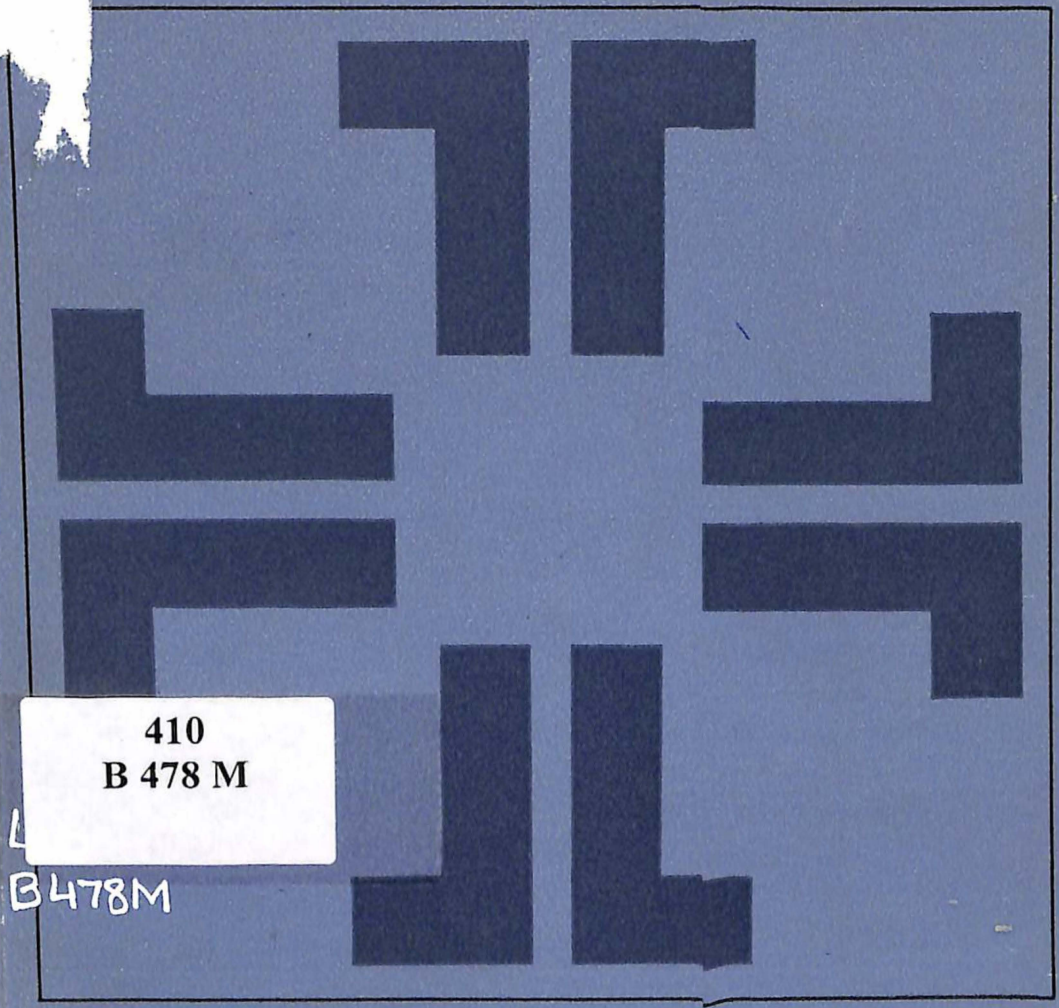
Manfred Bierwisch

Modern Linguistics



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MODERN LINGUISTICS

ITS DEVELOPMENT, METHODS AND PROBLEMS

by

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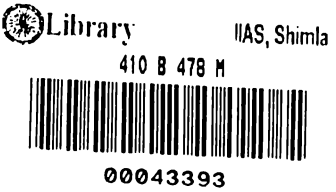

