GRAMMATICAL THEORY

Grammatical theory is designed to provide a coherent framework for the description of human languages; the nature of the theory that one adopts will be determined in large part by what aspects of language one wishes to describe. Thus, if one is interested in describing just those things people say under ordinary circumstances, one is likely to adopt a *stochastic* (Markovian) theory, which reflects the presumed finite-state character of both speech production and speech perception in man. If one is interested just how linguistic elements are distributed with respect to one another in all possible expressions in a given language, one operates within a *taxonomic* theory, in which linguistic elements are considered to be classes of elements on a lower level and/or members of a class on a higher level of analysis. If one is interested in how to associate the observed grammatical structure to each and every expression in a given language so as to provide a basis for accounting for its grammaticality, its range of possible interpretations (ambiguity), and its place among other expressions that are interpreted the same way (synonymy), one is likely to adopt a *transformational-generative* theory, in which the explication of these notions is viewed as the fundamental task of linguistics (Chomsky, 1957).

Whatever theory one adopts, it can be viewed as defining a class of grammars, namely, all those grammars that can be written within the limitations of that theory. Each of these classes of grammars, in turn, defines a corresponding class of languages, namely, all those languages that can be described by one or more of the grammars in the class. The class of languages that can be described by a given grammatical theory defines its "descriptive capacity." The three theories that were distinguished in the preceding paragraph can be ranked in order of increasing descriptive capacity; the Markovian theory has the smallest capacity, the taxonomic theory the next larger, and the transformational-generative theory the largest of the three. Moreover, for these three theories, one can specify what characteristics distinguish languages that fall within the descriptive capacity of a given theory from those that do not. For example, a language that permits unlimited nesting of its constituents can be shown to lie outside the capacity of stochastic theory, but within the capacity of taxonomic theory. Consequently, if one wishes to maintain a stochastic theory of human language, one must deny that unlimited nesting of constituents is a property of language. A characteristic of language that would make it fall outside the descriptive capacity of taxonomic theory, but

within transformational-generative theory, is ambiguity that is based on neither the arrangement of constituents nor their meanings, for example, the ambiguity in English of sentences, such as "What has your dog in its jaws?" and "The shooting of the hunters was a disgrace."

Transformational-Generative Theory

Proponents of transformational-generative theory have therefore claimed that theirs is a more adequate grammatical theory than the others we have briefly considered, but the truth of that claim is based on the assumption that their choice of what to describe is the right one for linguistic science. They are also faced with the problem of having a theory that in a sense succeeds too well; having established that transformational-generative theory enables one to describe linguistic phenomena that are outside the range of competing theories, they have found that their theory is also capable of describing languages that do not have the characteristics of human language. For example, it is not a problem to devise a set of rules that places modifiers of subject nouns after those nouns, but modifiers of object nouns before those nouns. But such a property is distinctly noncharacteristic of human language. Thus, one of the major research efforts has been the attempt to limit the descriptive capacity of the theory to correspond more accurately to the class of possible human languages.

At this point it will be useful to sketch in some detail a particular instance of transformational-generative theory, one that has been enormously influential, the theory developed in Katz and Postal (1964), and Chomsky (1965), now commonly referred to as "standard theory."

Standard Theory

Standard theory proposes that a grammar of a human language consists of a number of components, or blocs of rules; the rules in each bloc conform to certain principles of form, and the output of each component defines a linguistic level. The components are: (1) the base component, consisting of the phrase-structure categorial subcomponent and the lexical subcomponent; its output defines the level of deep structure; (2) the semantic component, which takes deep structures as input; its output defines the level of semantic representation; (3) the transformational component, which also takes deep structures as input; its output defines the level of surface structure; and (4) the phonological component, which takes surface structures as input; its output defines the level of phonetic representation. The base component is "basic" in the sense that it has no input from any other component of the grammar. The categorial subcomponent takes as its input the designated string of symbols #S# ("#" a distinguished boundary symbol for indicating the beginning and end of sentences, "S" the categorial symbol for "sentence"). The reason for choosing the sentence as the starting-point for describing objects of grammatical study is the assumption that the sentence is the smallest structural unit of language in which every major grammatical relation may appear; if one were to choose a smaller unit for study—say, the word—one would miss those relations among words that obtain in sentences, such as the grammatical relations of subject and object. Larger units of analysis, such as whole discourses, seem to yield few if any new grammatical relations for study not already found in sentences.

The phrase-structure categorial subcomponent contains rules of the form

$$A \longrightarrow X \qquad (1)$$

where A is a grammatical category, and X is a string of one or more grammatical categories. Grammatical categories are of two types: those that may appear on the left-hand side of some categorial rule of the type (1), and those that may not. The latter are called lexical categories. These categories cannot be analyzed as strings of other categories; rather they provide the categorization of the lexical items, which are introduced by the other subcomponent of the base component. Let C be such a category. Then we assume for each lexical category C, that there is a rule

$$C \longrightarrow \Delta \qquad (2)$$

where Δ is a designated categorial symbol (sometimes called the "dummy node").

