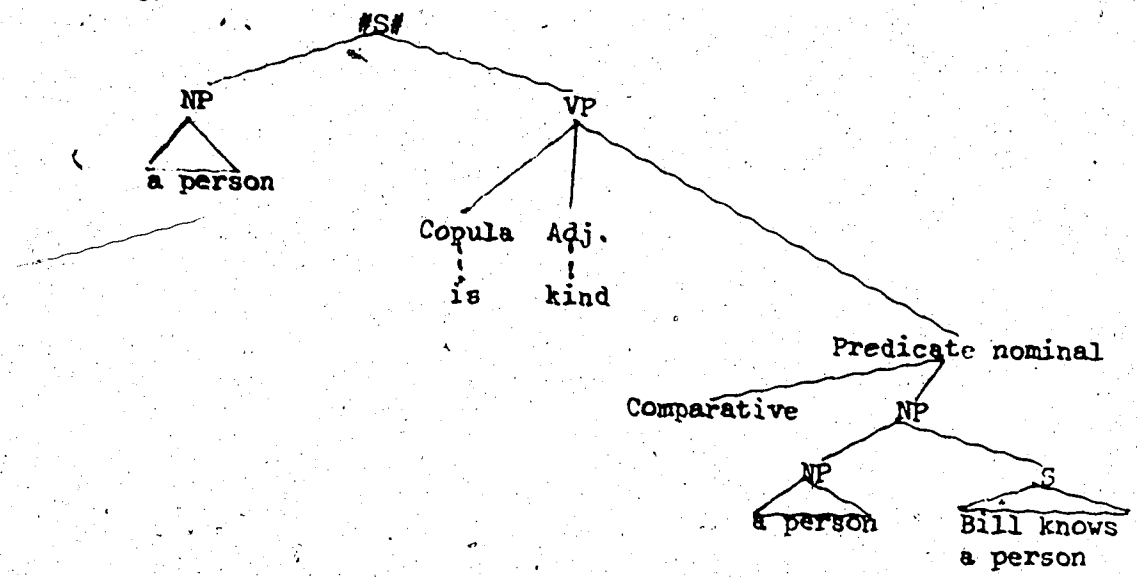
(61) John knows a kinder person than Bill

as follows:

(62)



(63)



It is pointed out that the deep structure source of the ambiguity in (61) is in S which is different in the two interpretations. It is hardly necessary to point out that (61) is a case of 'accidental homophony' in the manner of (38). MacKay and Bever's (1967) experimental materials contain a similar example which they take as a case of deep structure ambiguity.

(64) Italians like opera as much as Germans.

In (64), as much as, like than in (38) and (61) is a case of 'accidental homophony' which can be demonstrated by paraphrasing the two readings involved in it in a similar way:

(65) Italians like opera as much as Germans do

(66) Italians like opera as much as they like Germans.

If as much as is replaced by than in (64), the similarity between (38) and (64) will be obvious:

(67) Italians like opera more than Germans do

(68) Italians like opera more than they like Germans.

Furthermore, native-speakers hardly use constructions like (38) and (64); a great many even find them ungrammatical. The question of the grammaticality of (38) and (64) seems to be related to the educational background of the subject concerned. It is the case, however, that the ratio of frequency of (65) - (64) is very high, that is people use (65) more than they use (64).[1]

It can be said, then, that the grammatical structure of an individual language and the semantic context within which the tokens of the potential types realize in sentences are the two crucial variables underlying the phenomenon of grammatical homonymy in natural language expression. As a matter of fact, it is the interaction between the two variables that gives rise to homonymous con-

structions. A particular grammatical structure may be a potential type for homonymy; the potential realizes in only some of its tokens, however. If there are no clear semantic constraints on the possible constituent labelings and groupings, the different constituent analyses of a given token would result in different readings, that is, the token would be a homonym. With this perspective on grammatical homonymy in view, the typical TGG examples of deep structure ambiguity can be accounted for systematically without the intervention of the level of deep syntactic structure in the sense of Chomsky (1972b) and Jackendoff (1972).

In Syntactic Structures, Chomsky (1957, p. 81) suggests that transformational analysis can be used to determine the constituent structure of sentences: "...the behavior of a sentence under transformations provides valuable, even compelling evidence as to its constituent structure" (italics added). If transformational analysis is used to determine the constituent structure of constructional homonyms, the n relational structures involved in a given ambiguous sentence can be demonstrated at the level of surface syntactic structure. To take the crucial case,

(35) The police stopped drinking.

Prideaux (1972) uses transformational tests to demonstrate that the homonymy of (35) can be resolved in terms of surface structure constituent analysis. He proposes the following two bracketings:

(69) ((the police) ((stopped) (drinking)))
S NP VP V NP VP S

(70) ((the police) ((stopped) (drinking)))
S NP VP V V VP S

In (69) stop is treated as a transitive verb with drinking as its NP-direct, while in (70) stopped drinking is taken as a compound intransitive verb. If the bracketings in (69) and (70) are valid, as Prideaux (1972) argues, only (69) should be subject to passivization, since it is only in (69) that there is a direct object NP available. Hence, the passive of (69)

(71) Drinking was stopped by the police

should be non-ambiguous, which it is. Furthermore, if the ambiguity in (35) can be resolved only at the level of deep syntactic structure as it is claimed in TGG, Prideaux (1972) persists in his argument, its passive, i. e., (71) should be two-ways ambiguous, which it is not.

The fact that drinking in (69) is a direct-object NP can be shown by replacing it with a noun or pronoun:

(72) The police stopped the car

(73) The police stopped it.

Similarly, it can be demonstrated that drinking in (70) is not a noun but a part of the compound verb stopped drinking. The sentence (70) is similar to

(74) The police continued running

which is not ambiguous. Incidentally, when

(75) The police stopped running

is compared with (74), it becomes obvious that the syntactic potential of (35) and (74) for ambiguity is realized because of the semantic structure of the verb stop in the context of the lexical item police. If the lexical items the police and stopped in (35) are replaced by others, it is seen that the ambiguity of the syntactic type

of (35) depends upon the interaction of the semantic structures of the nouns and verbs involved in the tokens:

(76) The teetotallers stopped drinking

(77) The alcoholics stopped drinking

(78) The teenagers stopped drinking

(79) The carperters stopped drinking

(80) The alcoholics continued drinking

(81) The bartenders continued drinking

(82) The teenagers continued drinking

(83) The carpenters continued drinking.

It can safely be concluded that there are two distinct surface structures in

(35) The police stopped drinking

and the constructional homonymy of it depends upon the semantic structure of the relational elements in it. The transformation test yeilds the two constituent structures of (35) and an investigation of the semantic structure of the relational elements shows that the syntactic potential for the homonymy of (35) is governed by non-syntactic factors.

Following the same line of argumentation, the ambiguity of Chomsky's next example of deep structure ambiguity

(36) He hit the man with the stick

can be resolved as follows:

(84) ((he) ((hit) ((the man) (with the stick)))
S NP VP V NP NP PP

(85) ((he) ((hit) (the man) (with the stick))
S NP VP V NP PP

The two distinct groupings in (84) and (85) show that in (84) with the stick is a nominal adjunct, while in (85) it is a verbal complement. The validity of the two bracketings can be assured by the following transformational tests which show that none of the items in the transformational sets of (84) and (85) is ambiguous. In the following set of sentences, which are paraphrasal transformations of (84), with the stick remains a nominal adjunct:

(86) The man with the stick was hit by him

(87) It is the man with the stick who was hit by him.

But the phrase with the stick is a verbal complement in the sentences which belong to the transformational set of (85):

(88) The man was hit by him with the stick

(89) It is with the stick that the man was hit by him.

If the relational elements are replaced, it becomes clear that the realization of the grammatical potential for homonymy is not independent of the underlying semantic variables. The following are not ambiguous:

(90) He kicked the man with the stick

(91) He embraced the man with the stick

(92) He hit the man with the bow tie

(93) He hit the man with the blonde.

The source of the ambiguity of

(37) I disapprove of John's drinking

is the simultaneous presence of the factive and manner interpretations of the gerundial nominal John's drinking. The problem of the syntactic basis of the ambiguity of gerundive nominals has been widely discussed in the TGG literature (Lees, 1968; Chomsky, 1964,

1970a; Katz and Postal, 1964). In (37) the nominal could be interpreted either in terms of the fact of the activity or the manner of it. Wonder (1970) shows that the factive and manner interpretations of gerundive nominals depend upon the adjectival types used with the basic phrase markers which are determined semantically. He maintains that

> ... the factive and manner sense of the gerund may be referred to the natural difference in the original sentences constituting the basic input component. In the factive situation, the gerund phrase is embedded as a complementizer; in the manner situation, as a type of relative. The key to the grammaticality of either type is the adjective of the component matrix sentence. The feature <-animate> is associated with the factive sense and <+animate> with the manner sense. The simultaneity of both features renders the sentence ambiguous (Wonder, 1970, p. 266; italics added)

Wonder's finding suggests that the realization of the potential for ambiguity in the gerundive nominal is determined by the absence or presence of the feature 'animate'. Apart from the natural difference in the type of adjectives occurring in the factive and manner interpretations of the gerundive nominals, native speakers suggest that in everyday English the possessive indicates the manner interpretation:

(94) I disapprove of John's drinking

(95) I disapprove of John drinking.

The absence of the possessive in (95) invariably implies the factive interpretation and it is similar to

(96) I disapprove of John driving in Europe

(97) I disapprove of John staying home all day

(98) I disapprove of John cooking for his girl friend.

When John's wife is concerned about her husband's excessive drinking, she says:

(99) I am worried about John's drinking

Furthermore, the presence of the possessive s in the gerundive nominal in the subject position, as in

(100) John's driving scares me

causes no ambiguity for many native speakers. In the absence of any context, John's driving in (100) is interpreted only in the manner sense by most of the native speakers (see footnote 1).

The ambiguity in the next crucial example

(39) They are flying places.

also arises out of flying planes which can be treated as a nominalization as in the sentence:

(101) They are performing monkeys

as opposed to

(102) They are bombarding cities.

Prideaux (1972) suggests that (39) is a case of surface structure ambiguity which can be resolved by the following three distinct constituent analyses:

(103) ((they) ((are) ((flying) (planes)))
S NP VP V NP V N

(104) ((they) ((are) (flying) (planes))
S NP VP V V NP

(105) ((they) ((are) ((flying) (planes)))
S NP VP V NP N N

The validity of these syntactic analyses can be demonstrated by paraphrasing them accordingly:

(103) They are planes which are flying

(104) They are flying the planes

(105) They are planes for flying.

It is only (104) which can be passivized

(106) The planes are being flown by them

and it is unambiguous. If the surface constituent grouping in (104) were not correct, its passive form in (106) should be ambiguous.

The semantic control over the syntactic potential for the ambiguity of (39) is quite obvious. The following tokens of the type in (39) are ambiguous due to the absence of the controlling factors in the underscored relational terms:

(107) They are eating apples

(108) They are flying women.

The semantic structures of the underscored lexical items block the realization of the potential for ambiguity in the following tokens, however:

(109) They are picking apples

(110) They are ignoring women.

Related to the nominalization construction V+ING+N is the problem of V+ING+OF+NP in which V can be interpreted both subjectively and objectively, as in the sentence,

(40) The shooting of the hunters was terrible.

The crucial point in the disambiguation of (40) is that its objective reading as in

(111) The shooting of the hunters by the police...

is related to its passive form

(112) The hunters were shot by the police.

The fact that only one interpretation of (40) can be passivized suggests that the verb shoot can be labelled both 'Transitive' and 'Intransitive'. Furthermore, Lyons (1968, p. 251) points out,

> With a 'fully transitive' verb (i.e. with a verb which has an overt and specific object) phrases of the form the V -ing of NP do not normally admit of a subjective interpretation: they cannot be extended with an objective of NP (the shooting of the hunters of the deer). Instead, the subjective NP takes the 'possessive' suffix and the objective NP the preposition OF: cf. the hunters' shooting of the deer

For example, (113) and (114), but not (115), are allowed:

(113) The president disapproved of the shooting of the hunters by the police

(114) The president disapproved of the hunters' shooting of the Chinese bulls

* (115) The president disapproved of the shooting of the hunters of the Chinese bulls.[2]

Similarly, the ambiguity in (116) depends upon the subjective and objective interpretations of the verb boo:

(116) The booing of the president was terrible

(117) The booing of the president by the reporters was terrible

(118) The president's booing of the Congress was terrible

* (119) The booing of the president of the Congress was terrible (See footnote 2)

Moreover, the realization of the morphological potential for the ambiguity in (40) and (116) depends upon the semantic structures of the lexical items involved. The semantic restraints in the

lexical items in the following tokens do not allow the potential for morphological homonymy to realize:

(120) The shooting of the Indian cows was terrible

(121) The president disapproved of the shooting of the Chinese bulls

(122) The snoring of the girl was terrible.

Incidentally, the verb snore in (122) is intransitive; hence, the other readings are ruled out:

(123) The girl's snoring was terrible

* (124) The girl's snoring by the boy was terrible

* (125) The girl's snoring of the boy was terrible.

The ambiguity in (40), therefore, is a surface structure phenomenon. The pseudo-intransitivity of the verb shoot allows the optional deletion of the logical subject by the police after the shooting of the hunters. The absence of ambiguity in (122) is due to the full intransitivity of the verb snore.

The next example on the list is a case of what Bever and MacKay (1967) call 'multiply ambiguous sentences':

(41) We are surprised at the colonel's appointment.

The lexical homophony of 'appointment' gives the following two readings:

(126) We are suprised at the colonel's appointment as a judge

(127) We are surprised at the colonel's appointment with the president.

The nominalization colonel's appointment is ambiguous with respect to the role of colonel; in the absence of any ellipsis, colonel can be an agent and a patient simultaneously:

(128) We are suprised at the colonel's appointment (as a judge) by the President

(129) We are suprised at the colonel's appointment of his girl friend (as his secretary).

The ambiguity of the nominalization colonel's appointment is not due to its objective position in the sentence; it remains even the nominalization is in the subjective position in the sentence:

(130) The colonel's appointment surprised us.

A trivial change in the morphological structure of colonel's appointment resolves its ambiguity:[3]

(131) We are surprised at the appointment of the colonel.

It is obvious that (131) can be interpreted as

(132) We are surprised at the appointment of the colonel by the President

and not as

* (133) We are surprised at the appointment of the colonel of his girl friend.

There are interpretational constraints when the nominalization is used in the subjective position in the sentence. When the appointment of the colonel by the President is changed morphologically to the President's appointment, there is no doubt about the agency of the President's role. The President's appointment by the colonel would be anomalous.[4]

The morphological resolution of the ambiguity in the nominalization colonel's appointment clearly indicates that (41) is a case of morphological homonymy which can be ascribed to the morphological structure of English.

The last example of deep structure ambiguity often cited in the TGG literature is crucial. The ambiguity in it is due to the homonymy of logical relations:

(42) They claimed that he was quick to please.

The grammatical subject in the ambiguous sentence he was quick to please can be both a logical subject and an object.

(34) He pleased her quickly

(135) He was pleased quickly (by her).

Similarly, he can be both an agent and a patient in

(136) He was easy to please

(137) He pleased her easily

(138) He was pleased easily (by her).

This example is crucial because the justification for the independent level of the deep syntactic structure depends upon the relevance of logical relations in semantic interpretation. It is claimed that (42) cannot be disambiguated without capturing the logical relations which are not obvious in its surface structure. The claim with respect to the deep structural disambiguation of (42) involves two assumptions which have not been substantiated: (i) logical relations are a crucial parameter in semantic interpretation in general and in disambiguation in particular, (ii) The logical relations of (42) cannot be determined in terms of the surface structure information available in it.

If the elliptic her is added to (42), the logical relations in it become clear and the ambiguity is resolved:

(139) He was quick to please her.

Furthermore, (42) would give two unambiguous passive versions:

(140) He was pleased quickly by her

(141) She was quickly pleased by him.

Hence, it is not correct to assume that the logical relations of (42) cannot be captured in terms of its surface structure information.

Although the various types of ambiguity associated with nominalizations and complementizers can be resolved in terms of surface structure information, the decisive factor seems to be the nature of the relational structure of the verbs in question. The verbal forms in the major examples discussed here are notably the gerund and the infinitive. Bos (1971) proposes that it is possible to sub-categorize verbs in terms of "mutually differing features and a sub-categoric semantic aspect which is functionally related to these features" (p. 191). He specifies "thought of as a process (thought of as elapsing in time)" as the common categoric meaning for verbs. Bos's (1971, pp. 194-195) analysis of the sub-categories 'transitive' and 'intransitive' is as follows:

> With transitive verbs of 'activity' the 'process' is thought of as an 'activity' originating from something that is thought of as 'acting' and the relation as 'directly related to something (B) that is thought of as 'acted upon''. Since this relation is a directed relation: an activity originated from A directed towards B, the relation can also be thought of reversely as an activity directed towards B originating from A; hence:
>
> A ----> activity ---- B; B <---- activity <---- A.
>
> With transitive verbs denoting the 'existence of a state of things' the 'process' is thought of as the existence of a state of things not originating from something that is thought of as acting, but as existing with regard to something (A) and the relation is thought of as directly related to something (B) for which the existing state of A is valid. As this relation is centrifugal (A <--- the existence of a state of things ----> B), it cannot be thought of in the reverse.

In English, the active infinitive and the gerund can be used optionally. For example (Bos, 1971, p. 197):

(142) There was a quarter of an hour to kill (to be killed)

(143) There was no time to lose (to be lost)

(144) The secret is hard to explain (can hardly be explained

(145) The house needs painting (to be painted).

The crucial examples of the 'deep structure' type of ambiguity can be explained within the conceptual and operational framework formulated by Bos (1971). It ought to be emphasized that the active-passive opposition, at least with respect to the infinitive and the gerund in English, has a semantic basis and its operational role must be understood in that sense. The crucial examples

We were surprised at the colonel's appointment

John is eager to please

The shooting of the hunters was terrible

will now be reconsidered. The relational aspect of the meaning of the verbal forms in these examples is not actualized. It has been pointed out earlier that in case of the infinitive and the gerund in English it may be optional. When the feature associated with the relational aspect of the meaning of the infinitive or the gerund in question is neutralized, the resulting sentence is ambiguous, i.e., constructionally homonymous. For example, the homonymy in the above case can be shown by the passive operational measure:

We were surprised that the colonel appointed X

We were surprised that the colonel was appointed

John is eager to please X

John is eager to be pleased

That thehunters shot was terrible

That the hunters were shot was terrible.

The validity of the above passivizations can be checked by transforming them into cleft and pseudo-cleft forms. There are distinct cleft and pseudo-cleft versions for each of the active and passive sentences in question:

It surprised us that the colonel appointed X

What surprised us was that the colonel appointed X

It surprised us that the colonel was appointed

What surprised us was that the colonel was appointed

It is John who is eager to please X

Who John is eager to please is X

It is John who is eager to be pleased

Who is eager to be pleased is John

It is terrible that the hunters shot X

What is terrible is that the hunters shot X

It is terrible that the hunters were shot

What is terrible is that the hunters were shot.

It was pointed out earlier that the ambiguity of the nominalization colonel's appointment is not due to its position in the sentence; it remains even when it appears in the subjective position. For example:

The colonel's appointment surprised us

is ambiguous. It can, however, be disambiguated in the same way, that is, by applying the passivization operational measure to show the relational nature of the verb appoint:

That the colonel appointed X surprised us

That the colonel was appointed surprised us.