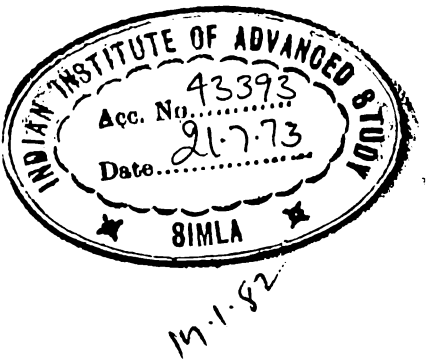

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PREFACE

The present volume is concerned with the study of natural language, and attempts to give a survey of contemporary linguistic theory, taking into account its history and its relation to other disciplines. This survey originally appeared in an edition of the non-scientific journal *Kursbuch* devoted to 'structuralism', and details and difficulties of a technical kind are, as far as possible, avoided. The attempt has not been to give an introduction to the subject, but, where controversies within linguistics are dealt with, to trace the problems posed—and the insights gained—by linguistic research. It may, on the other hand, contribute to an introduction as such, in that it gives some idea of the interrelation of the questions and problems introduced and of the technical apparatus necessary to their solution. The apparatus itself is not explained in detail.

The original version of this survey was completed early in 1966, and therefore does not reflect certain important innovations which have come about in the course of subsequent development. For example, the principle of marked and unmarked linguistic categories, articulated in the thirties by European linguists, has since been readopted and given a precise formulation. The discussion of the relation between syntactic and semantic structures has been enlivened by the consideration of facts previously ignored and by new suggestions for the theoretical solution of this central problem. First steps have been made toward a detailed examina-

tion of language in the social context, in order to provide a more exact explanation of linguistic change and of regional and social variation. While the developments introduce certain limitation on the present discussion of linguistic insights, I am sure that its orientation on the whole has not suffered, since an understanding of the further rapid development in any case presupposes an insight into the relations described here.

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INTRODUCTION

Language is an activity which invites and at the same time eludes our attention: we all command language and use it freely, but when we speak we are always a step ahead of what we are saying, concentrating on the things we are speaking about. In fact when we come to study language we usually do so first of all from a point of view outside it: philosophy is interested in the role of language in the cognitive process and in its relation to logic, psychology in its relation to thought and to the language-learning process, aesthetics in language as a literary medium. When during the last century the study of language came to constitute a scientific discipline, it concerned itself not with language as such but with the relatedness and the historical development of languages. Even today the idea that language, or a language, could be the specific concern of a systematic and empirically verifiable theory is by no means universally accepted — although such a theory is a prerequisite to the study of language from other points of view, such as those we have mentioned. A theory of language is essential if we are to able to describe exactly what kind of 'something', according to Marx, comes into being during the development of the speaker, and to say out of w h a t something and b y what something this takes place.

Natural languages and dialects, with their irregularities, their numerous and highly adaptable nuances, and their great flexibility, certainly seem to defy systematic descrip-

tion, and in fact any attempt at such a description is regarded by some students of language and of philosophy not only as hopeless but as mistaken or wrong. However, the study of language has been disregarding these scruples and has been developing the basic framework of an exact empirical theory of language for the last sixty years. And far from being the case that the infinite productivity and variability of human language has been ignored, it has even become the central task of linguistic science to explain them. The development of linguistic research towards a theoretically sound empirical science is mainly the achievement of one broad movement for which the name Structuralism is generally used (and often misused). Structuralism in linguistics has brought about decisive changes in methodology, while developments in other disciplines have corresponded closely to these changes: the insights of certain aspects of formal logic, mathematics, psychology, behaviour theory, and phonetics have all made their own contribution to the theory of linguistics. Conversely, structuralist thought in linguistics has been quick to influence the study of other disciplines, above all anthropology, poetics, and general aesthetics. The term structuralism, even within linguistics, means different things to different people, having become somewhat diffused in the process, but the divergent tendencies all have at least one aspect in common: human utterances and attitudes are no longer regarded as isolated and individual events, but are studies within the general framework of a system of relations which determines the structures of all these events. In fact when examined from this point of view surprisingly many phenomena, from folklore to religious concepts and complex aesthetic problems, become approachable in a rational way, and begin to lend themselves to precise description. This is always assumed by an empirically verifiable, and not merely speculative theory set up to account for the phenomena in terms of their underlying patterns.