The lexical subcomponent operates as follows. For each occurrence of Δ in each structure generated by the phrase-structure cat-

egorial subcomponent, a lexical item may be substituted, in accordance with a rule schema called the lexical-insertion transformation. The schema specifies that a lexical item may be substituted for Δ provided that it is a member of the category *C* immediately dominating Δ, and that it satisfies the categorial and lexical environment of that particular occurrence of Δ in that structure. For example, suppose we are contemplating substituting a particular lexical item for an occurrence of Δ that is dominated by the lexical category *V* (for "verb"), and that this category concurs with a direct-object *NP* ("noun phrase"). Then we may substitute for Δ any verb in the lexicon that is not specified as not occurring with direct objects, for example, the item *watch;* but not, for example, the item *seem* (a verb that cannot occur with a direct object) or *galaxy* (not a verb). If substitution for categorized Δs proceeds in some order, for example, if substitution of verbs precedes substitution for adjectives, and adjectives before nouns, then the insertion of items that are done later may be made sensitive to specific lexical properties of those that are done earlier. If this is done, then a syntactic account of so-called selection-restriction violations of the sort familiar from Chomsky's now-famous sentence *Colorless green ideas sleep furiously* can be provided. Finally, by substitution of a lexical item for Δ is meant the substitution of its phonological form, its semantic features (those properties required by the semantic component for the determination of the contribution to the meaning of the sentence provided by that lexical item), and its idiosyncratic syntactic features (basically an indication of the applicability of certain transformational rules when that lexical item is present).

The rules of the semantic component are, in essence, rules that construct semantic interpretations of their parts, starting with the interpretations of the lexical items and idioms in those sentences (Katz, 1972). In his most recent writings, Katz has argued that the semantic representation of a sentence is the embodiment of its logical form. Given a semantic representation, and the rules of inference, one should be able to derive every other semantic representation that follows from it logically.

The rules of the transformational component operate on constituent structures, and convert these into other constituent structures. The rules are also assumed to be (at least partially) ordered, so that the applicability of a given transformation may depend on the prior application of other transformations. Each transformational rule has two parts. The first, variously called the structural condition, or structural index of the transformation, is a finite sequence of elements, called factors. These are conventionally numbered from 1 to *n;* each factor is either the name of a category, a specific lexical item, or a variable, which can stand for any string of lexical items. The second, called the structural change, specifies what happens to each of the factors in the structural index. The operation on each factor is called an elementary transformation; the following are the permitted elementary operations: identity, substitution of another factor in the structure index; substitution of a specified lexical item; substitution of the null string (deletion); adjunction either to the right of or to the left of the factor by another factor, or a specified lexical item. These operations are subject to a considerable number of additional restrictions, called conditions on transformations, all intended to restrict the descriptive capacity of the theory to the class of human languages. For example, the deletion of a factor is permitted only if the factor is a specific lexical item, or there is another factor in the structure index which is identical to it in grammatical structure and lexical content. Many other conditions have been proposed and discussed in the literature (Chomsky, 1973).

A constituent structure is said to satisfy the structural index of a transformational rule, if there is an analysis of its string of lexical items into the structure index of that rule (if a factor is a category, then the corresponding substring of lexical items must manifest that category). Assuming that the conditions on ordering of transformations do not forbid the application of a given transformation, it is said to be obligatory if it must apply to all structures that satisfy its structure index, and optional if it may apply. Thus, the transformation that places the lexical item *not* after the first verbal auxiliary in English sentences, as in *Harriet should not drink anything* is generally assumed to be an obligatory transformation; the subsequent rule that associates *not* with an indefinite, indeterminate object is assumed to be optional. Its ap-

plication in this example would result in *Harriet should drink nothing,* but the failure to apply it would still yield a grammatical sentence.

The phonological component operates on input structures consisting of surface-structure bracketings of lexical items spelled out in "systematic phonetic representations" (Chomsky and Halle, 1968) which are construed as idealized representations of instructions to the vocal apparatus for the production of speech (equivalently, as instructions to the aural perceptual apparatus for the phonetic decoding of speech-signals). Generative phonology combines into one component the description of phenomena that had, in taxonomic linguistic theory, been handled separately under the rubric of morphophonemics and phonemics; most practitioners have now accepted Halle's (1959) demonstration that the insistence on an autonomous level of phonemic representation (as defined taxonomically) results in the inability to describe certain linguistic regularities. The units of phonological representations (whether phonemic or phonetic) are moreover considered to be features rather than alphabetic representations of entire segments.

Alternate conceptualizations of grammatical theory within the generative-transformational framework have also been developed. Two major alternatives have to do with how the relation of syntax to semantics is conceived. The first raises the question whether transformations are in fact "meaning preserving," or alternatively, whether all the information necessary for semantic interpretation can be reasonably provided in deep structure alone. It has been proposed (Jackendoff, 1972) that certain properties of surface structures that are introduced transformationally (i.e., that are not also properties of deep structures) play a role in certain aspects of semantic interpretation. Rather than abandon standard theory entirely to handle this aspect of the relation between syntax and semantics, it has been proposed that standard theory be "extended" to allow certain aspects of surface structure to be input to the semantic component.

The second alternative calls for a much more thoroughgoing change in the theory. Starting with work by Lakoff (1965), a number of investigations seemed to indicate that deep structures were much more remote from surface structures than was previously thought; finally, in McCawley (1968), it is argued that deep structures *are* semantic representations, and that there is no level of deep structure intermediate between semantic representation and surface structure. The resulting theory has come to be known as "generative semantics." Those who have adopted this theory have also largely abandoned the notion of the transformational component as articulated in standard theory, in favor of the conceptually much looser notion of "global rules" (Lakoff, 1970), in which the relation between underlying and surface structures is not defined in terms of the sequence of steps it takes to go from the one to the others, but directly in terms of correspondences that hold among elements in the two levels of representation. Compared to standard theory, generative semantics makes relatively few assumptions about the form of grammars. Consequently, it can be considered a retreat from the goals of tranformational-generative grammar. In other words, generative semanticists appear to have adopted goals that are much closer to the goals of taxonomic linguistic theory, in particular, the goal of describing the distribution of the elements of sentences taking into account the situations or contexts in which sentences may be used.

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See also DISCOURSE STRUCTURE AND DISCOURSE PROCESSING

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