THE PLACE OF GENERATIVE GRAMMAR
IN PRESENT DAY LINGUISTICS

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In recent years an increasing number of new attempts to formalize the theory of language have been observed. The attempts have been made not only by linguists, but also by representatives of other disciplines and chiefly by logicians and mathematicians. The phenomenon can be entirely comprehensible if we take into account the fact that a trend towards mathematization has taken over almost all branches of knowledge. The reason is not only — as some people affirm — that such a trend has come into vogue. It is quite natural that the necessity of precision in every discipline grows with the development of organized knowledge.

We must openly admit that it was the research of logicians that gave the impulse towards the formalization of linguistics. Although the object of linguistic studies of logicians is chiefly the so called artificial languages and especially the languages of logic and mathematics, nevertheless, the results of those studies have also thrown considerable light on some fundamental problems of natural languages. There is, after all, nothing strange in that because artificial languages are also languages. They differ from natural languages chiefly in that they are consciously constructed by man and so in comparison to natural languages present simplified and ordered systems and are therefore easier for description. It is a fact well known from the history of knowledge that a great many important scientific discoveries are made not by the examination of phenomena occurring in nature but by the investigation of artificial human creations (cf. Pierce 1961:30 ff).

The discussion of the problem of whether and to what degree natural languages display the characteristics of logical systems, and the similarities and dissimilarities observed between such systems and natural languages permit us to discover better the nature of the latter. Gradually de Saussure's postulate, that linguistics should become part of a general science of sign sys-

tems is being realized. This is a great opportunity for linguistics and linguists must not miss it.

It is true that it is not possible to say that any attempt made so far is completely satisfactory, and no doubt success in a completely formalized description of language is still a long way off. Nevertheless, the results which have been achieved through these attempts, and especially the prospects which thanks to them are open to linguistics, should encourage linguists to do further research in this field.

Not everyone yet sees the necessity of achieving such precision in linguistics as is required by mathematical logic, but we shall all easily understand this necessity if we realize the demands made on linguistics by the new applications of it caused by automatization. It is not only a question of machine translation but also of a number of other fields in which linguistics finds application today. Here belong, for example, such matters as the elaboration of methods of feeding information into computers in linguistic form, the construction of various devices for the automatic storing of information, and above all the application of linguistics in teletechnics. These matters require close collaboration of mathematicians, engineers and linguists, and the essential condition is precisely that the latter must formalize their linguistic description. On the other hand, the formalization of linguistic description will benefit linguists with the extensive possibilities of modern technical science, for instance, at least in the field of storing and classifying materials.

Linguists must not avoid the problems which extend the circle of those interested in linguistic matters and build a bridge between linguistics and other branches of science. The new tasks are not easy because they demand from the linguists a command of mathematical logic and even of certain areas of higher mathematics. In some countries, for example in the United States of America and in the Soviet Union, courses in the elements of higher mathematics are being introduced for the students of linguistics departments.

The attempts to make the science of linguistics more precise have brought in their wake an interest in the structure of language itself. The investigations conducted in this field made linguists aware of the existence of many controversial problems in most fundamental matters, such as the aims of linguistics and the choice of appropriate methods of research. It is in this context that one must look for the genesis of generative grammar. According to the approach of generative grammar the aim of a linguistic description is to specify or predict (otherwise: generate) all and only the grammatical sentences of the given language and to assign the appropriate structural description to each of them. Descriptive linguistics has thus had this aim for a long time. The innovation here is the application of the appropriate mathematical-logical apparatus elaborated by mathematical logic for the description of formal systems of different sorts and above all of the systems of artificial languages. And here we under-

stand a system not in the sense of de Saussure as a set of elements and relationships between them but as a device of the cybernetical type with input and output, a device which has its own internal structure and which by its action generates a definite set of elements. Such an approach satisfies the demands made on linguistics by its new applications and permits the comparison of natural languages with logical systems on the basis of a formal apparatus necessary for their description.