The above operational analysis of the crucial examples, which Chomsky usually discusses in relation to logical relations and deep syntactic structure, indicates that Chomsky's exposition of logical relations is misleading.

As Daneš (1966, pp. 226-227) points out:

> From an analytic point of view, the sentence structure is based on that kind of relations that is sometimes called 'logical', these relations are derived from nature and society and appear to be essential for the social activities of man, e.g.: actor and action; the bearer of a quality or of a state and the state; action and an object resulting from the action or touched by it, etc.; different circumstantial determinations (determinations of place, time,.....) causal and final relations, relations of consequences, etc. semantic relations like them are linguistically rendered in different languages differently, with different depth and width (and must not be confused with grammatical categories of subject, object, etc....)

Since the essential information is supposed to be in the categorial representation (the P-marker) of the sentence, the grammatical functions are not directly specified in the structural description. It is in this context that the importance of the distinction between logical and grammatical relations is emphasized in TGG.

In traditional grammar, grammatical structure was described in terms of grammatical functions and the logical-grammatical dichotomy

depended upon the morphological characteristics of individual languages. For Chomsky, the grammatical functions 'subject', 'object', etc., are "inherently relational notions" which means that they merely denote certain configurations of categories. Consequently, the grammatical functions are defined as follows (Chomsky, 1965, p. 171):

> Subject: of NP, S
> Predicate of: VP, S
> Direct-Object of: NP, VP
> Main-Verb of: V, VP

The rewriting rules which relate to these formulae define grammatical functions in terms of categorial configurations. Chomsky (1965, p. 73) states his position as follows:

> ....information concerning grammatical functions ....can be extracted directly from the rewriting rules of the base without any necessity for ad hoc extensions and elaborations of these rules to provide specific mention of grammatical function.

Since the essential information is supposed to be in the categorial representation (the P-marker) of the sentence, the grammatical functions are not directly specified in the structural description. It is in this context that the importance of the distinction between logical and grammatical relations is emphasized in TGG.

The classical logical-superficial notion seems to be consistent with the TGG deep-surface dichotomy. The logical distinction is based on the semantic relations of case. The logical subject of a sentence with an active verb is equated with the agent of the action, with the rest of the sentence constituting the logical predicate. Katz and Postal (1964, p.36) argue that "the correct grammatical relations

are automatically given by the configuration technique." They assert as a matter of principle that the general definitions of grammatical functions are applicable only to underlying P-markers or deep structures and not to derived P-markers or surface structures. Katz and Postal (1964, pp. 38-39) state their claim as follows:

> It appears that in the formally motivated underlying P-markers provided by the simplest transformational grammar there is associated with each grammatical relation a unique sub-configuration of constituents that can be taken as the formal basis for these relations. But in derived P-markers no such unique correlation between grammatical relations and configurations of constituents can be found.

The configurational definitions of grammatical functions in TGG have overshadowed the importance of the role of grammatical relations in sentence decoding. As Dick (1968, pp. 153-154) points out, grammatical functions can be partly correlated with formal features such as special morphemes or order of elements; however,

> ... within the full set of the linguistic structures of any one language, there does not seem to be a one-to-one correspondence between grammatical functions and configurations of categories (italics added).

It clearly follows from Lyons' discussion of the examples from different languages that there are far more distinctions involved that can be accounted for by the simple dichotomy of grammatical and logical subject (Lyons, 1968, pp. 338-344). When the different linguistic devices that are used to paraphrase the different interpretations involved in ambiguous sentences are considered, this fact becomes ovvious. Ulatowska (1971) found that native speakers of English use non-syntactic means

48% of the time to disambiguate sentences which are supposed to be cases of underlying ambiguity. The much more important point is the nature of the grammatical means utilized in these paraphrases. Ulatowsk's (1971) findings suggest that people mark grammatical functions by putting in relevant grammatical markers in the form of prepositions, determiners, reflexive pronouns, etc. The fact in Ulatowska's data that is relevant to the issue under discussion here is that the grammatical markers used by the people to resolve deep syntactic ambiguities are peculiar to the morphological structure of English. For example, to disambiguate the sentences

(146) John is the one to help

(147) Flying planes can be dangerous

(148) He told the policemen to stop drinking.

Ulatowska's subjects paraphrased them as follows:

(149) John himself is the one to help today

(156) Flying the planes can be dangerous

(151) He told the policemen themselves to stop...

The importance of the role of surface structure grammatical relations in normal sentence processing has been emphasized in recent psycholinguistic research (Hornby, 1972; Fletcher, 1973). When the role of morphological characteristics in the psychological process of disambiguation and the nature of the relationship between the morphological structures and the logical relations in individual languages are considered, the claim with respect to the central role of the deep structure categorial configurations in the interpretation of grammatically ambiguous sentences seems to be dubious.

2.2.0 Types of Ambiguity in Natural Language : Significant Issues and a Perspective

The discussion of the typical TGG examples of the lexical, surface structure and deep structure types of ambiguity in the sections 2.1.0 - 2.1.3 suggests that there are significant issues involved in the taxonomy of the types of ambiguity prescribed by the transformational generative theory of language and the form of grammar. In this section, these issues will be considered and a revised taxonomic perspective will be suggested in view of the light shed by these issues upon the nature of ambiguity in natural language both in terms of its linguistic sources and its processing by the language user.

2.2.1 Encoding and Decoding of Linguistic Ambiguity

Perhaps the simplest way to gain a proper perspective on the nature of ambiguity in natural language expression is to compare it with mathematical ambiguity. As Gross and Lentin(1970) point out, mathematical ambiguity is defined with respect to a given grammar: A mathematical sentence is said to be ambiguous if it can be generated by at least two derivations that correspond to two different trees. The mathematician can decide the degree of ambiguity of a sentence in a grammar by counting the different trees: "A sentence that can be generated by a grammar according to p different derivation trees has an ambiguity of degree p with respect to that grammar" (Gross and Lentin, 1970, p. 100). Ambiguity in mathematics, in short, is related to structure in terms of its origin and resolution. The problem of the sources and the resolution of ambiguity in

natural language is not so simple. People may or may not assign n different interpretations to a given ambiguous expression.

Normally the speaker encodes messages within a given contextual setting. The situational facts set up guidelines for the listener's decoding of a message. As Firth (1957) put it, every man carries his culture and his social reality about with him wherever he goes. Apart from the underlying parameter of the socio-cultural reality of a given speech community, there are contextual constraints within individual discourses. These constraints are such that they generally eliminate all the potentials for ambiguity in individual sentences. The issue at hand in the context of TGG, however, is about sentential ambiguity.

Each language has a set of linguistic devices which are used to encode messages. The speaker tries to use the various prosodic, morphological, and syntactic patterns at his disposal to encode his ideas into a message. His main concern is to indicate the relational structures of his sentences in specific ways. The different prosodic, morphological and syntactic structures are combined to convey different relational structures of his sentences in different ways in different languages. At times, the morphological and syntactic structures required in a given relational structure are such that one sentence allows more than one interpretation, i.e., the sentence turns out to be a constructional homonym either at the lexical, morphological or the syntactic level. From the decoder's point of view the homonymy can be explained in terms of either distinct labelings or groupings of the constituents.

The encoder does not have to worry about the potential for

constructional homonymy all the time. In most of the cases the semantic structures of the relational items are such that the labelings and bracketings of the constituents are uniquely indicated. As has been shown in 2.1.3, the socio-cultural reality of speech events, the semantic structures of individual languages and the framework of human cognition determine the combinations of relational elements. The implication is that a grammar can only indicate the morphological and syntactic structural types which have the potential for constructional homonymy. It is a semantic problem when the potential for constructional homonymy is transferred to the token of the type: it cannot be stated in unequivocal morphological or syntactic terms. Even though most of the serious modifications in the form of TGG have been motivated by this issue, it is not fully and explicitly accepted and incorporated into the theory of grammar. One of the major sources of evidence in support of the independent level of deep syntactic structure has been structural ambiguity. It has been assumed that all the sentences which can be interpreted in more than one way are amenable to formal syntactic analysis.

The possibility of the n readings of a given sentence may be due to the presence of the formally stipulated and semantically allowed n relational structures or simply due to the decoder's own perceptual interpretations which are sometimes allowed by the semantic vagueness of the content of a given constituent in the sentence. This problem arises mostly in the case of nominalizations. Lees' (1968) decision to analyse English nominalizations purely in syntactic terms depends upon the assumption that they incorporate the grammatical forms of many different sentence types. He claims that

> ... nominal compounds are understood on the basis of certain fixed syntactic relations (subject, object, etc.) which are specifiable only in terms of the relations among the constituents of underlying sentences, and nominal compounds are indeed multiply-ambiguous, i.e., can be understood, each one in several of the possible ways allowed by the grammar (and the associated semantic theory of sentence interpretation) (Lees, 1968, p. xxxiv).

A similar approach to nominal compounds was developed by the ancient Hindu grammarians. The syntactic analysis of the Sanskrit 'samas' (nominal compounds) was motivated, however, within a specific frame of reference. The transformational derivations of the 'samas' were guided by nonlinguistic considerations.

The examples of the nominal compounds discussed by the ancient Sanskrit grammarians are the names of different gods whose personal characteristics and life histories are a matter of common knowledge to the speech community. The underlying syntactic categorial configurations which the grammarians postulated to derive the nominals transformationally thus had a nonlinguistic basis. The hundreds of names by which Lord Krishna is known are all nominal compounds describing his characteristics which are known to the people. The question of the interpretation of the names does not arise to the grammarian or to the people. The grammarians categorised the compounds in terms of syntactic types simply from a prescriptive point of view. It must be emphasized that the whole objective of the ancient Sanskrit grammarians was to unify Sanskrit usage and interpretation in relation to religious practice and scriptures. The example, the compound nominal 'gopal' (cow protector) is invariably

interpreted as 'one who protects cows' which automatically indicates that it stands for Lord Krishna in Sanskrit literature. The compound 'pitambar' (yellow dress) refers to Lord Krishna simply because it is always associated with him. The question of the potential multiple ambiguity of 'yellow dress' was irrelevant and was not considered in the grammatical treatment of such nominals. Lees (1968, 1970), on the other hand, justifies the treatment of nominalization as a derivational process on the basis of the problem of its potential for multiple-ambiguity. He (Lees, 1966, p. 177) argues that the transformational (derivational) analysis of nominal compounds such as 'snake poison' explains their ambiguity without referring to extra-lingual factors such as 'the speaker's and hearer's common knowledge of their material culture'. The ambiguity of 'snake poison', for example, is accounted for in syntactic terms by deriving it as one surface structure from more than one deep structure, each deep structure receiving a semantic interpretation accounting for one of the interpretations in which 'snake poison' may be considered ambiguous, e.g. (i) X extracts the poison from snake; (ii) The snake has the poison; (iii) The poison is for snakes; etc. Even though Lees (1966, pp. 169-170) realized that there could be two possible deep structures even for unambiuous nominals like 'school grammar' within such a transformational framework for the analysis of English nominalizations that he was proposing, he remained insensitive to its theoretical implications. The convenience of the derivational approach, it seems, has sidetracked the question of distinguishing ambiguity or homonymy from vagueness. As Householder (1971, pp. 144- 145) points out in his criticism of Lees' de-

cision to treat English compound nominals transformationally:

> For compounds Lees did not specify semantic rules, but the line of generation which he followed was designed to provide a distinct source for every possible interpretation of uncertainty here to genuine ambiguity (with a definite listable set in interpretations) rather than to vagueness (where the discreteness of interpretations is not presumed).

In Sanskrit the interpretation of a given nominal was determined by the grammarians who used the religious background of the speech-community as a basis and not their own intuitions as the generative grammarians do. When the derivational analysis depends upon the grammarian's own intuitions about the possible relational interpretations of compound nominals, the question of the distinction between genuine formally indicated and semantically allowed ambiguity or homonymy and mere vagueness arising out of the relational indeterminacy of the situation becomes necessary.

The main issue in the question of the distinction between homonymy and vagueness is its operational basis. The problem arises because of the intuitive approach and the assumption that constructional homonymy is purely a syntactic phenomenon. If it is recognised that grammar can only indicate the morphological and syntactic types which have the potential for ambiguity but the realization of the potential in the individual tokens of the types depends upon the semantic structures of the relational elements in the typical sentences, then the question of the operational basis for the ambiguity-vagueness can be settled. The judgement of ambiguity, after all, as Hiż (1964, p. 98) points out, reduces to two pronouncements: (i) identity of meaning, and (ii) difference of meaning. If the ambi-

guilty in a given token of a given type can be resolved into semantically imcompatible readings, it can be considered a case of genuine ambiguity or constructional (structural) homonymy. The notion of 'systematic paraphrase' can be used to set up a linguistic criterion to characterize genuine ambiguity (Prideaux, 1972).[5] If a given case of multiple interpretation can be resolved in terms of a determinate set of semantically incompatible readings, on the other hand, then it can be taken as an example of vagueness. The notion of 'systematic paraphrase' can again be applied to determine if there is any interpretational residue left. The problem of interpretational residue can be settled operationally in terms of paraphrase sets. If a given case of multiple interpretation can be analysed in terms of a determinate number of paraphrase sets in the sense of Hiz (1964) and Smaby (1971), then it is a case of genuine ambiguity. If on the other hand, a given case cannot be resolved in terms of a determinate number of paraphrase sets, i.e., if there is some semantic (interpretational) residue left, it is a case of vagueness.

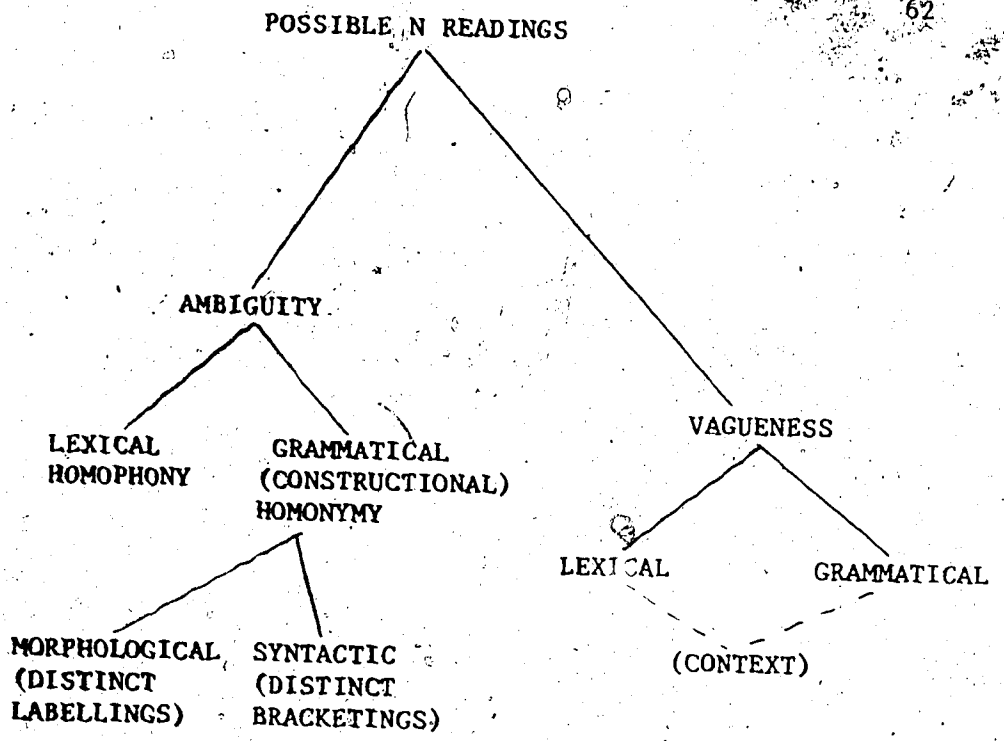
The problem of the distinction between genuine linguistic ambiguity and vagueness puts the question of the relationship between the source of an ambiguity in a given case and its possible n interpretations in a proper perspective which can serve as a basis for the taxonomy of the types of ambiguity.

2.2.2 A Taxonomy of the Types of Ambiguity

The discussion in 2.2.1. suggests that any taxonomy of the types of ambiguity in natural language expression must take into account the following points:

1. Ambiguity in natural language is not always related to formal linguistic structure in terms of both origin and resolution.
2. The rise of ambiguity in a given natural language expression depends upon the interaction of the grammatical characteristics of the language in question and the semantic structures of the relational elements involved.
3. Grammar can only specify the morphological and syntactic potential types for constructional ambiguity. The realization of the potential in a given token depends crucially upon the semantic structures of the relational elements.
4. The distinction between genuine linguistic ambiguity and mere vagueness must be recognised.
5. The notion of 'systematic paraphrase' can be utilized as an operational measure for the ambiguity vs. vagueness distinction: A lexically or structurally ambiguous sentence has a determinate number of semantically incompatible readings; sentences which can be assigned multiple interpretations due to vagueness leave some semantic residue, i.e., the set of the readings involved remains indeterminate.
6. Vagueness is possible at both the lexical and grammatical levels.

The phenomenon of natural language ambiguity can be presented graphically as follows:



When the language user assigns more than one reading to a sentence in natural language, it can be either due to constructional homonymy or vagueness. Vagueness cannot be resolved in terms of formal linguistic descriptions; it must be explained contextually. Constructional ambiguity is a genuine linguistic phenomenon and it can be analysed formally. Constructional ambiguity at the morphological level can be resolved by labelling the grammatical classes differently. It can be explained systematically at the syntactic level by showing the different hierarchical structures in terms of distinct constituent

groupings. The validity of the different constituent analyses can be tested in terms of the notion of 'systematic paraphrase'.

In this revised taxonomy of the types of ambiguity, the type of ambiguity associated with the level of deep syntactic structure is conspicuous by its absence. It has been shown in 2.1.3 that the cases discussed under this label in TGG can be analysed at the level of surface structure in terms of the grammatical peculiarities of English. The importance of the morphological patterns of individual languages and the interaction of the syntactic and semantic structures are given due recognition in this modified taxonomic perspective. Unlike mathematical ambiguity, which can be always explained structurally, natural language ambiguity cannot be accounted for without considering both linguistic structure and the language user.

FOOTNOTES

1. (p. 35) References to 'facts of usage' in this study are based upon actual fieldwork with native speakers of English. Six university-educated native speakers of English with different linguistic backgrounds were questioned individually. Different examples involving a specific point were presented on different days.

2. (p. 43) Douglas C. Walker indicates that (115) is acceptable for the reading: Hunters shoot the deer. X shoot the hunters.

3. (p. 45) In addition to the syntactic arguments presented here it is possible to account for the ambiguity of colonel's appointment in terms of its semantic structure. The nominalizations debator's rebuttal, defendant's acquittal, etc. are not ambiguous, but judge's acquittal and plaintiff's denial are ambiguous. These examples were suggested by Douglas C. Walker.

4. (p. 45) For some native speakers, the phrase the President's appointment by the colonel is ungrammatical.

5. (p. 60) A 'systematic paraphrase' is to be distinguished from a simple rephrasing. The former relates one sentence pattern to another in terms of a set of syntactic transformations which are independently motivated in the language, while the latter provides paraphrases which are not syntactically related in any systematic way. For example, sentences (207) and (208) are systematic paraphrases of sentence (202) on p. 88, but sentences (204) and (205) are, at best, simple rephrasings of sentence (202) on p. 87.