The development of a theory in this strict sense has only

just begun in those spheres which have come into contact with structuralism. Linguistics is perhaps the most advanced of them, and although it may still be far from providing a complete body of theory which describes the structures of natural language and accounts for them in terms of their derivation from deeper underlying relations, it is at least able to provide an exact formulation of the problems it must eventually solve. There are various possible ways to describe the present stage in the development of linguistic theory, its problems and its categories. I shall attempt to do so in such a way as to give an outline of the most recent development of linguistics. I shall only follow the discussion between various schools and concepts insofar as this will help to clarify the basic problems and to delimit the necessary terms and concepts by confronting them with contrary or outside ones. So I shall not try to give an accurate history of structuralism. I believe that a recapitulation of the problems from the more advanced standpoint will say more about the individual stages of development and the schools which have dominated them than would a purely chronological presentation.

2

COMPARATIVE PHILOLOGY AND THE NEOGRAMMARIANS

Linguistic research was dominated for almost a century by questions concerning the historical relatedness of individual languages, and the results of this approach were in themselves so suggestive as to preclude any other from the claim to scientific interest. Languages whose relatedness had never before been recognised, such as Sanskrit, Greek, Latin, English, Lithuanian, Russian and many others, were in fact proved to be related and their historical relatedness exactly described. If certain changes in sound and meaning (of words) were assumed, the form and meaning of the words of a newer language could be shown to be derived from those of an older one. On the systematic side, sound-shifts above all were established, which had occured at a particular time, to account for the complete change of a language as such, for example from Germanic to the Scandinavian languages, English and German dialects. Intermediate stages of such developments, where there was no record of the sound system could be reconstructed. Proto-Germanic and even Proto-Indo-European were made partially available in this way, until finally the whole geneology of the later Indo-European languages was constructed. For linguists who worked in this way a particular phenomenon was regarded as accounted for if it could be accurately placed within this historical process, and its relation to corresponding phenomena in other, later languages determined — when for example the English, Latin, and Russian words for "100", *hundred*,

centum and *sto* could be derived from a common source by regular sound changes. Working along these lines, Rask, Grimm and Bopp inaugurated the golden age of historical grammar and etymological dictionaries. The cause and nature of the historical processes were discussed only speculatively. Basically they were conceived of as an organic growth or on the other hand as a decay, and languages themselves were regarded as organisms with a mysterious life of their own. Exceptions and irregularities in the sound changes did not seem at all anomalous to a way of thinking largely committed to Romanticism.

In the 1870s, a group of young linguists joined together in sharply attacking this concept. Instead of regarding language as an organic process they assumed the operation of 'sound laws', the nature of which did not lie shrouded in history and even prehistory but was directly observable in every living language as the gradual change of language in use. For the neogrammarians Verner, Brugmann, Osthoff, Leskien and others there could be no exceptions to sound laws: any irregularity was only apparent and could only be the consequence of another law, as yet unknown. Thus it was possible to account for flaws in the general validity of the sound-shifts and the family tree of languages could be completed. Dead and reconstructed languages were treated in strict analogy to living languages and to the individual utterances of individual speakers. That is, actual usage represented the 'real' and 'observable'. The idea that language has a mysterious life of its own thus no longer had any place in philology. Under the influence of early positivism scholars relied strictly on what was perceptible and only based hypotheses on facts which were held to be objective in a positivist sense. But the historical nature of the approach remained unchanged.

However, the basic positivist idea did bring the whole basis of language study into question: if one could only study the history of a language on the evidence of directly

observable or at least assumed individual utterances, what is language itself? Is a language nothing but a totality of all the sentences produced randomly by a certain group of people?