The concept of linguistic description as a specification of correctly formed sentences was first proposed by the Polish logician Kazimierz Ajdukiewicz (1935). Thereafter it was taken up and developed by Y. Bar-Hillel (1950; 1953), J. Lambek (1958; 1961) and others. Such a description is not usually classed as generative grammar because Ajdukiewicz and his followers considered their task in general to be the formulation of rules which would state whether or not a given expression is a grammatically correct sentence. Such linguistic descriptions based on the logical concept of so-called recursive functions are generally termed as recognoscative grammar. Grammar understood thus can however take various forms and therefore several types can be distinguished. For that type which derives directly from Ajdukiewicz's concept, the name of categorial grammar has been generally accepted.

The creator of generative grammar proper is Noam Chomsky. In contrast to recognoscative grammar the grammar proposed by Chomsky (cf., for example, 1956, 1957, 1961, 1963, 1965, 1966) specifies or predicts grammatically correct sentences with the help of a set of rules which enumerate them (i.e., these sentences) constructively. The logical basis of grammar so conceived is the so called constructive definition of a set.

Since, however, both recognoscative grammar and also the grammar proposed by Chomsky conceive linguistic description as specifying (or generating) grammatical sentences, one should really call them both by the common term of generative grammar and within it distinguish two sub-types which one might call recognoscative grammar and constructivistic grammar respectively.

Besides recognoscative grammar and generative grammar in the narrower sense, there have recently been proposed a number of formal linguistic systems one of which especially worth mentioning here is the so called analytical grammar (otherwise called set-theory grammar) developed chiefly in the Soviet Union (cf. Kulagina 1958, Dobrušin 1961, Revzin 1962, 1967 and others), Rumania (cf. Marcus 1963, 1967), and Czechoslovakia (cf. P. Novák 1962, 1964, 1965, Nebeský 1962, 1963, Nebeský and Sgall 1964). The representatives of this trend, which is nearer both to traditional linguistics and to classical structuralism, have taken up a position opposed to generative grammar. Analytical grammar takes as a starting point a set of given correct (grammatical) sentences and considers as its aim the investigation of the structure of the sentences.

The emphasis here is on the elaboration of a method of textual analysis which thereafter should become a basis for constructing an appropriate grammar. From this point of view the aims of analytical grammar are almost identical with those of the American descriptivists. However, analytical grammar differs fundamentally from the descriptive grammar of American linguistics. The differences between them can be reduced to two points: first, the representatives of analytical grammar primarily take paradigmatic relations into consideration, not limiting themselves only to the investigation of distribution as the American descriptivists do, and, secondly, the whole concept of analytical grammar is based on set theory.

The generative grammar of Chomsky differs from analytical grammar and descriptive linguistics in that it does not endeavour to elaborate the procedure which would achieve the description of a given language on the basis of a considerable number of texts (so called corpus). Generative grammar is therefore not a method of textual analysis but is a theory of language. Its subject is the evaluation of linguistic description without regard to the way the description has been achieved. Generative grammar may therefore be considered as a means of presenting the results of a previous analysis. The methods we apply for that analysis are of no account here. In particular we may regard as permissible the use of personal linguistic intuition as well as the linguistic intuition of others over a wide range of phenomena.

One must pay particular attention to this because one may frequently meet here with misunderstanding which arises from treating generative grammar as a method of textual analysis.

Although one may arrive at the elaboration of generative grammar by various routes using also such an individually subjective factor as intuition, the grammar itself must nevertheless be so constructed that it generates only correct (grammatical) sentences and their structural descriptions which will accord with the intuition of native speakers excluding any ambiguities.

Chomsky's generative grammar may be regarded in a certain sense as an attempt to reconcile descriptive linguistics with traditional grammar. The descriptivists aiming at securing maximal objectivity tried to perfect a procedure of textual analysis which would assure that different investigators of the same texts would invariably achieve the same result. To this end they used the method of so called segmentation (i.e., the division of a text into segments of decreasing length) and classification of the separated segments on the basis of distributional criteria. The basic aim of analysis conceived thus was to establish to which defined classes the respective segments should be ascribed. Here were accepted only such classes (such categories) which had a formal feature in the shape of the appropriate distributional criterion. Taking as a basis only distributional criteria led the descriptivists necessarily to the acceptance of the structural homonymy over a wide range. Traditional grammar distinguishes a number of categories which are not distributionally conditioned, for example, genetivus subiectivus and genetivus obiectivus (cf. Latin amor matris in two senses 'the love of a mother' and 'the love towards a mother'). In such cases the descriptivists see no cause to accept two separate categories.