CHAPTER THREE

STRUCTURAL AMBIGUITY AS A CRITERION OF EXTERNAL ADEQUACY

3.0.0 Preliminary Remarks

The essence of the Chomskyan 'revolution' in linguistics lies in the nature of the goals which it outlined for linguistic theory to attain. In his new 'program for linguistic theory', Chomsky stipulated that the problem of justification of grammars was his fundamental concern. A grammar of the language L, he declared, is essentially a theory of L (1957, p. 49); hence, the significance of the need to develop and clarify the criteria for selecting the correct grammar for each language, that is, the correct theory of this language (ibid.) First, grammars must fulfill the 'condition of generality', i.e., the grammar of a given language must be constructed within the framework of a specific theory of linguistic structure in which the basic terms are defined independently of any individual language. Secondly, the grammar of a given language must meet certain external conditions of adequacy: it must be responsible to the native speaker of the language in question. Chomsky envisaged in Syntactic Structures that the generality condition and the external conditions of adequacy would jointly provide 'a very strong' test of adequacy for a general theory of linguistic structure and the set of grammars that it provides for specific languages. In particular, he emphasized that

> ....neither the general theory not the particular grammars are fixed for all time, in this view. Progress and revision may come from the discovery of new facts about particular languages, or from purely theoretical insights about organization of linguistic data - that is, new models for linguistic structure. But there is also no circularity in this conception. At any given time we can attempt to formulate as precisely as possible both the general theory and the set of associated grammars that must meet the empirical, external conditions of adequacy (Chomsky, 1957, p. 50; italics added).

The TGG theory of linguistic structure and the form of the grammars which follow from it have been greatly changed since its conception in The Logical Basis of Linguistic Theory (Chomsky, 1955). The external adequacy criteria, which have been extensively used to justify the revisions (Katz and Postal, 1964; Chomsky, 1965, 1972b; Jackendoff, 1972; Fillmore, 1968; McCawley, 1968, 1971; Lakoff, 1970), have still not been analysed with respect to the theoretical and practical problems associated with them.

The objective of this chapter is to examine the theoretical basis and the difficulties involved in the application of the external adequacy criterion of structural ambiguity. It will be shown that the methodological difficulties involved in the use of the external adequacy criterion of structural ambiguity are such that they call for a serious modification in its specification with respect to its actual execution.

3.1.0 The Notion 'Adequate Grammar'

Chomsky's initial interest in syntactic investigation was motivated by his goal of constructing a grammar that can be viewed as a device of some sort which can generate sentences of the language under analysis. In Syntactic Structures he insisted that ....in-

guists must be concerned with the problem of determining the fundamental underlying properties of successful grammars' (p. 11). Chomsky hoped that the study of the basic properties of 'successful' grammars would lead to a theory of linguistic structure in which the descriptive devices utilized in particular grammars would be presented within an abstact framework, i.e., without reference to specific languages.

3.1.1 Grammars and Native Speakers

How can the adequacy of a theory of linguistic structure based on the properties of 'successful' grammars be determined without first establishing criteria for 'successful grammars'? Chomsky suggested (1957, p. 11):

> We can determine the adequacy of a linguistic theory by developing rigorously and precisely the form of grammar corresponding to the set of levels contained within this theory, and then investigating the possibility of constructing simple and revealing grammars of this form for natural languages.

The degree of the success of a given grammar, then, would depend upon the way in which it corresponds with the form of grammar prescribed by the general linguistic theory, which, in turn, is constructed on the basis of 'the fundamental underlying properties of successful grammar." To avoid the obvious circularity in the logic of the relationship between the theory of linguistic structure, on the one hand, and the notion of a successful grammar, on the other, Chomsky placed the native speaker as an interface sponge between the two to absorb the circularity. He suggested an analogy between the native speaker and the successful grammar (1957, p. 15):

> Any grammar of a language will project the finite and somewhat accidental corpus of observed utterances to a set (presumably infinite) of grammatical utterances. In this respect, a grammar mirrors the behavior of the speaker who, on the basis of a finite and accidental experience with language, can produce or understand an indefinite number of new sentences. Indeed, any explication of the notion 'grammatical in L' (i.e., any characterization of "grammatical in L" in terms of "observed utterance of L") can be thought of as offering an explanation for this fundamental aspect of linguistic behavior.

The analogy was stretched further to imply that a successful grammar should be able to accomplish what the native speaker is potentially capable of doing in terms of his judgement with respect to the basic properties of natural language as reflected in the sentences of his own language. The crucial question for Chomsky, then, was how to characterize the native speaker.

The notion of an adequate grammar being a mirror of the native speaker's intuitions was highlighted when Chomsky adopted the Humboldtian conception of underlying competence as a system of generative process' (Chomsky, 1965, p. 4) in Aspects of the Theory of Syntax. A grammar of a language, then, could be characterized as "a description of the ideal speaker-hearer's intrinsic competence', argued Chomsky (1965, p. 4). The goals of developing and clarifying the methological questions of justification and adequacy of grammars, which formed the basis of Chomsky's new 'program for linguistic theory' in Syntactic Structures, acquired a specific direction. Chomsky suggested that no operational tests for the external adequacy criteria could be developed without bearing in mind that

> ...when an operational procedure is proposed

> it must be tested for adequacy (exactly as a theory of linguistic intuition - a grammar- must be tested for adequacy) by measuring it against the standard provided by the tacit knowledge that it attempts to specify and describe (1965, p. 19; italics added).
>
> ... the speaker-hearer's linguistic intuition is the ultimate standard that determines the accuracy of any proposed grammar, linguistic theory, or operational test... (1965, p. 21; italics added).

The next logically required step was to specify the properties of natural language in terms of which the tacit competence of the native speaker could be interpreted behaviorally.

The native speaker's judgements on grammatical relations, paraphrastic sets and structural ambiguity have been taken as some of the external indexes of his linguistic intuition (cf. Peters and Ritchie, 1969). Since an adequate grammar is defined as a theory of the native speaker's linguistic intuition (Chomsky, 1965, p. 19), the degree of its success (adequacy) can be measured in part in terms of its ability to recognise and describe grammatical relations, paraphrase sets (sentential relations) and structural ambiguity. Judgements on grammaticality and paraphrase relations have been recommended as heuristic devices for constructing grammars (Katz and Postal, 1964; cf. Prideaux, 1972; Derwing, 1973; Fletcher, 1973). These properties have been considered to be "the deeper and more important notions of linguistics" for which, it was assumed "there is no reason to expect ... reliable operational criteria (Chomsky, 1965, p. 19). Because it was assumed that there would be no operational criteria available for the notions of paraphrase and grammaticality in the near future, only the notion of structural ambiguity was selected as a

working external adequacy criterion. However, no attempt so far has been made to develop operational measures for it, either. In reference to the rationale for the selection of the notion 'structural ambiguity' as a criterion of external adequacy, Chomsky argued that

> There are many facts about language and linguistic behavior that require explanation beyond the fact that such and such a string (which no one may ever have produced) is or is not a sentence. It is reasonable to expect grammars to provide explanations for some of these facts (1957, p. 85; italics added).
>
> We can test the adequacy of a given grammar by asking whether or not each case of constructional homonymity is a real case of ambiguity and each case of the proper kind of ambiguity is actually a case of constructional homonymity. More generally, if a certain conception of the form of grammar leads to a grammar of a given language that fails this test, we may question the adequacy of this conception and the linguistic theory that underlies it (1957, p. 86; italics added).

It was in the context of the criterion of structural ambiguity that Chomsky tried to demonstrate the inadequacy of phrase structure grammar and justify the necessity of a higher, that is, transformational level.

3.1.2 Descriptive Adequacy of a Grammar and Structural Ambiguity

Initially Chomsky conceived a grammar to be a mathematical system. As mathematical systems specify sets of well-formed formulas, grammars must be able to separate the 'grammatical' sequences which are sentences of L from 'ungrammatical' sequences which are not sentences of L, hence, "The grammar of L will thus be a device that generates all of the grammatical sequences of L and none of the ungrammatical ones"

(Chomsky, 1957, p. 13). Later grammars were required not only to identify the grammatical sentences but to assign a structural description to each of them. Postal (1964) suggested that the test ability of a grammar was supposed to be in its ability to assign a 'correct' structural description to each sentence it generates. Chomsky presented the three-level scale of grammatical adequacy which incorporated Postal's (1964) requirement that a grammar be able to assign structural descriptions to all of its grammatical sentences:

> The lowest level of success is achieved if the grammar presents the observed primary data correctly. A second and higher level of success is achieved when the grammar gives a correct account of the linguistic intuition of the native speaker, and specifies the observed data (in particular) in terms of significant generalizations that express underlying regularities in the language. A third and still higher level of success is achieved when the associated linguistic theory provides a general basis for selecting a grammar that achieves the second level of success over other grammars consistent with the relevant observed data that do not achieve this level of success. In this case, we can say that the linguistic theory in question suggests an explanation for the linguistic intuition of the native speaker. It can be interpreted as asserting that data of the observed kind will enable a speaker whose intrinsic capacities are represented in this general theory to construct for himself a grammar that characterizes exactly this linguistic intuition (Chomsky, 1964, pp. 62-63; italics added).

In particular, it was emphasized by Postal (1964) and Katz and Postal (1964) and implicitly by others, that the rules of a linguistic description must somehow specify all the information about the sentences that a speaker utilizes to produce and understand them" (Katz, 1966, p. 123; italics added). It has been suggested by Fillmore (1972, p. 16) that the conditions which a grammar is required to fulfill at the 'higher' level of descriptive adequacy indicate

> ... a shift of interest away from the properties of an apparatus needed solely for generating the proper set of sentences, towards the mechanisms which speakers of a language can be shown to have, on the basis of any evidence within reach, account for their ability to do what they do when they communicate with each other using their language (italics added).

Fillmore seems to think that grammars are judged in terms of 'new kinds of questions' at the level of descriptive adequacy.

The link between the level of descriptive adequacy and judgements of structural ambiguity is difficult to understand, however. The weakness of the association between structural ambiguity and descriptive adequacy becomes obvious when it is viewed in relation to the various dimensions of the function assigned to the level of observational adequacy. At the first level, a grammar is judged in terms of its ability to generate all and only the grammatical sentences of the language in question. Structurally ambiguous sentences are a subset of the set of the grammatical sentences of a language and a grammar must generate them at the level of observational adequacy. What is the basis of the capacity of such a grammar? A grammar generates all and only the grammatical sentences of a language on the basis of its categories and rules. If a grammar can generate structurally ambiguous sentences, it must have the categories and rules required to generate them. Such a grammar also passes judgement on the status of its sentences with respect to grammaticality. It is obvious that it cannot distinguish structurally ambiguous sentences in this context unless it contains the necessary rules. The sentential property of structural ambiguity is related to the level of observational adequacy. What then is the status of

the link between structural ambiguity and descriptive adequacy? In order to understand the nature of the descriptive and methodological difficulties and issues involved, it is necessary to see how this link is specified.

3.1.3 Specification of the Structural Ambiguity Criterion

In his paper 'On the Notion Rule of Grammar', Chomsky (1961) specifies the procedural operations of the external adequacy criterion of structural ambiguity. A grammar of the language L, which is a set of rules, is required to provide a complete specification of an infinite set of grammatical sentences of L and their structural descriptions; the theory of grammar underlying it is required to make available a function f such that f(i. j) is the set of structural descriptions of the sentence s_i that are provided by the grammar G_j (p. 120). In particular, it was required that

> The set f(i, j) should contain more than one structural description only if the sentence s_i is ambiguous - that is, this is a reasonable empirical condition, one of many, on the grammar of a language(Chomsky, 1961, p. 120; italics added).

As Ziff (1965, pp. 135-137) points out, Chomsky's condition requires that a grammar should provide more than one syntactic structural description for a sentence only if the sentence is ambiguous. As an observationally adequate grammar is required to discriminate between grammatical and ungrammatical sentences, a descriptively adequate grammar is required to first recognise structural ambiguity in sentences; additionally, it is required to assign distinct structural descriptions, one for each of the readings. It is claimed that ambi-

guities in sentences and constituents are predicted when syntactic rules assign two or more nonequivalent phrase-markers to a given sentence (Katz, 1971). A theory of generative grammar is expected to provide (a) a general characterization of the class of possible phonetic representations and (b) a class of possible syntactic descriptions. That is, a generative grammar is required to determine pairings of phonetic signals with syntactic descriptions. Chomsky argues, accordingly,

> A gra[illegible]riptively adequate to the extent that it is [illegible]ly correct in a variety of respects, in par[illegible] the extent that it pairs signals with S[illegible]do in fact meet empirically given conditi[illegible]on the semantic interpretations that they support. For example, if a signal has two intrinsic semantic representations in a particular language ..., a grammar of this language will approach descriptive adequacy if it assigns two SD's to the sentence, and, beyond this, it will approach descriptive adequacy to the extent that these SD's succeed in expressing the basis for the ambiguity. In the case of THEY DON'T KNOW HOW GOOD MEAT TASTES, for example, a descriptively adequate grammar must not only assign two SD's to the sentence but must also do so in such a way that in one of these the grammatical relations of GOOD, MEAT, and TASTE are as in 'MEAT TASTES GOOD', while in the other they are as in 'MEAT WHICH IS GOOD TASTES ADJECTIVE' (where the notion 'grammatical relation' is to be defined in a general way within the linguistic theory in question), this being the basis for the alternative semantic interpretations that may be assigned to this sentence. Similarly, in the case of WHAT DISTURBED JOHN WAS BEING DISREGARDED BY EVERYONE, it must assign to the pair DISREGARD-JOHN the same SD; whereas in the other it must assign this very same relation to the pair DISREGARD-WHAT (DISTURBED JOHN), and must assign no semantically functional grammatical relation at all to DISREGARD-JOHN (Chomsky, 1966, pp. 14-15; italics added).

On what basis does a descriptively adequate grammar recognize and explain constructional homonymy? The obvious answer is that it depends upon its grammatical categories and the rules res-

training their syntactic concatenations leading to unacceptable strings. The crucial point to be determined by the external adequacy criterion is whether a grammar contains the grammatical categories and the rules combining them without which structural ambiguity cannot be explained. It is claimed, furthermore, that the categorial rules must be such that they also explain the deviant strings which result if the n interpretations are combined. For example, a grammar which fulfills the external condition must not generate the string

(152) I disapprove of John's excessive drinking of the beer.

The string in (152) is a result of the rules which cannot assign the interpretations

(153) I disapprove of John's drinking the beer

(154) I disapprove of John's excessive drinking

which, according to Chomsky (1968, pp. 27-28), result from the homonymy of the factive and manner interpretations allowed by the nominalization John's drinking in

(155) I disapprove of John's drinking.

The task of the structural ambiguity criterion is to see that the grammatical rules are formulated in certain ways. The formulation of the rules of grammar is required to be such that they must be able to assign n distinct structural descriptions and in each case permit one but not the other of the (n-1) possible ellipses.

The n distinct structural descriptions which the system of the rules of a given grammar is required to assign to a grammatical homonym to meet the external adequacy criterion of structural ambiguity

must have one specific property. That is, they must trace the derivational histories of the individual structures. Some transformations which require or permit the deletion of repeated elements are so general that the resulting surface structures become constructional homonyms. Consider the sentence

(156) I don't like John's cooking any more than Bill's cooking.

In the phrases John's cooking and Bill's cooking the form cooking means the same thing. When it is transformed to delete the repeated element, it becomes ambiguous:

(157) I don't like John's cooking any more than Bill's.

It is suggested that the structural descriptions specifying the factive and manner interpretations involved in (157) must indicate the derivational histories of the surface structures. In order to fulfill this condition, the structural descriptions of such sentences must specify the deleted elements. It is claimed that what is involved is some general condition on the applicability of deletion operations, a rather abstract condition that takes into account not only the structure to which the operation applies but also the history of derivation of this structure" (Chomsky, 1968, p. 28).

The function of the criterion of structural ambiguity, then, is to serve as an external constraint on grammars, that is, to link grammars with native speakers. When a grammar fulfills the condition of structural ambiguity along with the other constraints, it is supposed to become descriptively adequate. When a grammar is judged to be descriptively adequate, it is considered to be a superior

theory of the linguistic intuition of the native speaker. In order for a grammar to meet the criterion, it must be able to (i) identify instances of structural ambiguity and (ii) systematically account for it. i.e., assign distinct structural descriptions to all the readings. Each structural specification must be such that (i) it explains why the readings other than the one specified are not possible and (ii) it traces the derivational history of the strurture involved, in particular, indicating the transformationally deleted elements. The basis of the ability of such a grammar is its formulation of the categorial rules.

The conditions required in the execution of the external adequacy criterion of structural ambiguity are defined in such a way in TGG that non-trivial descriptive and methodological difficulties are involved. These problems and the issues entailed are discussed in the following sections.

3.2.0 Execution of the Structural Ambiguity Criterion

As it has been pointed out in 3.1.3, the essential question in the actual application of the criterion of structural ambiguity is related to the power of the descriptive apparatus of grammars. Does a proposed grammar contain the categories and the rules necessary to account for the structurally ambiguous sentences in the language it claims to describe? The first requirement for a discussion of the question is a clear delimintation of the notion 'structural ambiguity'. In Ziff's (1965, p. 141) words, "When is the ambiguity of a sentence of a type that does fall within the province of grammar?"

The descriptive and methodological considerations depend upon how the notion in question is delimited. That the function of the criterion is to judge the external adequacy of grammars is an important caveat for such an operational definition.

3.2.1. Operational Criteria for Structural Ambiguity

The purpose of the criterion of structural ambiguity is to check the adequacy of the formal grammatical categories and rules in relation to the sentences which contain more than one relational [illegible] the arrangement of the relational categories is such that the different formal 'tree structures' (Chomsky 1965, p. 12) that they can provide are not indicated in their sequence. The distinct 'tree structures' can be obtained, however, by labeling and grouping the constituents differently. As it has been pointed out in 2.1 and 2.2, not all the types of ambiguity in natural language expression are amenable to formal constituent analysis: it is necessary to make a distinction between the ambiguity due to constituent structure homonymy and the ambiguity due to vagueness in the message itself. The operational procedures must be, therefore, such that they can be used first to determine if the ambiguity in a given expression can be analyzed formally. In addition to distinguishing structural ambiguity from vagueness in the message, these operational criteria must also set it apart from lexical ambiguity. The second step is to decide the grammatical level of the homonymy in a given expression. If it is a case of morphological homonymy, it can be resolved by distinct labelings. If the homonymy in question is syntactic, on the other hand, then it can be disambiguated by distinct

constituent bracketings. How to formulate such operational criteria is the question which must be considered first. It is discussed in the following section.

Outside of its contextual setting and without punctuation in writing and prosodic correlates in speaking, the sentence

(158) They called Susan a waitress

is triply ambiguous:

(159) They called a waitress for Susan

(160) They said Susan was a waitress

(161) They called Susan, who is a waitress.

In an actual communicative event, however, the direct object - appositive interpretation of (161) will always be indicated by punctuation in writing and a corresponding acoustic correlate in speaking:

(162) They called Susan, a waitress.

The comma after Susan in writing is replaced by a measurable physical event in speaking. Martin's (1970) spectographic analysis of the physical correlates of syntactic boundaries shows that even though the acoustic pause itself is not present, the preceding syllables are always elongated. Martin's finding suggests that the perception of major syntactic breaks is triggered physically.