3

FERDINAND DE SAUSSURE

These questions posed by the positivist approach were historically and methodologically the ultimate source of structuralism. The Geneva linguist Ferdinand de Saussure, who himself had been an effective adherent of the neogrammarians, made this question the subject of his lectures between 1906 and 1911. His *Cours de linguistique générale,* which contains the essence of his lectures and was published posthumously, saw the start of a completely new approach to the study of language. Saussure is sometimes referred to as the father of modern linguistics. His ideas replaced the dominance of the purely historical research which pieced together the history of a language by tracing the development of isolated items such as words, sounds, *etc.* He regarded the history of a language as a sequence of states of an internally operating system, and he formulated this view as a dichotomy between *linguistique diachronique* and *linguistique synchronique.* Diachronic linguistics is the study of the history of a language, while synchronic linguistics is the study of a language as it is at any given point in time. This somewhat mechanical division is now almost universally regarded as being oversimplified. Its importance however lies in the fact that it freed linguistic work — and linguistic theory — from the purely historical approach, and provided a basis for the study of the language system as such. A question hitherto regarded as trivial became the centre of theoretical interest: how is an individual language constructed, and how must it

be described? From among Saussure's influential ideas four other main points have turned out to be particularly important to the development of linguistics.

3.1. LANGUE, PAROLE, LANGAGE

Given the distinction between synchronic and diachronic linguistics, and concentrating on the synchronic aspect, Saussure divided the data of linguistics into three distinct categories, the recognition of which was a prerequisite to any linguistic research. These were *langue* (language), *parole* (speech), and *(faculté de) langage* (linguistic disposition). The distinction between *parole*, which the neogrammarians had regarded as the objective data, and *langue*, which is also objective, though in a different way, is crucial. Seen in this way, language is not merely a collection of individual utterances, but consists of a system of elements and relations underlying the utterances. In other words it is the totality of all resources which determine the structure of individual speech events. One may draw an analogy between the *langue-parole* relationship and that between the score of a symphony and its many possible performances, which are determined by the fixed structure of the composition but are not identical to it: each performance has an acoustic existence, it can deviate to a greater or lesser extent from the score, it contains variations and even errors, and represents a particular interpretation of the score. Saussure, in distinguishing as he did between *langue* and *parole* brought a number of aspects into play which are not mutually compatible. The identification of *parole* with the individual aspect of language and *langue* with the social aspect has proved to be misleading. More important is the distinction between *langue* as the ability of the speaker and the hearer of a language to produce and understand sentences, and *parole* as the actual use to which this ability is put, namely in speaking and understand-

ing sentences. The terms *langue* and *parole* have therefore more recently been replaced by 'competence' and 'performance'. *Langue*, then, cannot automatically be taken to mean the social aspect of language, since within a given speech community individuals can be distinguished not only by differences in language use but also by differences in the underlying linguistic system they have acquired. We shall see later that the traditional concept of grammar, appropriately sharpened, describes just this linguistic competence.

Discussion of the relation between *langue* and *langage* was at first rather less lively than that of the relation between *langue* and *parole*. Ideas on the general human disposition for language-learning were very imprecise. It appears that Saussure was unable at the time to see the far-reaching consequences arising from this problem. However, the question as to what conditions are necessary for the acquisition of language is not only a cogent psychological one: the same conditions determine in various ways the specific structure of language. We shall several times have occasion to return to this aspect of linguistic theory.

3.2. FORM AND SUBSTANCE

If language does not consist of actual utterances but of the underlying structures of utterances, then its elements do not possess any physically describable substance. They are rather abstract entities and relations which can be realised with a considerable breadth of variation in sound and meaning. Saussure draws the very apt comparison with the game of chess. The individual elements of the game are the board and the pieces, their concrete shape and the material they are made of are unimportant: what is important to the game is the particular function, or value they have according to the rules of the game. A bishop for example can if necessary be replaced by a simple piece of wood of any shape:

the game remains unchanged if this substitute piece has the value of a bishop. This is formulated in Saussure's thesis that language is a system of values, not a collection of items defined by their substance, and that these values are characterized by their limitations, that is, by their negative, not by their positive features. If we take for example the words *rate* and *late*, what is essential is not the difference inarticulation but the fact that *l* and *r* have different values in the system. The difference is not purely phonetic, as it is for example in Japanese, where *l* and *r* do not have different values and therefore cannot serve to distinguish words.