However, we feel intuitively that traditional grammar is here in the right although it does not possess the appriopriate formal means of expressing such distinctions. Chomsky assigned himself the task of constructing a grammar which would faithfully account for the intuition of native speakers but would do it in a formal way. The supporters of generative grammar lay great emphasis on presenting all the information concerning structural description in a formal way, that is, precisely and explicitly.

According to this concept generative grammar should become a model for so called linguistic competence of the ideal language user. However, it is not here a question of a model of language usage, for that depends on many factors, int. al., also extralinguistic, but precisely of a model of linguistic competence, that is simply a model of a linguistic system since the linguistic competence of each language user can be reduced to the fact that he has mastered (internalized) that system of rules which permit him to construct ever more new grammatically correct sentences. Obviously this does not mean that each language user is explicitly conscious of those rules just as for instance not everyone who can multiply or divide could manage explicitly to formulate the appropriate arithmetical rules which he must earlier have mastered.

Generative grammar has its own history by now. More than one model has been proposed for it depending on the assumptions adopted as a point of departure. Chomsky himself began to construct his generative grammar first in a framework of the methods of American descriptive linguistics basing himself initially chiefly on the so called method of immediate constituents (IC method). Such a grammar has received the name of phrase structure grammar. However, Chomsky soon noticed that phrase structure grammar could not generate more complex structures. It also failed to explain the phenomena of structural homonymy. Thereafter he extended his grammar introducing into it so called transformational component. In order to distinguish it from other types of generative grammar it would be useful to call it transformational generative grammar.

Not all the supporters of generative grammar see the need to extend phrase structure grammar by the transformational component. Moreover, some models of generative grammar connect with other methods and assumptions, for example, with classical European structuralism (cf., e.g., Gaifman 1961, Hays 1961 and 1964) or with the so called stratification theory developed by Lamb (cf. Sgall 1967). In the first case we arrive at the so called dependency model of generative grammar; in the second generative grammar is construct-

ed on the basis of the concept of so called strata or levels in language, the number of which in the system of a language is however not yet definitively established. In the first type the fundamental role is played by the concept of syntactic dependency elaborated by the representatives of various directions in European linguistics. In generative grammar of the phrase structure or transformational type the concept of dependency does not operate. Other formal means exist here for the presentation of such phenomena as rection or congruence.

Transformational generative grammar is today something quite different from what it was when Chomsky and his followers began to propagate it. However, a close connection with mathematical logic was always obvious. There is even a striking parallelism in the development of generative grammar and mathematical logic. Chomsky initially ignored semantics completely maintaining that all semantic distinctions can be reduced to syntax. We may recall here that mathematical logicians did not at first see the need of elaborating logical semantics either. As Carnap said in 1929, the program of the investigation of logic required nothing but logical syntax. Logicians realized the need for investigating semantics considerably later.

In its present variant transformational generative grammar consists of three parts: syntactic, semantic and phonetic. The syntactic component specifies for each sentence on the one hand so called deep structure which is the basis for the semantic component, and on the other hand the so called surface structure which is the point of departure for the phonetic component. The syntactic component is therefore divided into two parts: the basic part and the transformational part. The first embraces a system of rules which generate a very limited set of underlying structures together with the corresponding structural descriptions formally presented in the shape of the so called phrase markers. These underlying structures are elementary units out of which the deep structure of each sentence is built up. The second part, the transformational, derives more complex constructions from these underlying structures by means of the operations called transformations. These constructions are the basis for the so called surface structure which is arrived at eventually as a result of applying the rules of the phonetic component.

It is not difficult to observe that the basic part of the syntactic component recalls the section of logical systems including so called formation rules, that is, the rules which in logic serve for the construction of basic assertions. Indeed in some works about transformational generative grammar (cf., for example, Studia grammatica 1 1965: 19) these rules are called rules of formation. The transformational component on the other hand is a parallel to the logical rules of inference or rules of derivation, that is, the rules which serve to derive one assertion from another.