That Susan is an indirect object in (159) and a direct object in (160) becomes obvious when (159) and (160) are passivized:

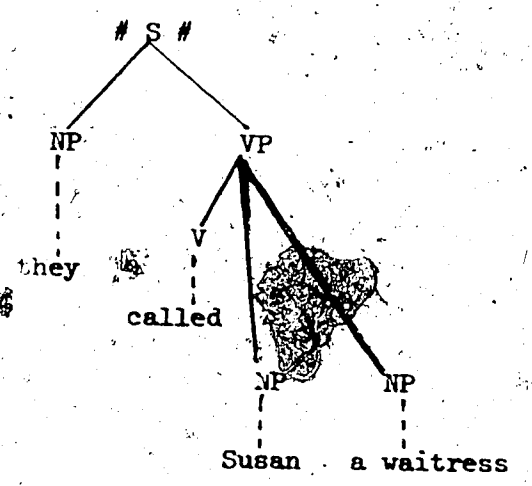
(163) A waitress was called for Susan by them

(164) Susan was called a waitress by them.

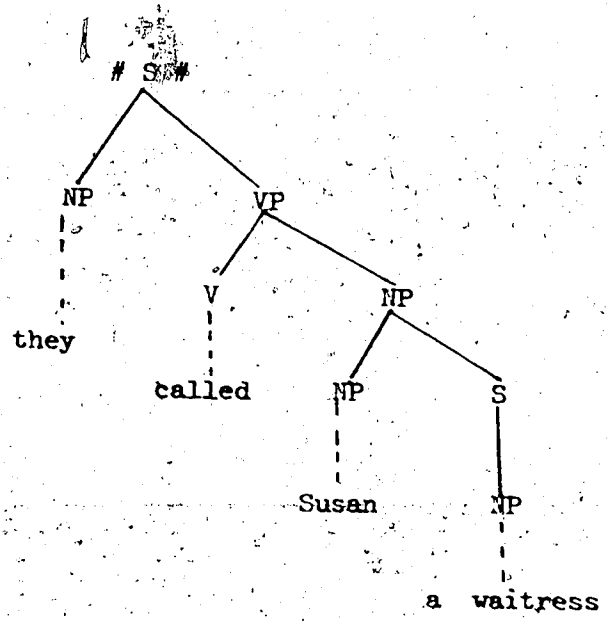
This is due to the lexical homophony of called; in the two passive forms the two lexical items are (a) called for and (b) called.

Thus, (158) contains two p-markers:

(i)



(ii)



In the following examples, there is an ambiguity between Position and Direction Adjuncts:

(165) He is allowed to run outside

(166) The baby was crawling upstairs.

In one reading, the adverb is part of VP, while in the other it is sentential in its scope of modification.

(167) When he is outside he is allowed to run

(168) When he was upstairs the baby was crawling.

The adjunct, however, becomes a separate intonation unit in speaking; in writing, the adjunct is transposed to the initial position and separated off by a comma:

(169) Outside, he is allowed to run

(170) Upstairs, the baby was crawling.

There is independent syntactic evidence to show that positional adjuncts can be transposed initially, while directional adjuncts cannot. In the sentences,

(171) The children are running around upstairs

(172) He was thrown overboard near the shore

the directional and positional adjuncts occur together. It is only the positional adjuncts that can be transposed initially:

(173) Upstairs the children are running around

(174) Near the shore he was thrown overboard

(175) Around the children are running upstairs

(176) Overboard he was thrown near the shore.

The sequence of the relational elements in the following

sentences is the same:

(177) James enjoys the theatre more than Susan

(178) He likes the dog more than his wife

(177) is not considered ambiguous; but ordinarily will be treated as an elliptical version of

(179) James enjoys the theatre more than Susan does.

In view of the perspective developed in 2.2, (178) is an example of grammatical homonymy: than can be treated as a conjunction in one case and as a preposition in the other, which can be demonstrated in terms of the ellipses they take:

(180) He likes the dog more than his wife does

(181) He likes the dog more than he likes his wife.

Also, there is independent syntactic evidence to support the claim that (177) is an elliptical construction which can be read as (179). Ellipsis of the object cannot take place unless the verb too is replaced by do (Quirk et al., 1972). Thus:

* (182) James enjoys the theatre more than Susan enjoys

is unacceptable. However, if the object is the complement itself, the verb is optional, as in

(183) James knows more about the theatre than Susan (knows).

To consider more examples of structural ambiguity, the sentence

(184) I saw him going home

contains two distinct surface structures. In one case, going home is a sentential adverb and it can be fronted transformationally:

(185) Going home, I saw him.

As Quirk et al (1972, p. 763) point out, (184) is ambiguous because of the "possible neutralization of the formal difference between non-finite clauses acting as supplementive clauses and those acting as complementation of the verb". On one interpretation, i.e., of the supplementive clause, I is the notional subject of going, whereas on the other, i.e., of verb complementation, it is him that is the notional subject of going. The neutralized formal difference is brought out when the two interpretations are paraphrased.

(186) I saw him while I was going home.

(187) I saw him while he was going home.

Quirk et al (1972) provide independent syntactic evidence to explain the basis of neutralization in (184). They suggest that the sentences

(188) The manager apPROACHED us, SMILing.

(189) The manager approached us SMILing.

are alternative renderings of the same sentence, different only in that (188) has two focuses of information, whereas (189) has only one. It is pointed out that the resemblance between non-restrictive relative clauses and supplementive clauses is accidental; the supplementive clauses are not separated intonationally when they occur in the final position, as the non-restrictive relative clauses are.

The ambiguity in the sentences

(190) He is friendly enough to help

(191) He is too good a man to kill

is due to the possibility of active and passive interpretations:

(192) He is friendly enough for him to help others

(193) He is friendly enough for others to help him

(194) He is too good a man for him to kill others.

(195) He is too good a man for others to kill him.

The ambiguity arises because a pronoun in the infinitive clause may be omitted if it substitutes for the subject of the main clause, as in

(196) I have been alive long enough to understand that

(197) It moves too quickly for most people to see (it).

When there is no subject in the infinitive clause, the understood subject is often the subject of the main clause. The infinitive may also be passive in meaning:

(198) It moves too quickly to see (to be seen).

The ambiguity in the examples discussed above can be systematically accounted for in terms of formal linguistic analysis. As the above discussion indicates, the formal analysis involves the morphological and the surface structure syntactic properties of English. There are however, certain cases of ambiguity in natural language expression which resists systematic formal linguistic analysis. The ambiguity in these expressions cannot be resolved without factual information concerning the message in a given case. As a matter of fact, what is involved in these cases of ambiguity is the clarification of some vague point in the message. For example, in

(199) Come and meet my beautiful wife

whether the adjective beautiful is restrictive or non-restrictive may be taken as problematical. However, it needs to be clarified.

factually if the man in question has another wife who is not beautiful and he is distinguishing one from the other. Similarly, the ambiguity in the sentence

(200) Mary is a beautiful soprano

cannot be resolved without factual knowledge about Mary's person. To take one more example, in the sentence (201)

(201) I dislike Brown's paintings of his daughter

the possible ambiguity between the paintings owned by Brown or the paintin of his daughter painted by himself cannot be settled without the factual information about Brown's life-style. It is obvious that these cases of ambiguity cannot be accounted for systematically in terms of linguistic rules. What is involved here is factual clarification on specification of the message, which cannot be stated formally.

How, then, can the difference between structural ambiguity and vagueness in the message be specified operationally? The discussion of the various examples indicates that a great many of the cases of ambiguity can be solved simply be looking at the prosodic features of punctuation of the expressions. That is, these sentences are unambiguous in their spoken and written forms. The constructional homonymy of the other cases is resolved when certain morphological and surface structure syntactic changes are introduced. There are various types of elliptical constructions which cause ambiguity; they can be disambiguated simply by inserting the elliptic elements. In fact, the prescriptive grammars and rhetoric text-books advise students to avoid structural ambiguity by using such devices. More crucially, the standard scholarly grammars of

English in the descriptive tradition (Jespersen, 1909-49; Kruisinga, 1931-32; Poutsma, 1926-29; Zandvoort, 1957) explain the various types of constructional ambiguity in more or less the same way. These devices can safely be taken as grammatical operational tests to determine whether a given ambiguous expression can be analyzed structurally or not. The cases which cannot be disambiguated by one of these operational tests must be kept outside of the range of 'structural ambiguity'.

The operational procedures to delimit structural ambiguity can be administered in three ordered steps. First, determine if the ambiguity in a given expression disappears when it is spoken or written. The critical cues are prosodic features and punctuation. If not, can the given ambiguity be resolved by simply substituting a single lexical item? If the findings of the second test are positive, then the ambiguity in the expression is non-grammatical. If the ambiguity remains after the first two steps, then check if it is due to grammatical (morphological and surface structure syntactic) homonymy. If it is due to the homonymy of either grammatical classes or constituent grouping, it can be resolved by (i) making morphological changes, (ii) transposing constituents, and (iii) inserting elliptic elements in case of elliptical constructions. The validity of the resulting distinct labelings and bracketings of constituents can be checked by transformational tests. As it has been shown in 2.1.4, paraphrastic transformations reveal the behavior of the constituents which cause structural ambiguity. If the ambiguity in the expression is due to vagueness in the message itself

it has nothing to do with the grammatical devices which carry it. If the ambiguity in a given expression is found to be structural both in terms of its origin and resolution, native speakers of the language should be able to provide paraphrases of the n interpretations involved. It is these n readings of the ambiguous sentence in question to which structural descriptions are assigned.

3.2.2. Descriptive and Theoretical Problems

The discussion in the literature of the cases of structural ambiguity arising out of Instrumental Adverbs gives an indication of the nature of the descriptive problems involved in the application of the criterion within the TGG framework. In the frequently discussed case

(202) He hit the man with the stick.

the phrase with the stick can be treated either as an Adjunct in the Noun Phrase the man with the stick or as a Complement to the Predicate Phrase hit the man. That is, the phrase with the stick can serve in Adjectival and Adverbial functional relations. Lakoff (1968; cf. Kooij 1971) argues that the sentence

(203) I cut my finger with a knife

is ambiguous in that it contains what he calls 'accidental' and 'purposive' interpretations, as in,

(204) I cut my finger on a knife

(205) I used a knife in making a cut in my finger.

He marshals 'grammatical evidence' to show that the two interpretations are based on grammatical differences. The essence of his argumentation is that there are various contexts where the accidental

interpretation holds. Kooij (1971, pp. 72-87) examines Lakoff's arguments and examples in detail and concludes convincingly that

> ... the 'accidental' and 'purposive' Instrumental sentences have the same grammatical structure as far as the notion Instrumental is concerned, and that their ambiguity is an ambiguity of an entirely different nature that is furthermore not even diacritic for these sentences since there are others that have neither an accidental nor purposive interpretation (p. 87).

In terms of the operational tests for structural ambiguity developed in 3.2.1, the case in question, that is

(202) He hit the man with the stick

can be treated as follows: The Adverbial Adjunct can be transposed syntactically, as in

(206) With the stick, he hit the man.

The validity of the argument of the two surface structures for (202) can be seen in the fact that it has two passive versions:

(207) The man with the stick was hit by him

(208) The man was hit by him with the stick.

The two surface structures of (202) can be shown by grouping it in two distinct ways:

```
( (he) ( (hit) ( (the man) (with the stick) ) ) )
S  NP  VP  V     NP  NP       PP                NP VP V

( (he) ( (hit) (the man) (with the stick) ) )
S  NP    VP  V     NP        PP              VP S
```

Grammatically speaking, there may seem to be hardly any difference between the two cases

(202) He hit the man with the stick

(203) I cut my finger with a knife.

But semantic structure of the lexical elements of the two tokens is such that only (202) is ambiguous. In (203) the phrase with a knife serves only the adverbial function, which can be demonstrated by transposing it, as in,

(209) With a knife, I cut my finger.

And allows only one passive form:

(210) My finger was cut with a knife ...

(211) My finger with a knife was cut ...

The ambiguity which Lakoff (1968) perceives in (203) is clearly not structural in origin.

As it has been pointed out in 2.1.4 (cf. Ziff, 1965), grammars can simply provide potential types for ambiguity. The realization of ambiguity due to the type into its individual tokens depends upon the long-range semantic constraints in the minds of the people involved and the immediate contextual constraints surrounding the discourse event. In most of the cases, the realization of the potential for ambiguity at the formal level is determined by the general semantic structure of a language; there may be cases, however, when it would be governed by the developmental histories of the cognitive systems of individual speakers and hearers. It is possible that the potential for grammatical homonymy in a given expression may realize within the cognitive world of a speaker, whereas the cognitive background of the hearer may not allow it. A McCawley might have read Babar as a boy and can imagine "the design of a gun with a trigger so large that an elephant could pull it" (McCawley, 1968, p. 129). Consequently, to him the sentence

(212) The shooting of the elephants was terrible

may be ambiguous. A Ziff might not be able to imagine the situation in question due to the difference in his cognitive world. Similarly, Lakoff's perception of the categories of 'purposive' and 'accidental' in (202) has only an individual basis. This sort of situation where the ambiguity is not generally recognized, needs a clarifying footnote. Within the TGG framework, however, grammarians impose ambiguity upon certain syntactic structures a priori. The consequences of imposing ambiguity from without upon a given grammatical structure are serious for the grammar of the language in question both from the internal and external points of view.

As for the internal point of view of the grammar of an individual language, the problem of the number of ad hoc categories like Lakoff's 'purposive' and 'accidental' would cause a serious difficulty. The categorial rules required to generate structural descriptions for the individual readings would not be needed elsewhere in the grammar. The fundamental principle that the categorial rules must have independent syntactic motivation would be violated. The number of such violations would correspond to the number of times the grammarian decides to impose ambiguity from without and introduces new categories to account for his interpretations. This has the potential for introducing endless, unmotivated complexities in grammars.

The intuitive privilege granted by the theory to the individual grammarians compounds the difficulty further. Individual grammarians depend upon their own 'competence' to construct grammars

As it has been pointed out in 1.2.2, different grammarians can construct different grammars all of which can reach the level of descriptive adequacy. The number of descriptively adequate grammars of an individual language would increase as individual grammarians treat individual cases of ambiguity due to vagueness in the message as cases of structural ambiguity. It is generally agreed that grammarians frequently disagree with each other (cf. Spencer, 1973). If the number of descriptively adequate grammars of a language cannot be limited, the theoretical status of descriptive adequacy becomes fatally doubtful (cf. Peters and Ritchie, 1969).

Gleitman and Gleitman (1970) suggest a 'core' versus 'penumbra' dichotomy in the native speaker's 'competence'. The 'core' part of a grammar would consist of the part of the knowledge of the language which is common to almost all the members of the speech community using the language. The 'penumbra' grammars, on the other hand, represent the rather privileged members who have acquired some more knowledge of and about their language. The 'core-penumbra' distinction can be used effectively only if the distinction between structural ambiguity and ambiguity due to vagueness in the message is strictly observed. If grammarians are free to use their own intuitions as a criterion to delimit ambiguity which is structural in origin, the distinction between 'core' and penumbra' grammars would lose its significance. The number of 'penumbra' grammars would be incredibly large. The 'penumbra' grammars would become mere footnotes specifying individual perceptions of some situations out of their contexts. The significance of the level of descriptive ade-

quacy will be reduced considerably if the 'core' grammar is separated from its troublesome 'penumbra' components. The grammars which are observationally adequate would be able to account for the 'core' part of the linguistic competence of the people of the languages described. The 'penumbra' grammars could describe the specialized aspects of the knowledge of the language of the various groups of a given speech community.

If structural ambiguity is delimited operationally as has been demonstrated in 3.2.1, the serious difficulties caused by the confusion between structural ambiguity and ambiguity arising out of vagueness in the message will no longer exist. The operational tests would automatically reveal the nature of the structural ambiguity in a given expression. A step-by-step execution of such procedures would show they provide cues for structural descriptions.

In its present form the sentence

(213) I knew that you had seen him before I met you

is ambiguous. If the constituent before I met you is transposed and proper punctuation inserted, it gives two distinct readings:

(214) Before I met you, I knew that you had seen him

(215) I knew that, before I met you, you had seen him.

The ambiguity in (213) is resolved, thus, by a simple procedure. As for the sentence

(216) I saw him riding a bicycle

the two interpretations, as in,

(217) I saw him while I was riding a bicycle

(218) I saw him while he was riding a bicycle

can be discovered in a similar way by transposing the constituent riding a bicycle:

(209) Riding a bicycle, I saw him.

The potential for ambiguity allowed by the syntactic pattern in sentences such as

(210) Pushing policemen can be provocative

(211) Boiling champagne can be interesting

can be detected by introducing minor morphological changes:

(212) Pushing the policemen can be provocative

(213) The pushing policemen can be provocative

(214) Boiling the champagne can be interesting

(215) The boiling champagne can be interesting.

In MacKay and Bever (1967, p. 200), the sentence

(216) Those who play chess as well as Bill came

is considered to be an example for the deep structure type of ambiguity. The morphological homonymy of as well as can be demonstrated by a simple procedure. The two readings are demonstrated by the following bracketings:

(217) Those (who play chess) as well as Bill came

(218) Those (who play chess as well as Bill) came.

In (217) as well as is a Conjunction and coordinates Those who play chess and Bill, while in (218) it is used as a Preposition comparing Those and Bill as chess players. Actually, (218) is an elliptical construction; if the deleted element is inserted, the ambiguity disappears and the bracketing is confirmed:

(219) Those who play chess as well as Bill does came.

To take one more example to illustrate how simple operational tests could be used to discover the structural origins of ambiguity in the various potential types, in

(220) His dancing was unexpected

the ing nominalization causes ambiguity between the fact of his dancing and the manner of his dancing. Similarly,

(221) I like dancing

can be interpreted as

(222) I like it when I dance.

(223) I like it when people in general dance.

The ambiguity in these cases, as Quirk et al, (1972, p. 742) point out, is that the ing nominalization links the activity to the subject of the sentence. When an object is added, however, the potential for ambiguity allowed by the ing nominalization does not materialize:

(224) His dancing the tango was unexpected

which is different from

(225) His dancing of the tango was unexpected.

Accordingly,

(226) I like dancing the tango

is unambiguous and the other interpretation requires morphological changes, as in,

(227) I like my/his dancing of the tango.

The ambiguity potential which the ing nominalization allows can, thus, be attributed to the surface structure characteristics of the English language. These properties of operational tests may

be along the lines suggested in 3.2.1. What is needed is a systematic and a thorough investigation of the surface structure patterns of individual languages.

If structural ambiguity is delimited in terms of a set of criteria and operational tests, then, there are no serious difficulties in recognizing and explaining it. A given proposed grammar of a language can be tested in relation to its adequacy in specifying the patterns which may be ambiguous in certain semantic contexts which can be stipulated by the semantic component of the language. In TGG theory and practice, however, the grammarian determines the structural interpretation of ambiguous sentences in terms of his individual perceptions regardless of the long-range and immediate semantic constraints. The categories which have a basis only in the individual perception of a situation by the grammarian are postulated as grammatical categories. The number of descriptively adequate grammars of a given language, consequently, cannot be controlled. The objective of the criterion of structural ambiguity is thus defeated. The claim about the external relevance of TG grammars cannot be justified, at least from the point of view of accounting for structural ambiguity. Peters and Ritchie's mathematical studies also suggest that

> ... whatever the facts of any natural language regarding grammaticality, ambiguity and paraphrase turn out to be, a grammar can be found to fit them within any version of transformational theory that has been proposed... (Peters and Ritchie, 1969, p. 152).

The operational specification of the criterion of structural ambi-

guity is such that it can be fulfilled "by virtue of the definitions of 'transformational grammar', not the nature of empirical reality" (ibid.).

The methodological basis of the present TGG practice also raises doubts with respect to the effectiveness of the structural ambiguity criterion as an external constraint on grammars. The criterion depends upon the assumption that native speakers can both recognize structural ambiguity and account for it in terms of structural descriptions. In Syntactic Structures, Chomsky (1957, p. 86) admitted that "Obviously, not all kinds of ambiguity will be analyzable in syntactic terms" (footnote 1) and suggested

> We can test the adequacy of a given grammar by asking whether or not each case of constructional homonymity is a real case of ambiguity and each case of the proper kind of ambiguity is actually a case of constructional homonymity (italics added).