3.3. SIGNIFIANT AND SIGNIFIÉ

Language differs from other systems and structures — from chess for example — in the nature of its elements. It is a system of signs, that is of inseparable combinations of two components which Saussure calls *signifiant* and *signifié*. This double-sidedness of the sign, already familiar as the *signans* and *signatum* of scholasticism, now becomes identified with the concept of linguistic values on the assumption that the two sides are mutually organising. In English for example *l* and *r* are two separate elements in the sound system because they serve to distinguish contents, for example in *read* and *lead*, *mirror* and *miller*, while this is not the case with 'clear l' and 'dark l' because these never serve to distinguish words. Conversely, the meanings of *big* and *large* are different sign contents because each has its own expression, while this is not so in German, where both meanings are expressed by *groß*. Thus German makes no distinction in its vocabulary between *big* and *large* and Japanese makes no distinction in its sound system between *l* and *r*. The *signifiant* and *signifié* constitute one whole structure and are inseparable. They are, in another analogy of Saussure, as dependent on each other as the two sides of a sheet of paper. Since we have described

language as an acquired competence and as a system of relations, it follows that both sides of the sign are of a psychological nature: a 'sound image' is bound to a 'meaning image', and neither the articulatory realisation nor the objects or relations designated are part of *langue*. The relation between *signifiant* and *signifié* is part of the linguistic sign and is at the same time conventional, that is not God-given but institutionalised. This insight too has its origin in the classic dispute as to the nature of the sign: whether it is *physei* (natural) or *thesei* (constructed). Signs can only be subject to historical change, and can only form the systems of different natural languages, in as far as they are conventional. As systems of signs languages have essential features in common with other sign systems, for instance with traffic signs, semaphore code and the formal languages of mathematics or chemistry. Saussure therefore allotted linguistics a special place within a general theory of signs which he called *sémiologie*. We may note in passing that a general theory of signs was at the same time receiving consideration in other quarters and from various points of view, for example by Charles S. Pierce in philosophy and by Frege and others in the course of work on fundamental problems of mathematics. But it was not until the thirties and forties that insights gained by logicians and philosophers began to have any influence on linguistics. Saussure limited himself to purely linguistic work.

3.4. SYNTAGMATIC AND PARADIGMATIC RELATIONS

The principles which determine the internal structure of the language system were derived by Saussure from two basic notions which have since become traditional in linguistics: s y n t a g m a t i c and p a r a d i g m a t i c r e l a t i o n s. Syntagmatic relations specify the combination of elements into complex forms and sentences, paradigmatic relations

are the relations between the elements of the language system. In the sentence *John came* the relation between the contents of *John* and *came* is the syntagmatic relation subject-predicate, while the syntagmatic relation between the expressions of the two signs is the linear sequence. At the same time each of the words stands in paradigmatic relation to other elements in the system which do not occur in the sentence: *John* to *he, somebody, my friend, a stranger, etc.*, and *came* to *is coming, goes, went, escaped, etc.* The value, or meaning, of the sentence *John came* is only determined by the total framework of relations and can only be understood against the background of these relations. Saussure thus replaced the traditional division of linguistic description into syntax, morphology, phonology, and vocabulary by the two categories of syntagmatic and paradigmatic relations under which all aspects of the linguistic system can be described. The linguistic system is thus a system of paradigms within which the signs, from the point of view of meaning as well as of sounds, delimit and specify each other. The syntagmatic relations an item can enter into is determined by the paradigm, or class, it belongs to. The actual structure of complex forms, phrases and sentences was for Saussure still essentially a matter of language use.