The concept of deep structure in American linguistics was initially introduced principally in connection with the difficulties of explaining homonymic structures. Hockett was probably the first to use the terms „deep grammar" and „surface grammar" (1958: 246 - 52), assigning to the former the task of investigating constructions with various meanings, which however can not be explained in surface grammar, that is to say, whose forms apparently do not differ from each other at all. Hockett however gave no formal explanation of these facts but stated only that in this field languages may differ considerably from each other. Sentences of the kind:

1. She is singing a hymn

or

2. She is running the car

which are one of the examples of homonymic structures and when translated into any language of the ergative type have a different structure (Hockett 1958: 251).

The concept of deep structure is being developed today not only by supporters of transformational generative grammar but also by representatives of other linguistic trends. By deep structure, generally speaking, one understands syntax which could be called semantic syntax, independent in a sense from morphology, that is, different from surface syntax which is closely connected with morphology. For example such expressions as

3. He writes ...
4. That he writes ...
5. His writing ...
   etc.

will have the same deep structure and the differences between them are reduced to surface structure.

The concept of deep structure plays a special role in transformational generative grammar. In American descriptive linguistics for a long time such concepts as deep structure and surface structure were not distinguished at all. One could say that implicitly they were considered to be identical. Therefore the basic conception of transformational generative grammar is the assumption that these structures are basicly different and that surface structure is defined as the application of a series of formal operations called grammatical transformations to more elementary constructions (cf. Chomsky 1965: 16 - 8). In this way an explanation may be sometimes found for fundamental differences between constructions whose surface structures are identical. For example, such Polish expressions as on the one hand

6. czytanie Janka 'John's reading' (genetivus subiectivus) and on the other:
7. czytanie książki 'reading a book' (genetivus objectivus)

are explained respectively as the transformations of the deep structures:

6a. Janek czyta, 'John is reading'
7b. ktoś czyta książkę, 'somebody is reading a book'.

Transformational rules transform on the one hand the same deep structures into different surface structures (as in the above examples 3 - 5) and on the other hand they derive from two or more deep structures identical surface structures (as in the above examples 6 - 7).

The concept of deep structure has not yet been defined unambiguously. The syntactic aspect here is not distinguished from the semantic by ascribing either grammatical or semantic features to categories separated in deep structure. It concerns especially relational categories such as subject, object, complements, etc. One of the sentences analyzed by Chomsky in his Aspects (1965: 22 - 3) may serve as an example:

8 (ii). I persuaded John to be examined by a specialist.

In Chomsky's opinion John is here on the one hand the Direct-Object of the so called Verb Phrase, and on the other hand the grammatical Subject and the logical Direct-Object(!) of the embedded (or subordinate) sentence. We have here a classical example of the confusion of grammatical and semantic relationships between parts of the sentence.

The problem of the parts of the sentence is in general the weak side of transformational generative grammar inherited from traditional grammar. In classical American descriptivism such terms as subject, object or predicate are not to be found at all (cf., for example, Harris 1951, Gleason 1955). If Chomsky at times uses such terms, he does it under the influence of traditional grammar but also with all its inconsistencies in this field.

Chomsky, moreover, deliberately avoids these concepts affirming that there is no need to use them in structural description because the function defined by them emerges indirectly from other facts. It is worth mentioning here that in transformational generative grammar the sentence is divided usually into two parts — Noun Phrase (NP) and Verb Phrase (VP) which correspond in a way to traditional concepts "subject group" and "predicate group". Thus in Chomsky's opinion "Subject-of", for English, is nothing but the relation holding between the Noun Phrase of a sentence of the form NP∩Aux ∩VP and the whole sentence; "Object-of" on the other hand is to be defined as the relation existing between the Noun Phrase of a Verb Phrase of the form V∩NP and the whole Verb Phrase, etc. (Chomsky 1965: 69).

Such an attitude results from underestimating the role played in linguistics by the careful distinction of two types of relation — syntagmatic and paradigmatic. Concerning the latter there is really no point in speaking of the subject, predicate or object, but on the syntagmatic level these concepts play a primary role because they name definite syntagmatic positions which can be occupied by respective paradigmatic categories. And thus in the position of the subject there may appear not only a noun but also, for example, a sentence appropriately adapted, that is to say, appropriately transformed (embedded sentence; cf. Polański 1967: 18 - 9). From this it transpires that one can speak of parts of the sentence only in a surface structure and only in a grammatical not a semantic or logical sense.