With respect to the behavioral correlate of ambiguity, native linguistic competence has been attributed to two types of knowledge on the part of the native speaker: (i) knowing that and (ii) knowing how (Hook, 1969; cf Harris, P., 1970; Derwing, 1973). The two types are implicit in the way the criterion is specified. In the first place, there is no guarantee that native speakers "acutally internalize rules specifically to capture the ambiguities" (Derwing, 1973, p. 162). As Peters (1970, p. 39) points out "...the intuitions a grammar describes are deduced from it by examining the set of structural descriptions it generates." There is no way of knowing whether the native speaker's intuition actually traces the structural origins of ambiguity in the way given grammar indicates.

There is a basic circularity in the way the relationship between a structural description and the native intuition is generally understood in TGG. Peters (1970, pp. 39-40) suggests that "the rules generate a set of structural discriptions and then certain properties of these structural descriptions are interpreted as making factual claims This is precisely the way the claim works in practice with respect to the behavior of the grammar of a language as a mirror of the native speaker's intuition for that language with reference to structural ambiguity. Consequently,

> ... there are many different transformational grammars that generate the same set of structural descriptions and there are many different sets of SD's that have the same empirical consequences. Thus the possibilities for different sets of rules to describe the same facts are enormous, in fact, infinite (Peters, 1970, pp 39-40; italics added).

It has been shown earlier how it is indeed impossible to limit the number of descriptively adequate grammars. Chomsky himself has been recently concerned with this weakness. He points out that

> The gravest defect of the theory of transformational grammar is its enormous latitude and descriptive power. Virtually anything can be expressed as a phrase marker, ... Virtually any imaginable rule can be described in transformational terms (Chomsky, 1972, pp. 124-125; italics added).

In the absence of any operational procedures to delimit structural ambiguity, this excessive power of TGG has rendered the external adequacy criteria ineffective.

The nature of the relationship between the level of descriptive adequacy and the structural ambiguity criterion in TGG is such that the link between grammars and native language users

has hardly any behavioral significance. The TGG criterion of structural ambiguity, in actuality, is governed by the formal grammatical apparatus and not the native speaker. The notion of descriptive adequacy requires that a grammar provide a 'correct' account of the native speaker's knowledge of his language. With respect to the ambiguity condition, the native speaker's knowledge involves both its 'know that' and 'know how' components. The native speaker, however, is set aside when the correctness of a grammar's handling of his knowledge is determined. What is at used in the procedure of checking the adequacy of a grammatical description is the analyst's ingenuity in writing the rules which generate structural descriptions. Prideaux (1971) has shown that the notions of descriptive adequacy and linguistic intuition of the native speaker both depend upon the validity of the linguistically significant generalizations. As he argues, the conditions of (i) observational adequacy, (ii) conflatability of rules, and (iii) independent motivation for at least some of the rules operate within a formal framework which leaves no room for any direct response to external considerations. Stuart's (1969) argument, i. e., the statement that a descriptively adequate grammar characterizes the native speaker's linguistic competence is simply an assertion by which competence is stipulatively defined, and applies to the way the operational specification of structural ambiguity is defined in TGG.

3.3.0 Summary

In his initial 'program for a linguistic theory' outlined in Syntactic Structures, Chomsky (1957) suggested that the form of grammars and the notion of simplicity would be continually revised until

the grammars selected by the theory do meet the external conditions. In a footnote, he added

> We may in fact revise the criteria of adequacy, too, in the course of research. That is, we may decide that certain of these tests do not apply to grammatical phenomena (p. 54; fn. 5).

As Prideaux (1973) points out, the recent changes in the internal apparatus have caused so much strife and confusion that the problem about external criteria has been set aside. Unless the external adequacy criteria are properly specified, they cannot be reliably used to evaluate the proposed changes in the form of grammar and the theory of language. Serious doubts have been raised regarding the ontological status of the level of descriptive adequacy which, in TGG, is of crucial importance from the point of view of the external relevance of grammars (Peters and Ritchie, 1969; Peters, 1970; Prideaux, 1971, 1973).

In this chapter, it has been shown that the link between structural ambiguity and descriptive adequacy is dubious. As regards the actual execution of the criterion of structural ambiguity within the TGG framework, there are serious descriptive and theoretical difficulties. These problems can be solved by recognizing the distinction between structural ambiguity and ambiguity due to vagueness in the message. If a battery of operational tests is developed in terms of the surface structure properties of an individual language, the cases of ambiguity which are structural in origin can be specified. These tests automatically reveal the constituent structure of the various interpretations involved in the various types of structurally ambiguous sentences.

The objective of the criterion of structural ambiguity cannot be fulfilled unless its external basis is restored. If the criterion is made externally relevant, it can be an effective procedure to test the adequacy of individual grammars and the theory of grammar, as it was originally envisaged in Syntactic Structures.

CHAPTER FOUR

STRUCTURAL AMBIGUITY AND DEEP SYNTACTIC STRUCTURE

4.0.0. Preliminary Remarks

The term 'deep syntactic structure' has been a focal point in the development of the overall theoretical and descriptive framework of TGG. The proposition of the deep-surface structure dichotomy brought with it an array of new concepts and required radical changes in the 'program for linguistic theory' proposed in Syntactic Structures. Within the revised framework bearing on the concept of deep syntactic structure, the grammar proposed by the linguist is an explanatory theory; it suggests an explanation for the fact that... a speaker of the language in question will perceive, interpret, form or use an utterance in certain ways and not in other ways" (Chomsky, 1970, p. 428; italics added). The certain ways that the speaker was expected to follow in his encoding and decoding of utterances were specified in the following way:

> Knowledge of a language involves the ability to assign deep and surface structures to an infinite range of sentences, to relate these structures appropriately, to assign a phonetic interpretation to the surface structure and to construct a semantic interpretation on the basis of the grammatical relations of the deep structure (Chomsky 1970c, p. 430).

The importance of surface structure properties like focus, topic and comment, reference, scope of logical elements, etc., has been recognized in the 'Extended Standard Theory' (Chomsky, 1972b).

The central character of the deep structure hypothesis is that " ... the grammatical relations defined in the deep structure are those that determine semantic interpretation" (Chomsky, 1970b, p. 106) has been retained, however. Insofar as the alternative proposals which reject the deep structure hypothesis are not based on 'empirical content and justification' Chomsky considers them mere 'notational variants'. He suggests (1970b, p. 80):

> There is only one way to provide some justification for a concept that is defined in terms of some general theory, namely, to show that the theory provides revealing explanations for an interesting range of phenomena and that the concept in question plays a role in these explanations (italics added).

Structural ambiguity has been specified as one of the major phenomena which cannot be explained without the concept of deep syntactic structure (Chomsky, 1965, 1968, 1970c, 1972b). It has been claimed that the surface structure of a given ambiguous sentence gives no indication of the n-ways in which it can be ambiguous. Chomsky has consistently argued that the transformations producing structurally ambiguous sentences obliterate the system of grammatical relations and functions that determine the number of the readings involved in a structurally ambiguous sentence. As Jackendoff (1972, pp. 3-4) points out:

> From the beginning of generative grammar, the idea that functional structure is preserved by transformations has been fundamental. In fact, one of the original arguments for the explanatory adequacy of a level of underlying syntactic structure, related to the surface by transformations, was that this underlying level expresses necessary generalizations about understood subjects and objects of verbs - for example the active-passive relationship or the ambiguity of sentences like I found the boy studying in the library.

Even though Jackendoff (1972, p. 5) rejects the Katz-Postal hypothesis of meaning preservation under transformation (Katz and Postal, 1964), he insists that "we must retain the conception of deep structure as representing a level of syntactic generality, the conception that originally motivated its existence."

The objective of this chapter is to show that it is not possible to justify the level of deep syntactic structure on the grounds that it is required to account for structural ambiguity systematically. It will be pointed out that the concept of deep syntactic structure is only a piece of grammatical engineering which results from the Chomskyan definition of 'transformation' rather than from the actual process of disambiguation in natural language.

4.1.0 Transformational Generative Perspective on Structural Ambiguity and Deep Syntactic Structure

Hockett (1954) justified the necessity of constituent structure as an independent level in grammatical analysis in part on the grounds that structural ambiguity could not be systematically accounted for without it. When Chomsky proposed his 'program of linguistic theory' in Syntactic Structures, he turned Hockett's observation into a methodological canon. He tried to show that 'constructional' homonymy could not be treated adequately at the level of surface constituent structure and the existence of a higher level of transformational analysis was warranted on a theoretical basis.

4.1.1 Structural Ambiguity and Transformational Analysis

Even though Chomsky initially accepted Harris's concepts of 'kernels' and 'transformations', his theory of language required a sig-

nificant change in the definition of 'transformation'. Harris viewed transformations as sentence-to-sentence equivalence relations (Harris, 1970; cf. Kac, 1973). As Smaby points out, transformations in Harris are designed to have direct empirical correlates" (1971, p. v). Chomsky's 'generative' approach to the study of language prescribed the form of grammar in such a way that 'transformation' could not be treated as a mapping of a set into itself. In a way, 'transformation' was used as a discovery tool in Harris. In accordance with his view of a grammar of a language as a projective device to generate the grammatical sentences of the language and explain the native speaker's linguistic behavior, Chomsky set up transformations as instructions in the course of generating sentences, that is, as mappings on the path from abstract grammatical structures to phonetic representations. In Kac's (1973, p. 469) words, "H(arris) views transformations as relationships among classes of sentences, while in Chomskyan and post-Chomskyan theory they are mappings of 'abstract' syntactic representations onto actual-sentence structures." Chomsky's primary motivation for his modification of Harris' definition of 'transformation' seems to have originated from Harris' general framework of transformational analysis. For Harris, "Transformational analysis is not primarily an indicator of the structure of each sentence separately, but rather a pairing of sets $\{A\}$, $\{B\}$, of sentences..." (Harris, 1968, p. 60; italics added). Besides being a relation which preserves sentencehood, "transformations can indicate the structure of each sentence and that each sentence can be characterized by its transformational relations to a unique set of other sentences..." (ibid., p. 63; italics added).

It is Chomsky's definition of 'transformation' that sets him apart from Harris with respect to structural ambiguity. Harris does consider ambiguity to be a general property of sentences and makes it a condition for a theory of language structure (Harris, 1968, 1970). When Harris introduced the concept of 'transformation' into 'structural linguistics' during the early fifties, he justified it on the grounds that it was necessary "for the theory of language structure, for operational investigations in it, for a treatment of homonymities" (Harris, 1956, p. 388). In his paper 'Transformations in Linguistic Structure', Harris (1964, p. 476) explains the relationship between structural ambiguity and transformational relation as follows:

> Sentential transformations are a relation among sentences. They are an equivalence relation, though not exactly on sentences but rather on readings on sentences. A sentence may have two or more grammatically distinct readings each of which has transformations different from those of the others.

Harris observes that the sentences in each of the paraphrase sets arising out of an ambiguous sentence are different transformational results with different meanings; further transformations may operate differently on them. Transformational analysis, thus, is used as a method of treating homonymity in Harris' approach.

During the Syntactic Structures period, Chomsky was close to the Harrisian mathematical framework. He treated structural ambiguity in terms of nonequivalent derivations.

> When the simplest grammar automatically provides nonequivalent derivations for some sentence, we say that we have a case of 'constructional homonymity', and we can suggest this formal property as an explanation for the semantic ambiguity of the sentence in question. (Chomsky, 1956, p.114)

Within the Harrisian framework of transformational analysis, however, sentences are described as composed of kernels, rather than of parts or elements which are themselves not sentences. In Chomsky, it is the generative rules which describe the elemental composition of sentences. The syntactic categories of the generative rules have a language-independent basis. The transformational operation has a unidirectional basis for Chomsky. The unidirectional derivational definition of 'transformation' allowed Chomsky to postulate a dichotomy of levels in syntactic structure. The kernel-nonkernel distinction was challenged soon after the publication of Syntactic Structures (Schachter, 1964; Heidolph, 1964; cf. Lyons, 1966, p. 119). Lees (1968), Klima (1964) and Katz and Postal (1964) posited abstract negative, interrogative and imperative morphemes on an optional basis in the phrase structure rules. Passive sentences are derived "not from corresponding active forms, but rather from underlying P-markers containing an Adverb-manner constituent dominating by plus a passive morpheme dummy" (Katz and Postal, 1964, p. 72). These changes in the form of grammar led to the formulation of the deep-surface syntactic structure distinction. To relate the two levels of syntactic structures in some way, Chomsky had no alternative but to define the operation of transformation in extremely loose terms. He states it as follows:

> The basic property of transformations is that they map phrase-markers into phrase-markers. Each transformation applies to a phrase-marker on the basis of the formal configurations expressed in it, and quite independently of the meanings or grammatical relations expressed by these formal configurations. The transformation applies blindly to any phrase-marker of the proper form, caring nothing about meanings or grammatical relations (Chomsky, 1972a, p. 197).

With the development of the concept of 'deep syntactic structure', it was prosposed that what was labelled 'transformational ambiguity' would be treated in terms of 'deeper connections'. In Syntactic Structure, Chomsky suggested that "A significant number of the basic criteria for determining constituent structure are actually transformational" (1957, p. 83). The label 'transformational ambiguity' made sense in that context. It was implied that the transformational relations can be heuristically used to explain constructional homonymity. Within the modified form of grammar

> ... a transformational grammar, because it assigns both an underlying and a superficial phrase marker to a sentence, can treat a case such as "John knows a kinder person than Bill" as one where two different deep structures collapse into one surface structure, and can use ellipsis as the source of ambiguity" (Katz, 1971, pp 77-83).

Specifically, it is claimed that for every structurally ambiguous sentence there must be as many distinct deep syntactic structures as there are 'readings' and each interpretation must be derived from the various underlying structures by rules. These rules, it is further claimed, have an independent syntactic motivation, that is, they are an integral part of the grammatical system of the language concerned.

Chomsky's conditions for the level of deep syntactic structure are as follows (Lakoff and Ross, 1967; Botha, 1968):

(i) Basic grammatical relations (e.g., subject-of object-of) are represented at this level in terms of fundamental grammatical categories.

(ii) The correct generalizations about selectional

restrictions and co-occurrence can be stated at the deep structure level.

(iii) Lexical items are assigned to their appropriate categories at this level.

(iv) The structures defined at this level are the input to the transformational rules.

Accordingly, the level of deep syntactic structure is defined as follows:

> The deep structure is a well-defined level which meets the phrase structure conditions of the base rules, defines the proper contexts for lexical insertion, and provides the appropriate grammatical relations for interpretation in terms of "semantic relations" and "conceptual structure" (Chomsky, 1970b, p. 117).

The special link between the deep structure and structural ambiguity is intact in the recent revisions in the overall framework of TGG. Both Chomsky (1972b) and Jackendoff 1972) define the role of transformations in such a way that the deep structure still remains the mainstay of semantic information, especially in the form of logical relations signalling the relational structure of sentences. The process of disambiguation is supposed to be one of the empirical consequences of the logical relations captured in deep structure.

The typical examples of deep structure ambiguity discussed in the TGG literature have been reanalyzed in 2.1.3 to show that the ambiguity in them can be accounted for in terms of the surface structure characteristics of English. It will now be shown that there are also descriptive difficulties in the deep structure treatment of some

of these examples. Moreover, the consequences of the deep structure resolution of the ambiguity in these examples cause problems for the assumptions which are basic to TGG. It will also be pointed out that the ontological status of deep structure is questionable from the point of view of the native speaker's decoding of ambiguity.

4.2.0 Deep Structure as a Medium in Disambiguation

The different deep structures postulated to disambiguate a sentence are essentially the statements of the functional relations involved in the various readings. Most of the types of ambiguity discussed in TGG involving such a procedure of disambiguation depend upon various kinds of nominalizations. The claim that these ambiguities cannot be systematically accounted for without the medium of deep syntactic structure can be substantiated only if it can be shown that (i) deep structures can be postulated for the n interpretations that can be assigned to an ambiguous sentence without any consequences which may be damaging to the basic assumptions of TGG; (ii) logical relations play a central role in sentence processing; and (iii) non-linguistic factors, such as the kind of imagery involved, are not basic to the decoding of nominalizations. These requirements are discussed in the following sections.

4.2.1 Internal Problems

There are several arguments in the current linguistic literature against the existence of deep syntactic structure as an independent level. One of the most cogent of them is that there is a great deal of indeterminacy in the postulation of deep structures. As Kooij (1972) and Haas (1973a, 1973b) point out, different linguists

propose different underlying structures for one and the same sentence within the TGG framework. It is obvious in the literature that

> Again and again, we are invited to choose between alternative 'deep structures' and find that the comparative appropriateness of each varies with the lexical content and with the context of the constructions to which the proposed deep-structure rules apply (Haas, 1973b, p. 94; italics added)

The question of the indeterminacy of deep structures becomes much more acute when it is considered from the point of view of ambiguous sentences. Some typical examples discussed in the literature are cited below.

The ambiguity in the popular case

(228) Flying planes can be dangerous

is accounted for differently by different linguists by postulating different underlying structures for it. Chomsky explains the ambiguity in question by deriving flying planes transformationally either from a structure underlying

(229) They fly planes ...

or from a structure underlying

(230) Planes fly ...

The logical relations of subject and object are supposedly captured at the deep structure level. According to Lyons (1968), the underlying structure of (230) recurs in (229) and the ambiguity of the nominalization flying planes can be accounted for by deriving it from the underlying structure of (230) either with or without a 'verb + causative' transformation. In the solution proposed by Fillmore (1968; cf. Haas, 1973b, p. 284), the difference between planes being

object in (229) and subject in (230) is not relevant. In his 'case grammar' model, subject and object are 'superficial' categories of 'surface structure' constituents. Fillmore explains the 'deep' difference between the two readings simply in terms of the agentive case in (229) and its absence in (230). Case differences, and not functional relations, are specified at the deep syntactic level in case grammar.

In the next example,

(231) He saw the girl with the flowers

the prepositional noun phrase complement with the flowers can be interpreted in more than one way. If the ambiguity is to be resolved through the medium of deep structure, the phrase has to be derived transformationally from an underlying structure. A specific verb is required to postulate an underlying syntactic structure for the phrase. The precise relationship between the relational elements the girl and the flowers depends upon context. Consider Kooij's discussion of the issue:

> Differences between interpretations can be so gradual that it becomes intuitively unattractive to assume that such interpretations actually originate from deep structures. When I say I saw the girl with the flowers, I say something like I saw somebody and that somebody was a girl with flowers that has been previously identified. When I say I saw the girl with the flowers, I say something like the previously identified somebody-who-is-a-girl that I saw, was the one with the flowers. To me, the difference between these two sentences seems to be a difference in topicalization of essentially the same semantic material and not a difference in deep strucutre (Kooij, 1972, p. 895).

Bach (1968) suggests that the underlying sentence for the phrase with

the flowers does not contain a regular tense element but a context-sensitive narrative tense which is an attempt to introduce the notion of semantic specification by context. It is in this context that Jackendoff (1972) concedes that there never have been really compelling arguments to allow syntactic status to the various interpretational differences which can arise out of NPs in sentences like

(232) John wants to visit a museum every day.