The derivation of all linguistic structures from syntagmatic and paradigmatic relations which determine both the content and expression of the sign implies a certain hypothesis concerning not only the categorial and technical resources of a general theory of linguistic description but also the nature of the human linguistic faculty itself. The acquisition of language as a system of syntagmatically and paradigmatically organised signs presupposes the ability on the part of the speaker-hearer to perform two basic operations: firstly the ability to break down certain items, namely the utterances of a language, into the basic elements, on various levels, into sounds, syllables, words and word groups, and secondly the ability to classify the segments according to the syntag-

matic relations or constructions they can enter into and to differentiate the elements within the same syntagmatic class. But a linguistic theory based on the two fundamental operations of segmentation and classification is inadequate to the task of accounting for the structure of natural languages. At the same time the approach inaugurated by Saussure was in itself very suggestive, and for the past decades most linguists have been working within its limitations. We shall refer to this approach by the now customary term t a x o n o m i c l i n g u i s t i c s.

Many of the concepts outlined here have also been formulated by other linguists. They were a necessary consequence of the development of the subject, and were in part a formulation of long accepted principles. However, Saussure was the first to incorporate them into a general theoretical framework. This original formulation is inadequate in various ways. The basic assumptions concerning the nature of the linguistic system remained to be reified by the analysis of individual languages, and some of the categories, when they were put into practice, turned out to be too ambiguous. The inadequacies led later to the formation of several structuralist schools, which in most cases grew up around academic societies, and of which the Prague, Copenhagen, and American schools were to become the most important.

4

PRAGUE PHONOLOGY

The most influential work of the Prague Linguistic Circle was carried out during the thirties, until the German invasion of Czechoslovakia brought the work of the Circle to an abrupt end. Its most important contribution to linguistic theory was in the study of sound systems, or phonology. Leaving out of consideration its achievements in other fields, two ideas have turned out to be particularly influential: the concept of phonological features and that of morpho-phonemic structure.

4.1. PHONEMES, OPPOSITIONS, FEATURES

The elements of the linguistic system corresponding to the smallest elements of speech in an utterance are called p h o-n e m e s. Their number varies from language to language between about twenty and forty. Alphabetic letters are based on phonemes but do not correspond to them exactly. The phoneme in the Saussurian sense is not defined by its own acoustic substance but by its place within the whole system of phonemes, and its relation to them. To account for this relation between phonemes in the system the Prague School introduced the concept of 'opposition'. In English there is an opposition between *l* and *r* while the *l*-like and *r*-like sounds of Japanese do not constitute an opposition but are variants in the realisation of one and the same phoneme.

The idea that phonemes can be grouped into classes according to their opposition relations in fact goes as far back as the Sanscrit grammar of Panini.

Consider part of the consonant system of English:

(1)

p	*b*	*m*
t	*d*	*n*
k	*g*	*η*

(where *η* corresponds to the orthographic *ng* as in *king.)* Here it is not simply the case that each phoneme is opposed to the others. Rather, a whole system of opposition is operating: the voiceless stops *p t k* are in opposition to the voiced *b d g;* all these six are in opposition to the nasals *m n η*. On the other hand oppositions obtain between the labials *p b m,* the dentals *t d n* and the velars *k g η*. These classifications, with some modifications can easily be added to (1):

(2)

	non-nasal		nasal	
labial	*p*	*b*	*m*	front
non-labial	*t*	*d*	*n*	
	k	*g*	*η*	back
	voiceless	voiced		

Thus unique classes are arrived at with only one member in each class.

Nikolai Trubetzkoy examined the opposition structure of the phonological systems of numerous languages, revealing several general structural types, so that phonemes could be compared solely on the basis of their place in the system, each phoneme being classified according to the various opposition relations it enters into. For example English *d* is a member of the classes stop, voiced, and dental. Class membership then being specified by a phonological feature,

and its place in the system being determined by features, it is a small but very significant step to regard not the phonemes but the oppositions, that is the phoneme features, as primary in the system, and to regard the phonemes themselves as 'bundles of features', such as 'voicedness', 'nasality', 'stop', *etc.*, which are then distinct from other bundles, or combinations, of features. The number of basic elements necessary to construct, and therefore to describe, a sound system can thus be reduced. At a high degree of abstraction this can be formulated as follows: 2^n phonemes can be uniquely determined by n features. That this formulation, however, is overgeneralised we shall see in the following section.