We must observe that the concept of deep structure and of transformational rules transforming its elementary constructions into sentences with a definite surface structure permits us to investigate in a much wider range and in a systematic way the paradigmatic relations not only between the particular forms of the same morphemes or words but also between entire constructions. Larger constructions, just as morphemes or words, and chiefly embedded sentences, before being inserted into the appropriate position may undergo various formal modifications. Such formal modifications of constructions with the same deep structure are in definite paradigmatic relations to each other.

In deep structure the function of particular categories should be defined only semantically on the basis of such terms as agens, patiens, process, etc. but not such as subject, object, predicate, etc. The semantic functions of deep structures are expressed in surface structures by the respective parts of the sentence, for example patiens by direct object of the sentence in active voice or by subject of the sentence expressed in the passive voice, etc.

The concept of deep structure is connected also with other difficulties. There is a tendency to derive an ever greater number of various linguistic expressions from the same deep structure. Lakoff for example tries to show that sentences of the type:

a. Seymour sliced the salami with a knife .

b. Seymour used a knife to slice the salami

have basicly the same deep structure (Lakoff 1968 : 4 - 21). He does it, moreover, convincingly. The question arises, however, how far one can go in such cases. It is not possible to demand from linguistics that all synonymic sentences or so called paraphrases should be reduced to one basis. It is necessary to differentiate structural linguistic synonymy from synonymy not conditioned linguistically (cf. Sgall 1967: 34 - 8). It appears that several representatives of transformational generative grammar do not realize this.

On the other hand — not without the influence of work on machine translation — we observe finally in several representatives of transformational generative grammar possibly exaggerated attempts made in order to prove the thesis that deep structures are to a considerable extent, if not entirely, identical for all languages. This has revived the idea of a universal grammar. In this approach one should take deep structure as abstractive and detached from a linguistic form that it could become entirely intangible and arbitrary. And yet one of the important functions of grammar is to show which aspects of every experiment must be expressed in a linguistic message (it was Boas, 1938, who first emphasized this, and recently Jakobson, 1959, drew attention to this). And the grammars of various languages differ considerably in this respect.

The theory of transformational generative grammar may be accused of many faults and insufficiencies. There is much arbitrariness in it and there are many unsettled questions. It seems, for example, that it uses nonterminal symbols too freely. And these symbols should after all represent definite linguistic categories. Because the so called rules of substitution (usually called rewrite rules or rewriting rules) do not permit the repetition of the same symbol on the left and the right side of the arrow in the process of generating sentences, the symbols are differentiated without any reference to linguistic categories. And so, for example, the symbols MV, Vb, V are symbols which appear in every comprehensive generative derivation and which denote absolutely the same category, namely the verb.

Despite all its deficiencies, however, transformational generative grammar has achieved certain successes. In its framework a series of concrete problems in various languages has been dealt with, such as, for example, the so called nominalizations or various ways of transforming sentences into nominal constructions, pronominalizations, articles, etc. The postulation of expressing explicitly structural description involves the necessity of solving many empirical problems often posed for the first time.

Chomsky's introduction of the concept of grammatical transformation, taken from Harris (1952, 1957), considerably extended the range of distributionae criterion and gave a basis to extensive investigations into reciprocal relationships of various linguistic constructions. In European linguistics this concept was called syntactic derivation, (cf. Kuryłowicz 1936). The rules of syntactic, semantic and phonetic component of transformational generative grammar are closely connected and present in a monolithic and consistent way the reciprocal links between the particular parts of the linguistic system from phonetics to syntax and finally to semantics.

REFERENCES

Ajdukiewicz, K. 1935. "Die syntaktische Konnexität". *Studia Philosophica* 1. 1 - 27.

Bar-Hillel, Y. 1950. "On Syntactical Categories". *The Journal of Symbolic Logic* 15. 1 - 16.

— 1953. "A Quasi — Arithmetical Notation for Syntactic Description". *Lg.* 29. 47 - 58.

Boas, F. 1938. *Language*. In: *General Anthropology*. Boston.

Carnap, R. 1929. *Abriß der Logistik*. Wien.

Chomsky, N. 1956. "Three Models for the Description of Language". *I.R.E. Transactions on Information Theory*, vol. IT-2, 113 - 124. Reprinted, with corrections, in R. D. Luce, R. Bush, and E. Galanter (eds.), *Readings in Mathematical Psychology*, vol. II. New York: Wiley. 1965.