These examples and discussions are typical of the current linguistic literature. Associated with the problem of the indeterminacy of deep structures in many of the cases which are classified under 'deep structure ambiguity' is the issue of the descriptive consequences which follow from these structures. The underlying syntactic structures postulated to account for the ambiguity arising out of some nominalizations lead to some consequences which are embarrassing to the basic assumptions of TGG.

The first point is that the grammars which are equipped with the rules to resolve ambiguity in terms of deep syntactic structures allow tautologies. For example, the nominalization in the familiar example

(233) They are flying planes

will receive three interpretations one of which will be a tautology (cf. Lyons, 1968; Prideaux, 1972). In addition to the interpretations

(234) They are planes which are flying

(235) They are flying planes

such a grammar will also allow the following reading:

(236) They are planes for flying.

The last reading will be a result of formulating the grammar so that it can assign two underlying structures to the nominalization in the example

(236) They are eating apples.

Related to the construction V+ING+N is the problem of V+ING+OF+NP in which V can be interpreted both subjectively and objectively. The ambiguity in the sentence

(237) The shooting of the hunters was terrible

is explained in the literature by deriving the subjective reading from The hunters shoot and the objective one from X shoot the hunters. The grammar which treats the ambiguity of (237) in this way will encounter difficulties in case of constructions like the eating of the apples, the cooking of the Italians. Such a grammar will assume a transformational relationship between the two constructions. As Lyons (1968, pp 252-253) points out, the phrase the eating of apples can syntactically receive the subject interpretation which allows the generation of

* (238) The apples are eating bravely

(239) The hunters are shooting bravely.

Similarly, the grammar can assign an objective reading to

(240) The cooking of the Italians was gourmet-good.

In fact, Chomsky (1968, p. 54, fn 9) does suggest the possibility of assigning such an interpretation to the nominalization John's cooking:

> There may also be other interpretations, based on other ambiguities in the structure John's cooking - specifically, the cannibalistic interpretation and the interpretation of cooking as "that which is cooked".

The solutions required by problems such as these are costly for such a grammar on the whole. They involve making decisions for the other components of the grammatical machinery. The following quotation from Lyons (1968, pp 252-253) indicates some of the issues arising out of the the deep structure hypothesis:

> If the deep structure resolution of the ambiguity of phrases like the shooting of the hunters and the eating of the apples is adopted, either the subjective phrase the eating of apples and the sentence The apples are eating should both be generated as grammatical (and systematically related to one another in terms of their 'deep' structure) or they should both be excluded as ungrammatical. And their grammaticality or ungrammaticality would depend upon whether the noun 'apple' and the verb 'eat' are subclassified in the lexicon (by means of grammatical 'features') in such a say that the grammatical rules will admit or prohibit the combination of a noun with a given 'feature' (e.g., animate as the subject of the verb-class of which 'eat' is a member).

These kinds of solutions cannot go very far. There are still many cases in which the ambiguity of the nominal compounds depends upon dialectal and other aspects of the background of the native users of the language concerned.

Prideaux (1972) suggests that the ambiguity of compound nominals like beer drinking and drinking beer in sentences such as

(24) The police stopped beer drinking

(242) The police stopped drinking beer

depends upon the kind of nominalizations allowed in the subject-of and the object-of positions in a given dialect. He points out that in his dialect the two compound nominals are equivalent in the subject position. For example, the following are equivalent:

(243) Beer drinking is fun

(244) Drinking beer is fun.

In both (243) and (244), beer is the object of drinking. In the object-of position, however, only one ordering is allowed, which makes (241) and (242) distinct both syntactically and semantically. The kind of the solution that Lyons (1968, pp 252-253) suggests above will not work in the case of Prideaux's example. Furthermore, such a grammar will obviously treat the sentences

(245) The police stopped apple eating

(246) The police stopped cigar smoking.

as syntactically related to (244). How would the grammar then account for the fact that the reverse order in the compound nominals in (245) and (246) is unacceptable? For example, the following are not allowed:

* (247) The police stopped eating apple

* (248) The police stopped smoking cigar

* (249) Eating apple is fun

* (254) Smoking cigar is fun.

The grammatical engineering required to account for the differences between the nouns like apple and cigar, on the one hand, and the ones like beer and poker, on the other, will be very costly. The usual practice in TGG at the present time is to assume that the semantic component can be adjusted in some way to accomodate such syntactic problems. The weaknesses of syntactic rules will be concealed in this way as long as it is possible to take it for granted that the semantic component is flexible enough to allow any kind of adjustment

for the grammarian's convenience. Consequently, essentially semantic issues are explained syntactically, and the embarrassing consequences of such syntactic rules are left for the semantic component to deal with on an ad hoc basis. A great many underlying syntactic categories and rules postulated to account for the derivations of ambiguous sentences owe their existence to this tendency. Since the type of ambiguity arising out of the gerundive construction is widely discussed in the TGG literature, it provides a good illustrative case in point.

Katz and Postal (1964, p. 122 ff) first differentiate the construction John's washing the car from the one with the genitive of, John's washing of the car which can be transformed to this washing of the car of John's. Then they suggest that the genitive of construction is associated with adjectives which can form manner adverbials. For example,

(255) John washes the car rapidly

(256) John's rapid washing of the car ... .

Katz and Postal pursue the argument by linking the manner constructions with a much more general group of adverb-type constructions. The following equivalents are put forward as evidence in favour of their hypothesis:

(257) John's way of driving

the way in which John drives

(258) John's purpose in driving

the purpose for which John is driving

(259) John's period of driving

the period during which (when) John drives.

This distinction between the 'factive' and 'manner' interpretations is used by Katz and Postal to account for the ambiguity arising out of the gerundive nominalizations, as in

(260) I dislike John's driving.

'Factive' and 'manner' are considered to be syntactic categories associated with the gerund. It is argued that it is the syntactic basis of the gerund that provides the basis for the ambiguity in (260). As Wonder (1970, p. 256) points out, Katz and Postal's argument is essentially circular insofar as the problem of gerundive ambiguity is concerned. He argues

> If the gerund is of the manner type, then an adjective associated with the manner concept would of course be quite appropriately used with it. It could be just as well maintained, however, that the adjective made the gerund interpretable as one of manner (italics added).

Wonder's analysis of the adjectives associated with the factive and manner constructions shows that the difference between the two types is not syntactic, but semantic in character. Wonder convincingly argues that "there is nothing necessarily 'adverbial' or 'factual' about the gerund per se; it is a nominalization which simply reflects the factive or manner sense of the original input" (1970, p. 260; italics added). It seems that there is no basis for Katz and Postal's attempt to explain the ambiguity arising out of the gerundive nominalization in terms of the deep syntactic categories. At the root of the issue is the general tendency to impose some sort of cognitive identity on a multitude of syntactic constructions and then account for it in terms of deep syntactic categories. The fine points of surface syntactic differentiation are ignored when such deep cate-

gories are postulated. For example, there are some obvious facts associated with the use of the factive gerundive construction which Katz and Postal ignored in their analysis of it. It has been pointed out in 2.1.3 that the question of gerundive ambiguity does not arise in actual use. Native speakers of English mostly drop the genitive 's for the factive reading of the gerundive nominalization. The native user's practice of dropping the genitive 's is considered to be a fact of performance in TGG; hence, it is supposed to be trivial for the purpose of linguistic description. In fact, it is only in formal English that the omission of the genitive 's is prescrptively prohibited. There is independent syntactic evidence in support of the argument that the 's in the factive gerundive construction is artificial. Why is the genitive 's not required in the gerundive construction Verb + (Pro) Noun + Gerund? For example, in the sentences

(261) I remember John dancing

(262) I have seen John dancing

dancing functions as a gerund. For a very small number of English verbs, the gerund is syntactically optional with the 'plain infinitive' (verb stem). Native speakers use them in specific contexts, however (see Patel, 1964). The following pairs are not synonymous:

(263) I have seen John dance.
I have seen John dancing

(264) I have watched John dance
I have watched John dancing.

The gerund in this construction is used in the factive sense (cf. Zandvoort, 1957). Similar problems arise when attempts are made to explain the difference between two surface syntactic constructions in

terms of deep syntactic categories.

In order to explain the ambiguity of

(265) the growing of tomatoes

and the nonambiguity of

(266) the growth of tomatoes

through the medium of deep syntactic structure, Chomsky (1972, pp. 58-60) postulates the following deep structure:

(267) John (+cause, grow) tomatoes.

His justification for +cause in (267) as a "lexical property which can be assigned to certain verbs" depends upon the following assumptions in a crucial way:

> Associated with this feature are certain redundancy rules which are, in this case, universal, hence not part of the grammar of English but rather among the principles by which any grammar is interpreted. These principles specify that an intransitive with the feature (+cause) becomes transitive and that its selectional features are systematically revised so that the former subject becomes the object. Similar principles of redundancy apply to the associated rules of semantic interpretation (Chomsky, 1970a, p. 59).

It is suggested that the difference between (265) and (266) can be accounted for by restricting the feature (+cause) "with respect to the feature that distinguishes derived nominals such as growth from forms such as growing, limiting it to the latter case" (p.60). As Chomsky himself points out, the solution which he has proposed "involves an ad hoc step" as long as there are no general grounds for the proposed feature (+cause). As a matter of fact, the difference between (265) and (266) can be explained without the medium of deep syntactic structure which necessitates such problematic assumptions. There are clear

surface structure constraints upon the acceptibility of the two constructions in question. The following are used in specific contexts and are not synonymous:

(268) The growth of John's tomatoes this year is extraordinary

(269) The growing of John's tomatoes this year is extraordinary.

When the definite article is replaced, however, only one is acceptable:

(270) John's growing of tomatoes this year is extraordinary

* (271) John's growth of tomatoes this year ....

Native speakers of English might suggest that they would replace growth by crop in (271). The difference between (265) and (266) is, thus, obvious and the ambiguity of (266) can also be resolved at the level of surface structure. When the definite article is replaced by an agent, the potential for the homonymy between the intransitive and the transitive readings disappears. The sentence (270) is ambiguous, but the source of ambiguity now is the nominalization John's growing and not growing of tomatoes. The nature of the type of ambiguity involved in John's growing is discussed in 2.1.3 in relation to its factive and manner interpretations.

Associated with the issues discussed so far in relation to the usefulness of the medium of deep syntactic structure in disambiguation is the question of transformational constraints. One of the most basic problems currently discussed in TGG is the issue of whether certain transformations can be constrained in such a way that they

can be blocked in specific cases without sacrificing generality. With reference to the specific question of the factive-manner interpretations allowed by a specific nominalization type common in both English and French, Ruwet (1973) suggests that it is impossible to block ungrammatical sentences. He emphasizes that the ungrammaticality of these sentences so generated is not due to "any accidental lexical reason"; in fact, the nature of ungrammaticality in these sentences says something about the surface structure constraints which they violate (Ruwet, 1973, p. 420). Following Klima (1970), Ruwet claims that the alternative way of dealing with transformational constraints is the formulation of perceptual strategies. The perceptual strategies proposed for the factive-manner ambiguity nominalization construction in French are stated by Ruwet (1972) in terms of surface structure constraints. Both Ruwet and Klima (1970) thus adopt a revised perspective on the traditional distinction between competence and performance. Ruwet (1973, p. 442) explains their position as follows:

> The essential thing is that this approach redistributes, so to speak, the roles played by the theory of competence and the theory of performance; types of facts which up till now have been described in (grammatical) terms of transformations or of constraints on transformations (or on derivations as in Lakoff 1970a, 1970b) are described now in terms of behavioural constraints.

In Klima (1970) and Ruwet (1973), deep structures are linked with surface structures by transformations which are constrained in terms of the facts about the surface structure of the language in question. Even though they keep the level of deep syntactic structure in their form of grammatical description, Klima and Ruwet propose a close

liaison between the grammar and the users of the language it tends to describe. What is the implication of the Klima-Ruwet position with reference to the traditional TGG claim that a certain type of structural ambiguity cannot be resolved without the mediation of the deep syntactic structure? Because the perceptual strategies which constrain the transformations are stated in terms of the surface structure properties of individual languages in Klima-Ruwet, the implication is clear: the perception of the type of structural ambiguity stipulated in the TGG literature is guided by the surface structure characteristics of individual languages.

The discussion so far has indicated that there are serious problems associated with the analytical procedure of resolving structural ambiguity through the medium of deep syntactic structure. There is a great deal of indeterminacy involved in the selection of deep structures for some sentences. The consequences which follow from the deep strutures postulated for some sentences, furthermore, are embarrassing for some of the basic assumptions of TGG. It may very well be that the concept of the independent level of deep syntactic structure and the assumptions which motivate it have no external basis. Its ontological status with respect to the process of sentence decoding has also been widely questioned in the recent psycholinguistic literature. The available psycholinguistic evidence relevant to the issue at stake is considered in the following section.

4.2.2 External Considerations

The theory of language which guides the assumptions underlying the post-Syntactic Structures transformational generative form of grammar

revolves on the concept of "knowledge of language, a certain cognitive system". An optimal grammar within the TG form is required to fulfill certain primary empirical requirements with respect to grammaticality, paraphrase relations and structural ambiguity. The following quotation from Katz (1971) states the typical claim from the perspective of TGG:

> Corresponding to the distinction between grammatical and ungrammatical strings of words, there is the distinction in visual perception between distorted and undistorted images, and corresponding to degrees of ungrammaticality there are degrees of visual distortion. Ungrammatical strings such as "run which bark therefore chiefly the a of when" correspond to certain kaleidoscopic images in which the parts of things are attached at the wrong places. Corresponding to syntactically ambiguous sentences such as "The shooting of the hunters was terrible", there are the ambiugous figures found in texts on the psychology of perception (Katz, 1971, pp. 130-131).

It is claimed that the native user's "knowledge of the language" is reflected in his responses to these sentential properties. It is the underlying syntactic structure which is supposed to mediate between the user's linguistic competence and the phenomena of grammaticality, paraphrase and structural ambiguity. With reference to structural ambiguity, in particular, it is assumed that the surface structure is opaque and it cannot be made transparent without intervention of the deep syntactic structure. The linguistic definition of deep structure stipulates the central role of the logical relations of subject and object in sentence interpretation. It also depends upon the assumption that the transformational relation is derivational in function. In relation to structural ambiguity, it is claimed that the n-interpretations involved in some of the sentences of the deep structure type, mostly nominalizations, can be captured

only at the level of deep structure. The recent psycholinguistic research contains negative evidence on each one of these issues.

The first issue concerns the parameter of logical relations in sentence decoding. As has been pointed out in 2.1.2, Chomsky rejuvenated the traditional distinction between logical and grammatical relations when he proposed the deep-surface syntactic structure dichotomy. In traditional grammar, the notion of 'grammatical function' was central and the logical-grammatical dichotomy was motivated in terms of the morphological properties of individual languages; furthermore, grammatical functions were not considered to be inherently relational. Chomsky (1965) decided to determine grammatical functions only in terms of categorial configurations. As for the associated traditional notion of the psychological topic-comment (subject-predicate) distinction, Chomsky (1965) treated it as a mere detour. Commenting upon Cook Wilson, a traditional grammarian who along with others made the psychological subject-predicate distinction explicit, Chomsky says "Whatever the force of such observations may be, it seems that they lie beyond the scope of any existing theory of language structure or language use". (1965, p. 163). Hornby (1972) presents experimental evidence to suggest that the psychological subject and predicate cannot be equated with the logical subject and predicate. Hornby asked 280 college students to select one of two pictures to go with a sentence in an ambiguous situation. The ambiguity was created by the fact that neither picture actually represented the content of the sentence. Subjects were expected to select one picture or the other depending upon which aspect of the sentence

(the agent or the object) is taken to be the psychological subject. Hornby's experimental materials consisted of seven types of surface structures: active (The Indian is building the igloo), passive (The igloo is being built by the Indian), cleft agent (It is the Indian who is building the igloo), cleft object (It is the igloo that the Indian is building), pseudocleft agent (The one who is building the igloo is the Indian), pseudocleft object (What the Indian is building is the igloo), stressed agent (The INDIAN is building the igloo). The results show that for all the sentence structures there was a tendency for the subjects to select one picture more frequently than the other. For the active sentence form, the picture depicting the agent was most frequently selected; it was the same for the cleft object and the pseudocleft object patterns. This was not the case for the other four sentence types. For the passive, cleft agent, pseudocleft agent, and stressed agent structures, the picture containing the object was most frequently selected. As Hornby points out,

> Since neither the agent nor the object is consistently selected across sentence types, it is evident that the selection is not determined by the logical (case) relationships among the constituents. That is, subjects do not consistently select the picture depicting the logical subject (the agent) as being what the sentence is about (Hornby, 1972, p. 639).

It has also been demonstrated that the selection of pictures is not a direct function of the order of the constituents in the surface structure of the sentence, i.e., subjects do not consistently select the superficial subject (appearing near the beginning of the sentence)

as being what the sentence is about. In light of the other results reported in the psycholinguistic literature, Hornby's conclusions do not sound implausible.

Slobin (1966) has indicated that non-reversible passives (e.g., The flowers were being watered by the girl) take no longer to evaluate than equivalent actives (e.g. The girl was watering the flowers). He argues that subjects form judgements about picture evaluation regardless of the form of the sentence. Similarly, Johnson-Laird (1968) suggests that the function of the passive is both to draw attention to differential emphasis being placed on the logical subject and object and to indicate this emphasis by changing the word order. In Johnson-Laird's experimental tasks, subjects had to choose between different syntactic forms of a statement in order to communicate a difference in the relative sizes of coloured areas. When they were trying to convey that there was a difference in size between the logical subject and object, subjects tended to choose a passive rather than an active form of the descriptive statement. Herriot (1969) used sentences that were non-reversible only in the sense that they described expected events, e.g., The doctor treated the patient and The bather was rescued by the lifeguard. Although the converse of the sentences was perfectly possible, there was no difference in the times taken by subjects to state the actor and object of active and passive sentences. When the subjects and objects were equally likely either way round (e.g., The bather hated the sister), passives took more time than actives. This suggests that language users need time to determine the relations which are

semantically most plausible. There are several other research findings which suggest a similar direction (e.g., Baker, Prideaux and Derwing, 1973).

The second point that is frequently asserted in TGG is that the ambiguity arising out of nominalizations cannot be resolved without the medium of deep structure. Recent psycholinguistic research on the question tends to show that the language user's performance on the tasks involving nominalizations cannot be explained in terms of their deep-structure complexity (Paivio, 1971a, 1971b; Wearing, 1971). Rohrman's (1968) initial work indicated that variations in deep structure could predict the recall of English nominalizations with identical surface structures (e.g., growling lions, digging holes). Wearing's (1971) replication of Rohrman's study suggests that semantic (pictorial) vividness was confounded with nominalization type in Rohrman's experiment. In Wearing's (1971) data, nominalizations that were correctly recalled were given higher vividness ratings and the intransitive nominalizations were rated more vivid than object nominalizations. Furthermore, there was no reliable difference between the vividness ratings of transitive subject and object nominalizations. Wearing's finding seems to be plausible within the framework of Paivio's (1971a) work on the role of imagery in learning and memory. Paivio's extensive survey of the literature and his original work show that rated imagery scores are correlated with paired-associate learning, even with concreteness and meaningfulness controlled.