The theory of phonological features continued to be developed systematically in the forties and fifties by Roman Jakobson, who, in the course of research on widely different languages, found that the same features could be used again and again for their description. About a dozen features in all were found to be necessary, though these do not all occur in all languages. In Russian, for example, the consonants are classified as palatalised or non-palatalised, while the feature palatalisation does not occur in English. Jakobson was able to show that the selection made by a language from the universal inventory of features is not arbitrary. Certain features, such as voiced, contoid, dental, and labial, occur in all languages, while others are more special and occur only occasionally, in which case they often presuppose the presence of certain other features. The distinctions associated with them are more easily lost in the course of historical change than those associated with other features. The feature of vowel rounding for example, which distinguishes the German *œ* and *y* (orthographic *ö* and *ü)* from the corresponding *e* and *i*, is absent in many languages. The front rounded vowels in German appeared no earlier than the 8th century, by the process of 'Umlaut'. Many dialects have since discarded them in favour of unrounded vowels, so that *wünschen* [vʏnʃən] (wish) and *Löwe* [lœ: və] (lion) would be pronounced:

[vɪnʃən] and [le: və]. Within the universal inventory a certain hierarchy emerges which, as Jakobson has shown, corresponds to the order in which the ability to distinguish between sounds is developed by a child and in which this ability is disturbed through aphasia. A child does not learn to distinguish between *e* and *œ* until after he commands more basic distinctions between consonants and vowels, and between open and closed vowels.

The basic elements of the sound system are thus linked to deeper underlying psycholinguistic facts, and the hierarchy of phonological features represents an important hypothesis concerning one aspect of the human linguistic faculty. It implies that the sound structures which a normal person can learn to master are based on a very limited, hierarchically ordered basic inventory. The elements of this inventory are not of an acoustic or articulatory nature, but are abstract values in the Saussurian sense. The names we have used for the individual features should not be allowed to obscure this fact. They should now be thought of as abstract representations of neurological structures which control the analytic process of hearing and the activity of the articulatory organs. Phonological features cannot in fact be realised acoustically or articulatorily without these processes. These extralinguistic correlates have been studied in detail in the last few years, and the abstract system of relations underlying the sound structure, and above all its relations to psychological and acoustic facts, has become more clearly understood. This correspondence between systemic relations and phonetic categories is at the same time the reason why the number of features necessary for the description of a sound system cannot simply be reduced to the theoretical minimum formulated above. If a language contains 32 phonemes then logically five elements would be sufficient to specify them. But no meaningful acoustic correlates could be assigned to these features, and so a larger number of features are needed, which could then, however, be taken from the universal

inventory. Here we are confronted with the fact that the structure of a natural language is more complex than the most simple logical form would suggest. At the same time it becomes evident that this redundancy can be accounted for by general assumptions of deeper underlying relations.

Phonology itself helps to sharpen certain concepts on the purely formal side of linguistic theory. Since every segment is specified according to which features it does or does not have, a phoneme, that is a bundle of features, can be more precisely defined as a series of binary choices: for each feature occuring in a language each phoneme is given a plus or minus. In English for example *p t k* have a minus value for the feature of voicing and *b d g* have a plus. The sound structure of the syllables, words, and sentences of a language can thus be described by means of a matrix in which the horizontal rows represent the features and the vertical columns the segments within the item being described. The places in the matrix are occupied either by a + or a −. Thus very simply and incompletely the words *good fun* could be represented thus:

(3)

	g	u	d	f	ʌ	n
vocoid	−	+	−	−	+	−
contoid	+	−	+	+	−	+
labial	−	−	−	+	−	−
fricative	−	−	−	+	−	−
voiced	+	+	+	−	+	+
.....						

Since the columns are labelled with features from the universal inventory, the sound structure of every sentence in every language can be represented in this standardised matrix form. The features state in an abstract way the impulse, the innervation pattern, according to which the speech organs work and the structure which the hearer for his part must filter from the sound sequence in order to understand it.