— 1957. *Syntactic Structures*. The Hague: Mouton&Co.

— 1963. "Formal Properties of Grammars". In R. D. Luce, R. Bush, and E. Galanter (eds.), *Handbook of Mathematical Psychology*, vol. II. 323 - 418. New York: Wiley.

— 1965. *Aspects of the Theory of Syntax*. Cambridge, Mass.: M. I. T. Press.

— 1966. *Cartesian Linguistics. A Chapter in the History of Rationalist Thought*. New York and London: Harper & Row, Publishers.

Добрушин, Р. Л. 1961. „Математические методы в лингвистике" *Математическое просвещение* 6. 37 - 51.

Gaifman, C. 1961. *Dependency Systems and Phrase Structure Systems*. Rand-Corporation P-2315. Santa Monica.

Gleason, H. A. 1955. *An Introduction to Descriptive Linguistics*. New York: Holt, Rinehart and Winston.

Harris, Z. S. 1952. "Discourse Analysis". *Lg.* 28. 1 - 30.

— 1957. "Co-occurrence and Transformation in Linguistic Structure". *Lg.* 33. 283 - 340.

Hays, D. G. 1964. "Dependency Theory: a Formalism and Some Observations". *Lg.* 40. 511 - 25.

Hockett, Ch. F. 1958. *A Course in Modern Linguistics*. New York: The Macmillan Company.

Jakobson, R. 1959. "Boas' View of Grammatical Meaning". *American Anthropologist* 61, n° 5, part 2, Memoir n° 89 of the American Anthropological Association (cf. also the French translation „la notion de signification grammaticale selon Boas" in: *Essais de linguistique générale*, Arguments 14, Paris, Les Editions de minuit).

Кулагина, О. С. 1958. „Об одном способе определения грамматических понятий на базе теории множеств." *Проблемы кибернетики* 1. 203 - 14.

Kuryłowicz, J. 1936. "Dérivation lexicale et dérivation syntaxique". *Bulletin de la Société linguistique de Paris* 37. 79 - 92.

Lakoff, G. 1968. "Instrumental Adverbs and the Concept of Deep Structure". *Foundations of Language* 4. 4 - 21.

Lambek, J. 1958. "The Mathematics of Sentence Structure". *American Mathematical Monthly* 65. 154 - 70.

— 1961. "On the calculus of syntactic types." In: *Structure of Language and Its Mathematical Aspects. Proceedings of Symposia in Applied Mathematics*, vol. XII. 166 - 78.

Marcus, S. 1963. *Lingvistică matematică. Modele matematice in lingvistică*. Bucureşti, Editura didactică şi pedagogică.

— 1967. *Algebraic Linguistics; Analytical Models*. New York and London: Academic Press.

Nebeský, L. 1962. „O jedné formalizaci větného rozboru". *Slovo a slovesnost* 23. 104 - 7.

— 1963. „O jednom algebraickém modelu jazyka". *Slovo a slovesnost* 24. 231 - 7.

Nebeský, L., and P. Sgall. 1964. „Algebraická lingvistika". In: *Cesty moderní jazykovědy*. Praha, Orbis. 72 - 102.

Novák, P. 1962. „Některé otázky syntaktické analýzy". *Slovo a slovesnost* 23. 9 - 20.

— 1965. "Mathematical models of linguistic objects". *Prague Studies in Mathematical Linguistics* 1. 155 - 7.

Pierce, J. R. 1961. *Symbols, Signals and Noise: The Nature and Process of Communication*. New York: Harper and Brothers.

Polański, K. 1967. *Składnia zdania złożonego w języku górnołużyckim*. Wrocław — Warszawa — Kraków: Ossolineum.

Ревзин, И. И. 1962. *Модели языка*. Москва: Изд. АН СССР.

— 1967. *Метод моделирования и типология славянских языков*. Москва: Изд. „Наука".

Sgall, P. 1967. *Generativní popis jazyka a česká deklinace*. Praha: Nakład. Československé akademie věd.

Studia Grammatica 1. 1965. Deutsche Akademie der Wissenschaften zu Berlin, Arbeitsstelle Strukturelle Grammatik. Berlin: Akademie-Verlag.