Paivio (1971b) compared rated imagery and deep structure complexity as predictors of the free recall of English nominalizations. All three of his experiments showed a consistent positive effect of imagery but not of deep-structure complexity. Paivio first obtained imagery ratings for Rohrman's (1968) set of nominalizations. The ratings showed that the subject nominalizations significantly exceeded the object nominalizations in their average imagery, which hinted that an imagery interpretation of Rohrman's data was at least plausible. Paivio (1971b) selected items from Rohrman's pool so that imagery and nominalization type varied factorially. The high-imagery subject nominalizations were items like falling stars, dancing girls, and reigning kings; low imagery subject nominalizations included existing situations, clamoring masses, and persisting doubts. High-imagery object nominalizations were items like mopping floors, ironing clothes, and painting pictures; low imagery object nominalizations included hearing rumors, yielding points and keeping secrets. Results clearly indicate that nominalization type has no main effect but did interact with imagery level in such a manner that more subject than object nominalizations were recalled when their imagery level was low, but this was reversed when imagery was high. As Paivio (1971b) emphasizes, the interaction is weak relative to the main effect of imagery and provides no support for a general interpretation of the data in terms of deep structure.

Paivio conducted further experiments (1971a) to extend the generality of the finding. In these experiments a new pool of nominalizations was used. Subjects were asked to supply an appropriate participle to fill the blanks in base sentences corresponding to the types

of nominalizations, e.g. someone is -----ing holes (object); the tigers are -----ing (subject). Both high-imagery concrete and low-imagery abstract nouns were used in the frames, and the same nouns appeared in subject and object nominalization frames for different groups. Nominalizations were selected from the normative data so that word frequency and associative probability were matched for corresponding subject and object types. The results supported the earlier findings. In all three experiments, nominalizations with imagery behaved in an inconsistent way, this lack of pattern indicated that some variable other than nominalization type was producing the effect of imagery level. For all three experiments correlations were computed between mean recall scores for the nominalizations and the rated imagery values of the participles alone, the nouns alone, and the two combined. The average correlations show that noun imagery is the best predictor of recall, and nominalization type is the poorest. Both Paivio (1971b) and Wearing (1971) thus found complexity of deep structure inadequate as an explanation for the language user's processing of the different types of nominalizations. Paivio (1971a, 1971b) and Wearing's (1971) data and interpretation concerning the falsification of the deep structure complexity hypothesis are consistent with the general trend prevalent in the recent psycholinguistic research which attempts to interpret TGG in terms of the language user's performance. Several experiments involving various response tasks have falsified the derivational theory of complexity (see e.g., Johnson-Laird and Stevenson, 1970; Watts, 1970; Holmes and Forster, 1972; Baker,

Prideaux and Derwing, 1973; etc.).

The rejection of the derivational theory of complexity implies that the definition of 'transformation' adopted by Chomsky is misguided. In the historical perspective on structural ambiguity and transformational analysis developed in 4.1.1, it has been pointed out that it was Chomsky's view of the transformational operation that triggered the revision of the grammatical model in Syntactic Structures. The unidirectional derivational definition of 'transformation' left the door open for the concept of deep syntactic structure. Chomsky justified the necessity of transformational analysis on the grounds that 'constructional homonymity' could not be explained without it. He formulated the definition of 'transformation' in such a way, however, that it could not act as a constraint on the intemperate loosening of the grammatical model. The newly available psycholinguistic evidence clearly suggests that it is the speaker's intententions which determine the particular syntactic patterns selected. The surface structure syntactic arrangement of the relational elements is such that it can uniquely serve the speaker's purpose give a specific sociolinguistic setting. As Baker, Prideaux and Derwing (1973, p. 203) point out:

> ...an English sentence is not either passive or not passive. It is either passive or active, i.e., it must have one or the other voice. Similarly, a sentence must have a mood - most commonly either declarative or interrogative- and a modality, either affirmative or negative. This suggests that, rather than choosing to add a passive transformation or not, the speaker must opt for one or the other positive aspect of voice, and similarly for mood and modality. The choices, of course, are dictated by the speaker's intention

> to communicate a specific meaning which takes a particular syntactic form in a given language.

The experimental work on the use of negation provides the same perspective (see Greene, 1972, pp. 116-118). Wason (1965) suggests that one 'context of plausible denial' is when a negative is used to correct a misconception. There is more reason to say The train was not late this morning if the train is normally late. It denies the mistaken expectancy that it was late this morning as usual. As Greene (1972, p. 117) suggests, the proposal that the function of the negative is to reverse meaning states more than the obvious logical relation:

> What is being claimed is that the negative is concerned with a relationship between two propositions, the negative statement and a prior assertion. An affirmative, on the other hand, carries no special implications about prior assertions. In other words, choice of the negative form indicates that the speaker is not merely stating a proposition but doing so in relation to some presupposition, whether an overt prior assertion or an unstated expectancy.

In French, there is a special form of the affirmative for performing the function of denying a prior negative assertion; the use of oui would imply agreement as in Yes, I didn't shut the door, whereas the use of si would imply the denial Yes, I did shut the door (Greene, 1972, p. 118). Obviously, the French speaker's choice would depend here upon a given point in the speech chain.

The fact that the speaker's choice of a specific syntactic

structure is not independent of the events in the speech chain taps the essential aspect of the issue. If the semantic continuity of the speech chain is reflected in the grammatical patterns actually used in it, the users must somehow be aware of the syntactic relatedness and the semantic cohesion amongst them. It seems reasonable to speculate that it is the native user's ability to grasp the syntactic relatedness and semantic cohesion of the various grammatical patterns of his language that prompts his responses to sentences involving structural ambiguity and paraphrase relations. Whenever the user can perceive structural ambiguity, he is generally able to provide the involved n-interpretations which are not paraphrases of one another (cf. Hiz, 1964). In this context, it is interesting that Fletcher (1973) offers an operational definition of a paradigmatic paraphrase set in terms of the sentences which are allowed as answers to the same question. As he suggests, "If the linguistic domain of interest is extended to include question-answer as a formal unit, classes of paraphrases can be set up according to the questions they occur with." (Fletcher, 1973, p. 132). Synonymy and ambiguity, the two major, seemingly divergent properties of natural language, do not seem to be disjoint for the language users. What can be said about the nature of the transformational device and the necessity of the level of deep syntactic structure in the context of the language user? It seems that the language user operates in terms of his ontogenetically acquired knowledge of the various degrees of syntactic and semantic relatedness amongst the different grammatical patterns in his language.

Chomsky's attempt to justify the existence of the abstract categories and the level of deep structure at which their relational character is realized can be interpreted within a fixed framework of "assumptions, themselves subject to question" (Chomsky, 1970a, p. 1 fn 2; italics added). The link between the concept of "knowledge of the language", on the one hand, and the process of disambiguation, on the other, seems to have neither a logical nor an empirical basis. It is his definition of 'transformation' which seems to have allowed him to freely practice his favourite research strategy: "Pushing a precise, but inadequate formulation to an absurd conclusion may be an important method of discovery" (Chomsky, 1955). The "interpretive definition" (Greenberg, 1970, p. 9) of the level of deep syntactic structure in terms of structural ambiguity is an attempt in that direction.

4.3.0 Summary

In his criticism of Harris' attempt to postulate the primitive status of hierarchical structure in terms of its necessity in the analysis of discontinuous morphemes (Harris, 1945), Hockett (1954, p. 220) points out

> ... since there is no situation in which the analyst is actually forced to use discontinuous morphemes, its dependence on IC-structure cannot count in any sense as evidence for the status of the latter.

Chomsky's attempt to grant primitive status to the level of deep syntactic structure on the grounds that it is necessary to explain structural ambiguity presents a similar situation. The historical perspective within which Chomsky introduced the notion of structural ambi-

guity of the deep structure type is given in 4.1.1. It has been shown in 4.2.1. that the analytical procedure of resolving structural ambiguity through the medium of deep structure involves several difficulties in relation to the underlying theory of grammar. The external considerations discussed in 4.2.2 suggest that the status of deep syntactic structure is questionable from the point of view of the language user. There is no 'epistemic correlation' (Northrop, 1947) between Chomsky's (1965, 1970c) construct of linguistic competence and structural ambiguity. The root of the difficulty seems to be in his approach to the notion of 'transformation'.

CHAPTER FIVE

DISAMBIGUATION AND LINGUISTIC THEORY: CONCLUSIONS

5.0.0 Preliminary Remarks

The notion 'structural ambiguity' is important in TGG from the point of view of disambiguation. The native hearer's ability to resolve structural ambiguity is taken in TGG as a psychological index of his linguistic competence. It is also from the point of view of disambiguation that an independent level of deep syntactic structure is, in part, justified. The relationship between structural ambiguity and transformations has been extensively utilized in TGG. As Zwicky (1973, p. 112) indicates, "claims of ambiguity are central to virtually every claim about transformations in the current literature, especially to the controversial ones." The perspective on disambiguation within which the relationship between structural ambiguity and transformations has been considered in TGG, however, begs the question of the nature of the process of disambiguation. Chomsky casually remarks that the native speaker perceives structural ambiguity if you "simply arrange matters in such a way that his linguistic intuition can be stimulated by adding a slight elaboration of the sentence" (ibid). As a matter of fact this is the core issue. The decisive question in the issue is how the native hearer's tacit linguistic intuition is prompted when "a slight elaboration" is added to a given ambiguous sentence.

There are three readily observable properties of ambiguity in natural language expression which say something significant about the process of

disambiguation. First, speakers sometimes notice ambiguity in sentences isolated from their context. For example, the sentence

(272) John decided on the boat

is ambiguous when it is taken out of its context. The ambiguity is structural and it can be resolved by assigning two distinct surface constituent structures to the sentence:

(a) ((John) ((decided) (on the boat)))
S NP VP V PP VP S

(b) ((John) ((decided on) (the boat)))
S NP VP V NP VP S

Second, as soon as the sentence is inserted in its discourse context, it is usually no longer ambiguous. How does it happen, then, that a given ambiguous sentence ceases to be ambiguous when it is placed in its discourse context (cf. Hiz, 1967)? The concomitant observable fact is that, whenever the native speaker is able to perceive ambiguity in a given sentence, he is generally able to show his understanding by providing a paraphrase of each reading involved it it. The third compelling point in regard to disambiguation is that it can be related to the notion of grammatical transformation. It can be shown, for example, that the sentence (272) is ambiguous because it has two distinct passives:

(Pa) It was decided by John on the boat.

(Pb) The boat was decided on by John.

If these three observations are considered together, they converge towards one question: what are the parameters and heuristics which enable native hearer's to perceive ambiguity in isolated sentences and provide paraphrases of the different readings?

The objective of this chapter is to propose a perspective on the process of disambiguation within the framework of natural language understan-

ding. Some implications of this perspective for linguistic theory will be suggested. The conclusion will indicate that, in light of the perspective on disambiguation presented here, the claims associated with the notion of structural ambiguity in TGG are untenable.

5.1.0 Natural Language Understanding and Disambiguation

If ambiguous sentences become ordinary sentences in discourse context, it is necessary to account for this phenomenon in describing normal language processing. It is premature at the present stage of psycholinguistic research to be definitive about the precise nature of the factors involved. A broad outline can, however, be suggested on the basis of guided speculation, especially in light of what is known about the acquisition and use of language.

Understanding natural language discourse is essentially "a matter of analytical data processing of some sort" (Ziff, 1970, p. 76). The most compelling logical basis of this argument is the commonplace observation that language comprehension admits of degrees. If all the relevant variables are not processed, there cannot be what Carnap (1956) calls 'intentional isomorphism' between the encoder and the decoder. In addition to the information associated with prosodic patterns, lexicon, inflectional and derivational morphology and word order, the variables related to the context of the discourse must be processed. The context of a given discourse includes variables connected with presuppositions which may be linguistically marked or logically inferred. All the variables involved in the process of natural language comprehension may be subsumed under what the semioticians refer to as the 'functional logical semiotics of natural

language' (Pelc, 1971).

The speaker selects the linguistic devices which have the appropriate reflexes for the semantics of content, form and illocution of his intended message (cf. Fletcher, 1973). The acoustic variables in spoken communication and their spatial counterparts in writing interact with the contextual variables to form a basis for preliminary analysis. It seems that the decoder's perceptual strategies operate to integrate the three types of semantic information on the basis of the preliminary analysis. Syntax, which is considered to be the epicenter of all language behavior in TGG, is important in comprehension only to the extent that it indicates semantics of form and illocution. There is some computer simulation and psycholinguistic evidence available which supports this view of syntax (see, e.g., Bever, 1970; Watt, 1970; Hunt, 1971; Schank, 1972; Baker, Prideaux and Derwing, 1973). Even within the framework of formal linguistic analysis "the syntax is shown to be a consequence of the presuppositions" (Lightfoot, 1972, p. 294).

It is generally assumed in TGG that there is some sort of correspondence between the syntactic and ontological categories. Jackendoff (1972, p. 386) recently reaffirmed the position in explicit terms:

> If we open up a human being, what do we find inside? The answers have been of the form: We find a fourchambered heart, a spine, some intestines, and a transformational grammar with two or more syntactic levels.

Jackendoff's assumption implies a close correspondence between grammatical and ontological categories. It is hard to find any acceptable logical or empirical justification for such a link. Jackendoff's statement is motivated, it seems, by Chomsky's uncertain position in regard to the nature

of man's capacity for language.

For Chomsky (1971, p. 18), the human organism is "initially endoved with conditions on the form and organization of language" and "the semantic system of language is given largely by a power independent of conscious choice" (italics added). The corollary of this assumption is that the mental constructs and processes responsible for the use and acquisition of language are linguistic per se in terms of both origin and purpose. It is the case that there are specific areas in the brain which are related to language functions in terms of both origin and use (Kimura, 1967; Geschwind and Levitsky, 1968; Gazzaniga, 1970; Witelson and Pallie, 1973). This does not, however, mean that these brain mechaniams do not share the general constructs and processes involved in the other higher mental functions. It is not difficult to find evidence which suggests that the specific language areas in the brain are not indispensable (Lenneberg, 1971, 1973). It has also been shown that the language-dominant left hemisphere can process nonverbal input as well (Krashen, 1972). In this context, Locke, Caplan and Kellar (1973, p. ix) suggest that the functional mechaniams employed in the generation of language are "an extension of preexisting perceptual and cognitive systems." Lenneberg (1971) analyses several basic relational concepts from arithmetic and language and demonstrates their similarity. It seems highly unlikely that the cognitive processes associated with language are different from the rest of the human cognitive processes. Locke, Caplan and Kellar (1973, p. 9) explain the historical background which seems to have created the apparent confusion between 'language as a process' and 'language as a product'. As they suggest:

> The genesis of language, the development of non-

> perceptual experience and the distinction of man from other biological systems by virtue of this capability has allowed easy equation of language with a process that was unique not only in terms of the structure of its product, but also in terms of its mechanisms" (italics added).

As for the unique aspects of 'language as a process' in relation to first language acquisition, it is now generally agreed that what children from different linguistic backgrounds possess in common is "certain general methods for organizing various kinds of sensory input" (Shipley, Smith and Gleitman, 1969, p. 338). There is no reason to believe that the capacity the child brings to bear upon the linguistic input is uniquely linguistic (cf. Derwing, 1973, pp. 63-83).

If language as a process is not different from what goes on in human cognition in general, then natural language comprehension is a case of what transpires in human information processing as a whole. The available theories of speech perception stress the importance of 'data from previous spectra', context, and expectation (Wathen-Dunn, 1967; Neisser, 1967). It is accepted that non-acoustic factors play a significant role in the perception of phonological units and that meaning cannot be grasped without considering nonlinguistic variables. Even though the essential aspect of 'analysis-by-synthesis' is "rules for generating spectral patterns" in principle (Stevens, 1960), the approach does not treat contextual cues as minor ways to supplement perception. The fact that analysis-by-synthesis provides a coherent account of the way listeners make use of contextual information is perhaps the most powerful argument for the approach (cf. Neisser, 1967). Neisser (1967, p. 196) suggests that

> The relevant context is not limited to the preceding words of the speaker. Any factor

> which predisposes the listener to synthesize one utterance rather than another will affect speech perception. Expectation, familiarity, and perhaps preference can play the same roles in hearing that they do in vision.

The relevant point is that contextual leads are of utmost importance in natural language comprehension.

How is disambiguation related to the process of natural language comprehension? It is observed that ambiguous sentences generally cease to be so when they are placed in a discourse or situational context. If natural language understanding depends upon the general principles of human information processing, interesting questions are raised about the nature of the psycholinguistic parameters and contextual variables associated with disambiguation.

A considerable amount of psycholinguistic research has been devoted to the process of disambiguation. The major issue dealt with in these studies (MacKay, 1966, 1969; Foss, 1970; Garrett, 1970; Carey and Mehler, 1970; Lackner and Garrett, 1972) can be stated as follows: are the different readings of an ambiguous sentence perceived simultaneously or individually? Although these studies fail to provide clear answers to such questions, some of the findings are relevant to the problem of the nature of disambiguation.

Ulatowska's (1971) data unequivocally show that the relationship between the linguistically defined type of ambiguity and its disambiguation is not a direct or simple one. It is only lexical ambiguity that is resolved by simple lexical substitution. The important point is that even the case of simple lexical substitution requires time. Studies which attempt to measure the reaction time to the different types of ambi-

guity show that there is a significant difference between lexically ambiguous sentences and normal ones in terms of the amount of time native subjects require to react to such sentences (e.g. MacKay, 1966; MacKay and Bever, 1967; Foss, Bever and Silver, 1968; etc.). There are two oth findings in the psycholinguistic literature on ambiguity which are relevant to the question in point. First, it is generally found that ambiguities related to grammatical organization require more processing time. The second point is suggested by Ulatowska's (1971) data: in general, native speakers of English do not always use grammatical means to resolve syntactic ambiguities. Many of the devices employed by Ulatowska's subjects are lexical and pragmatic in nature. When subjects in Ulatowska (1971) resort to grammatical means, they depend upon the surface structure characteristics of English, such as morphological features, word order, passivization, change of focus, topicalization, etc. The major pragmatic tool to which Ulatowska's subjects turn to resolve ambiguity is presuppositions; they make the presuppositions underlying a given interpretation explicit. It seems that the organization of discourse is such that the parameters of natural language understanding are signalled with a certain degree of redundancy. A given sentence may contain the potential for structural ambiguity or content vagueness which may or may not be realized. The interpretations which cannot be integrally related to the intentions of the speaker in a specific discourse are eliminated per force.

It seems reasonable to assume that the parameters and heuristics which control the potential for structural ambiguity in regular discourse also guide subjects in disambiguating isolated sentences. The various lis-

guistic and non-linguistic devices that native listeners use to resolve ambiguity and to paraphrase the different readings point in that direction. It is accepted that ambiguities related to referential relations between nouns and pronouns cannot be resolved without providing the anaphoric (preceding) or epiphoric (anticipatory) context. Quine (1951) has noted the similarity between the role of variables and the roles of pronouns and other English referentials. Hiz (1969) analyzes the behavior of the anaphoric and epiphoric pronouns and other referentials in English to show that there is a similarity between referentials in a natural language and variables in a formal language of mathematics. In mathematics, several occurences of the same variable within the same formula are referential to each other, provided that they all occur within the scope of the same binding quantifier. In addition to this formal property, natural languages display a considerable degree of redundancy. When the ambiguity in a given sentence can be accounted for structurally, native listeners can perceptually assign more than one structural description on the basis of the semantic potential underlying mostly the lexicon and at times the syntactic form.

Several psycholinguistic studies (MacKay and Bever, 1967; Foss, 1970; Foss and Jenkins, 1973; etc.) show that there are also differences in reaction times for the various types of ambiguity. These researchers explain the latency differences between surface structure and deep structure types of ambiguity in terms of derivational complexity, which is formally motivated within TGG. The latency differences between any two types of ambiguity can also be explained in terms of the number of the

formally allowed possible semantic choices. Many of the experimental sentences in these studies follow the syntactic form of

(273) The shooting of the hunters was terrible

It is assumed that native listeners cannot disambiguate (273) unless they can postulate two different deep structures for it. But the ambiguity of the type represented by (273) can be explained in terms of the relational properties of English verbs. Bos (1971) categorizes English verbs and claims in connection with the verb shoot that "the ambiguity in these constructions lies in the optionality of the relational aspect of meaning of their verbs and that the different possibilities of interpreting them have nothing to do with the functional syntactic categories of subject and object" (p. 198). The latency required by a given subject to perceive the ambiguity of (273) would depend upon how fast he can retrieve from his cognitive bank the information about the relational properties of shoot. The organization of normal discourse is such that the information preceding and following the verb shoot across sentence boundaries constrains the semantic potential for relational optionality associated with this verb.

A discussion of the parameters associated with the process of disambiguation indicates that one factor that guides the hearer is the circuitry of cross-references. Palek (1968a, 1968b, 1971) analyzes the phenomenon of cross-reference and points out that

> The separate sentences of a given discourse are usually not only arranged in successive order, but in their form they are dependent on each other in a certain way, so that a fluent speaker is able to identify their sequence as a cohesive discourse (Palek, 1968a, p. 255; italics added).

There is no doubt about the fact that discourse is not a successive order-

ing of isolated sentences. There are various linguistic devices which maintain the thread of cross-reference. Pronominalization, for example, is not just the substitution of a pronoun for a noun; it operates within the scope of the unit of cross-reference. It seems that the phenomenon of pronominalization is very much like that of co-occurrence relations; while co-occurrence functions at the sentential level, pronominalization involves cross-reference both within and beyond the sentence. The question in the context of disambiguation is the extent to which listeners have to go back and forth in time along the cross-referential thread. Palek's notion of 'hyper-syntax' is worth considering in this context. He stipulatively defines this concept in terms of the linguistic means which native speakers use to maintain the circuitry of cross-reference in discourse.

What is the relevance of the hyper-syntactic notion of the sentence in its contextual relations to ambiguity and disambiguation? The potential for ambiguity of a given type is realized in a token when the sentence in question is isolated from its hyper-syntactic scope. Ambiguous sentences do not remain so in normal discourse because the potential for ambiguity is in general not allowed to be realized within the hyper-syntactic scope of the ambiguous sentences in question. When the semantic properties of the relational elements of a given ambiguous sentence can be stated within the scope of the sentence, the hearer can generally assign different hierarchical structures to that sentence. For example, the semantic bases of the two different constituent structures in each of the sentences

(274) It was sent by the senator from Ohio.

(275) What disturbed John was being disregarded by her

can be perceived within the scope of the sentences. The two readings of (274) can be explained by the fact that the semantic basis of its constituents allows two constituent bracketings:

(274a) It was sent (by the senator) (from Ohio)

(274b) It was sent (by (the senator from Ohio)).

The validity of the two distinct groupings of (274) is indicated by the fact that (274) allows two non-passives which correspond to (274a) and (274b), respectively:

(274c) The senator sent it from Ohio

(274d) The senator from Ohio sent it

The self-sufficiency of the semantic structures of the two distinct interpretations of (275) can be demonstrated by two procedures. First, it is possible to provide paraphrases of the two readings strictly within the scope of (275):

(275a) What disturbed John was that he was being disregarded by her

(275b) She was disregarding what disturbed John.

Secondly, there are two distinct cleft-sentences corresponding (275a) and (275b), respectively:

(275c) It was being disregarded by her that disturbed John.

(275d) It was what disturbed John that was being disregarded by her.

The potential for ambiguity of the types in (274) and (275) is realized when the sentences are isolated. The semantic structures underlying the two sentences are such that they can be specified on the basis of the information within the scope of the individual sentences. The grammatical arrangement is such that the sentence can be parsed in more than one way.

Within the scope of a given hyper-syntactic unit in normal discourse,

every sentence has a distinct parsing. When a given sentence is isolated from its hyper-syntactic scope, it may allow more than one distinct parsing. Outside of its hyper-syntactic scope, it may also be the case that a given sentence cannot be interpreted in a definite way. When an isolated sentence can be read in different ways by different native speakers, it is a case of vagueness rather than ambiguity and cannot be understood outside of the scope of the specific hyper-syntactic unit to which it belongs. The interpretation of such a sentence depends upon the speaker's intentions which cannot in this case be specified without hyper-syntactic information. For example, when a listener hears the sentences (Quirk, et al., 1972, p. 941)

(276) William Wordsworth is my favourite English poet

(277) Emily Bronte is my favourite English novelist

outside of their hyper-syntactic scope, it would be difficult for him to decide if the speaker meant (278) or (279) for (276):

(278) William Wordsworth is my favourite English poet, not John Keats.

(279) William Wordsworth is my favourite English poet, not William Shakespeare.

In (278), the new or distinguishing information is contained in William Wordsworth, while in (279), it is only the information in Wordsworth that is new. The scope of the variation in information in cases like (278) and (279) cannot be determined without knowing what is presupposed by the speaker, and such presuppositions fall within the range of hyper-syntax. The hyper-syntactic unit to which (277) belongs will provide the presuppositional information which can determine whether the reading

(280) Emily Bronte is my favourite English novelist, not Charlotte is an appropriate interpretation of (277) or not. In the case of certain sentence patterns, there are overt prosodic and syntactic correlates of the speaker's intention and presuppositions. The characteristics of the cleft and pseudo-cleft patterns have been observed both analytically and experimentally (Akmajian, 1970; Quirk et al., 1972; Fletcher, 1973). As Quirk et al. (1972, p. 951) observe:

> The usefulness of the cleft sentence partly resides in the unambiguous marking of the focus of information in written English, where the clue of information is absent. The highlighted element has the full implication of contrastive focus: the rest of the clause is inferred with other items which might have filled the focal or 'hinge' position in the sentence.

The discussion so far indicates that there are two kinds of sentences in normal discourse that can be distinguished from the standpoint of hyper-syntax. Some sentences are related to their preceding and following counterparts and they contain syntactic devices which reflect their hyper-syntactic scope. These sentences cannot be processed on their own, that is, outside of their hyper-syntactic domains. Whatever cross-referential information is required to understand a given sentence forms its hyper-syntactic scope. On the other hand, there are sentences which can be understood in isolation. The semantic structure underlying these sentences is such that they can be interpreted without any cross-referential information. These sentences, as it were, are self-contained so far as their hyper-syntactic ranges are concerned.

Ambiguous sentences can be divided into two broad categories from the point of view of the role of hyper-syntax in normal language compre-

hension. The semantic basis of the potential for structural ambiguity in some sentences is such that their ambiguities can be resolved by distinct labellings and bracketings of their constituents. Sentences which contain structural ambiguity in the sense discussed in 2.1 can be disambiguated without any cross-referential dependence. As has been pointed out in 2.1.3, it is now accepted in TGG that the various types of ambiguity arising out of the scope of negation and quantifiers, indefinite NP's, genericity, and referential opacity cannot be resolved without contextual information. The contextual liaison of such elements is available hyper-syntactically, that is, in the sentences which precede and follow the ambiguous sentence in question. Providing the deleted elements for an ambiguous sentence brings the hyper-syntactic scope of the sentence into focus. The different ellipses that go with the different readings of an ambiguous sentence form the hyper-syntactic units for those readings.

From the point of view of hyper-syntax, ambiguous sentences can be grouped into two types. The logical distinction between 'open' and 'bound' sentences (Quine, 1960) seems to be applicable in this context. Logicians perfer the term 'binding' for cross-reference in relation to variables. Quine (1960, p. 137) explains the distinction between 'open' and 'bound' sentences in logic as follows:

> If a sentence or relative clause contains an appositive or binding occurrence of 'x' and sundry recurrences of 'x', then ordinarily it will include a component sentence that contains some of the occurrences of 'x' but, within itself, none to bind them. Such a component sentence, considered by itself, is called an <u>open</u> sentence, and its unbound occurrences of variables are said to be <u>free</u> in it.

Structurally homonymous sentences can be considered open in this sense. They contain n distinct hierarchical structures which can be identified by distinct labelings and groupings of constituents. All the other types of ambiguity involve bound sentences. As a matter of fact, ambiguous sentences associated with the scope of negation and quantifiers, indefinite NP's, genericity, and referential opacity are treated in terms of 'binding' in the logical literature (e.g., Quine, 1960, pp. 134-156).

Consequently, the absence of ambiguity in normal discourse can be attributed to hyper-syntax. The ability of native speakers to provide paraphrases of the different readings of an ambiguous sentence can also be explained in terms of hyper-syntax. As Quine (1960, p. 159) suggests,

> If we paraphrase a sentence to resolve ambiguity, what we seek is not a synonymous sentence, but one that is more informative by dint of resisting some alternative interpretations.

An ambiguous sentence, after all, is a paraphrase of n other sentences that are not related to one another by paraphrase (Hiz, 1964; Nolan, 1970). It must be the case that bound sentences are hard to paraphrase when they are isolated from their hyper-syntactic units. It therefore follows that bound ambiguous sentences cannot be disambiguated without discourse context.

The logical consequences of the perspective on the process of disambiguation presented here are pertinent to linguistic theory. The relevance of these implications is pointed out, especially in relation to TGG, in the following section.

5.2.0 Implications for Linguistic Theory: Conclusions

As Quine (1953, pp. 13-14) suggests, "A theory is committed to those and only those entities to which the bound variables of the theory must be

capable of referring in order that the affirmations made in the theory be true." Chomsky's commitment to the abstract entity of competence is motivated only on the formal basis of syntax. If disambiguation is a function of hyper-syntax, which includes cognitive (presuppositional) and factual cross-reference, it cannot be explained in terms of the native speaker's tacit linguistic competence in Chomsky's sense. Within the perspective proposed in 5.1, the process of disambiguation is viewed in the context of natural language comprehension and human data-processing. The framework adopted here is consistent with Lenneberg's position in relation to the competence-performance dichotomy. He suggests,

> Competence and performance can only be idealized limits of a continuum. In actual fact, it should be impossible ever to be faced with competence without performance, and every performance must have some aspects of some sort of competence behind it. One cannot study knowledge without studying knowing; i.e., one cannot abstract from the cognitive process that is actually the substrate of having knowledge. Similarly, one cannot study language without actually studying knowing a language (Lenneberg, 1973, p. 522).

It has been suggested in 5.1. that the notion 'knowing a language' in relation to a given native speaker is meaningful only in terms of his general level of cognition. This applies to both the acquisitional and normal functional aspects of language capacity.

As for structural ambiguity, the different relational structures can be determined in terms of distinct surface structures. So far as the other types of ambiguity are concerned, native speakers do depend upon non-linguistic information. As McCawley (1968, p. 129) suggests,

> ...disambiguation actually involves not merely linguistic competence but also the language user's factual knowledge; indeed, it is merely a special case of the judgement of a speaker's intentions.

The factual context and the speaker's intentions are accessible hyper-syntactically. It is possible, then, to account for the process of disambiguation in terms of observable phenomena. It is difficult to see how a theory of language can be committed to the term 'linguistic competence' in the sense in which it is presently understood in TGG, as exemplified, for example, in Chomsky (1971).

5.2.1 Disambiguation and Deep Syntactic Structure

The ontological commitment to the independent level of deep syntactic structure in TGG is supposedly justified in part by the existence of ambiguity. The explanation offered by generative grammarians is that surface structures of structurally ambiguous sentences are inadequate to indicate the different relational structures underlying them. It is suggested that the distinct readings can be represented only at the level of deep syntactic structure. The implied assumption in this claim is that the transformations which derive surface structures from deep structures obliterate the differences.

The hyper-syntactic approach to disambiguation precludes the necessity for the level of deep syntactic structure as an indispensable mediator. The fact that ambiguous sentences do not remain so in normal discourse removes the mystery associated with disambiguation. The question about the relevance of this phenomenon is never raised in TGG, as a theoretical issue. Usually, different deep structural representations are postulated for a given ambiguous sentence on an intuitive basis. It is then suggested that the ambiguity in that sentence is explained through the medium of deep syntactic structure.

The different deep structures which a given linguist can propose

for an ambiguous sentence may be treated as syntactic representations for the different readings of that sentence. They may be used, in other words, to model the products of disambiguation. But this does not necessarily mean that native speakers resolve ambiguity in this way. The model for a product is not a model of the process and the parameters involved. If deep syntactic structure is justified in a syntactic model to interpret ambiguous sentences without any coordinated ontological commitment in regard to the process of disambiguation, there cannot be any objection. It will, however, deprive the transformational-generative theory of grammar of one of its most fundamental assumptions, since it will remove the link between a grammar and the native speakers of the language, at least with respect to the phenomenon of structural ambiguity. It may be recalled that TG grammars are supposed to be theories of the linguistic intuitions of the native speakers of the languages in question. The notion of structural ambiguity has been a central concern in that context.

The question regarding the status of the link between deep syntactic structure and disambiguation raised here has ramifications for other areas in the nomological network of TGG. The problem of the relationship between structural ambiguity and transformations is briefly stated in the next section.

5.2.2 Disambiguation and Transformations

The fact that a sentence may have two or more grammatically distinct readings has played a significant role in the development of the notion of transformations. It has been emphasized first by Harris and then by Chomsky that the distinct readings of a structurally ambiguous sentence

have transformations which are different from one another. The same insight led them to different approaches.

The competence-performance dichotomy and the related notion of formal linguistic universals led Chomsky to treat disambiguation in terms of deep syntactic structure. If structural ambiguity cannot be resolved without the intervention of deep syntactic structure, it was argued, then structural ambiguity must be taken as a significant constraint upon transformations. That is, the transformations needed to map deep structures onto surface structures must be written in such a way as not to lead to constructional homonymy. The constraint is used as a criterion of adequacy in controversial cases. But disambiguation, as has been suggested in 5.1, is not a function of syntactic structure alone. It has also been shown in 2.1.3 that all the cases of structural ambiguity have a semantic basis. No crucial cases of pure syntactic ambiguity have been reported in the linguistic literature so far (cf. Swaby, 1971).

The fundamental fact about transformed strings is that they are parts of larger hyper-syntactic units or texts. This implies that the issue of the constraints on transformations must be considered in terms of hyper-syntax. Swaby (1971, p. 4) suggests that transformations must be written in the context of paraphrase relations:

> The problem of how to write transformations which will operate only in the proper contexts will require careful selection of members of paraphrassic sets so that transformations will not resolve ambiguities. Each complete paraphrastic set has some member or members which together specify what transformations can be performed on any members of the set.

Prideaux (1972), in fact, suggests that the problem of structural ambi-

guity must be tackled from the point of view of paraphrase relations. Native speakers paraphrase to avoid ambiguities in normal life (cf. Quine, 1960) and they demonstrate their understanding of an ambiguous sentence by paraphrasing the different readings. The validity of the paraphrase disambiguation of a given sentence can be confirmed in terms of transformational tests, as was demonstrated at length in Chapter 2.

The question of how to write transformations so as to avoid structurally ambiguous surface structures has been approached in TGG, it seems, from an angle which does not exist in natural language. During the early stage of the development of TGG, Hiz (1960, p. 316) remarked:

> In general, transformations are not like steps of a proof that preserves truth but rather like recursive rules of well-formedness or grammaticality that not only disregard truth but also change the topic or subject matter. The problem of how to characterize the class of those and only those transformations which are paraphrases, i.e., which are information perserving, may prove interesting.

The perspective on disambiguation presented in 5.1 indicates a similar direction. The historical context within which Chomsky modified Harris' bidirectional definition of sentential transformations is set in its proper perspective in 4.1.1. Considering the nature of the observable triple relationship between structural ambiguity, paraphrase, and grammatical transformations, Harris' treatment of "transformations as relationships among classes of sentences" (Kac, 1973, p.469) seems plausible on both logical and empirical grounds.

SUMMARY

The notion 'structural ambiguity' occupies a central position in transformational-generative grammar. It is utilized to link grammars with native speakers-hearers and to justify the behavioral relevance of the abstract constructs 'native linguistic intuition', 'descriptive adequacy', and 'deep syntactic structure'. The formal and empirical aspects of the legitimacy of these interpretive links were examined in this thesis.

First, a taxonomic perspective on the types of ambiguity was developed in order to (i) delimit the notion 'structural ambiguity', (ii) specify an operational procedure to distinguish structural ambiguity from content vagueness, and (iii) re-analyze the crucial data cited in TGG. It was suggested that syntactic description can only specify the structural patterns which may give rise to ambiguity in specific contexts. Whether the potential of a given syntactic pattern for ambiguity realized in a given token depends upon the semantic structures of the relational terms involved. The crucial cases of the deep structure type ambiguity were analyzed in terms of surface structure characteristics of English.

Secondly, the methodological issues associated with the actual application of the structural ambiguity criterion of external adequacy were analyzed. It was argued that (i) the level of descriptive adequacy is an artifact; (ii) within the current framework of TGG, the external adequacy criterion of structural ambiguity is only a formal device; and (iii) if the criterion is executed on the basis of the operational criteria suggested in this study, it will preclude the necessity for deep syntactic structure as an independent level.

Thirdly, the problem of the ontological status of deep syntactic structure from the point of view of structural ambiguity was considered. The argument against the construct is motivated from three dimensions: (a) in chapter 2 the crucial data were reanalyzed in terms of surface structure properties; (b) there are non-trivial internal difficulties associated with the use of deep syntactic structure as a medium in disambiguation, in that it involves a great deal of uncertainty as to specific deep structures and allows the grammar to generate tautologous and anomalous strings; and (c) the available psycholinguistic evidence does not indicate any effect of deep syntactic structure as a parameter in the process of disambiguation. When the methodological perspective within which Chomsky introduced the concept is examined in its historical context, it seems that it is the derivational (unidirectional) approach to the operation of grammatical transformation which makes the deep level necessary in TGG.

Texts containing structurally ambiguous sentences are a significant source of primary linguistic data. The strategically important property of structural ambiguity is that it can be systematically related to another equally salient property of natural language expression, namely, paraphrase. The relationship between the two is such that it says something crucial about natural language as both a product and a process. As a matter of fact, the relationship between these two observable properties seems to be a most logical way to discern the nature of the connection between language as a process and language as a product. It is on the basis of this kind of knowledge that structural ambiguity can be epistemically associated with the primitive 'capacity for natural language'. The interconnection between structural ambiguity and paraphrase must be reflected in the form of grammar, es-

pecially in the definition of 'grammatical transformation'. Viewed from this frame of reference, structural ambiguity, paraphrase and grammatical transformations cannot be studied in terms of isolated sentences; the three are interlinked at the level of discourse. The thread of discourse is maintained through the circuitry of cross-reference, which can be analyzed in terms of hyper-syntax, that is, discrete units of cross-reference. Within the hyper-syntactic approach, the taxonomic perspective on the types of ambiguity will be such that it will be possible to formulate a battery of operational tests to distinguish structural ambiguity from content vagueness. Consequently, it will be possible to execute the external adequacy criterion of structural ambiguity on an objective basis; thus applied, it will preclude the necessity for deep syntactic structure as an autonomous level in grammatical theory.

In final conclusion, the analysis of the notion of structural ambiguity presented in this study indicates that Chomsky's methodological handling of the phenomenon of structural ambiguity is, to use Hiz's (1967, p.68) word, 'pedestrian'. Even though the methodological and metatheoretic claims made by Chomsky on the basis of structural ambiguity are untenable, the questions that he has raised are crucial for linguistic theory. This study provides at least a preliminary background for an alternative approach to structural ambiguity and disambiguation which attempts to circumvent these difficulties.

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