4.2. MORPHONOLOGICAL STRUCTURE

In order to explain morphonological structure some apparently insignificant facts first have to be mentioned. If we consider the word pairs *logic—logician* and *music—musician* it is clear that something takes place in the sound structure which is not reflected in the normal orthography: the *c* in *logic* and *music* is pronounced *k* while that in *logician* and *musician* is pronounced *ʃ*. The same occurs in the orthographic *t* in *illustrate—illustration, demonstrate—demonstration* and *violate—violation*. In both sets of examples the *i* in the suffix is not pronounced. These processes are obvii ously not exceptions, and in other languages there are similar phenomena, which are often more complex. The correct use of regular alternations such as these is part of linguistic competence. To account for them Trubetzkoy introduced the concept of the morphophoneme, or simply m o r p h o n e m e, by which he meant an abstract entity which underlies both alternating phonemes, and occurs in one concrete form or another, depending on certain conditions. In other words there is a more abstract structure than the sound structure itself as described above, and the description of the smallest phonological segments, the phonemes, thus takes account of the smallest grammatical segments, the morphemes (for example *ian, ion)*. The segments of this more abstract structure are the morphonemes. On this level the *c* of *logic* and of *logician* is the morphoneme *K*, which occurs as *k* in *logic* and *ʃ* in *logician*. Similarly the morphoneme *T* occurs as *t* in *illustrate* and *ʃ* in *illustration*. The idea of this kind of more abstract sound structure was being developed at about the same time by Edward Sapir in America. Yet there was no immediate influence on American linguistics: the generally accepted taxonomic conception of language could not accomodate the significant consequences of such an idea. The morphonemes cannot be arrived at by a mere classification of the primary sound segments. The example

logic— logician itself shows that the relation between the two is far more complex.

In the last decade Morris Halle, a student of Roman Jakobson, and Noam Chomsky have been systematically developing the idea of morphonological structure. At first morphonemes were also represented as bundles of simultaneous elements, that is, classificatory features related to the phonological features discussed in the previous section, without being identical to these. In this way the morphonological structure can also be described by feature matrices. The sound structure of a sentence then has two levels, both statable in matrix form, and the concrete phonetic level is derived by applying phonological rules to the more abstract morphonological level. For example to perform the alternations *logic—logician* and *illustrate—illustration* a speaker of English must command certain rules which may be represented as follows:

(4)

$$\text{(a)} \quad \left\{ \begin{matrix} T \\ K \end{matrix} \right\} \longrightarrow \int \; / \_\_\_\_ i$$

$$\text{(b)} \quad i \longrightarrow \emptyset \; / \int \_\_\_\_ V$$

These two rules mean in effect: (a) that T and K become $\int$ before i, and (b) that i is eliminated between $\int$ and a vowel. This formulation is in fact oversimplified and is only meant to show the principles of such rules. In reality the rules must apply to features, not segments, if they are to account for more relations besides those between T, K and $\int$.

If we assume that a linguistic theory provides for such rules as those in (4) then the words in the lexicon need no longer be given in their concrete phonetic form but only in their morphonological shape, which requires far fewer features (later this structure too will have to be further simplified). Two significant psychological implications follow from this. Firstly, the speaker now only has to retain in his

memory the morphonological form of the words and the rules for their completion, thus considerably reducing the required memory capacity. The sound structure of the words actually spoken is thus far more precisely determined and contains far more features than the abstract forms retained in the linguistic memory. Here we meet a new aspect of the redundancy of natural languages: the concrete sound structure contains numerous superfluous features which make it relatively resistant to acoustic misunderstandings without overloading the memory. Secondly, the assumption of phonological rules means that the use of a word, even only considering the sound structure, is a highly complicated process: what the speaker recalls from his memory is not simply a ready-made sequence of phonemes. Rather, the basic form consisting only of the abstract minimum is made complete in accordance with the rules, and only the end product of this process then forms the concrete innervation pattern for the speech organs. Processes such as those assumed here take place, of course, at the subconscious level.

The phonological rules and their implications take the theory of phonology far beyond the stage reached by the Prague School but illustrate at the same time the real significance of its contribution.

5

THE COPENHAGEN SCHOOL

The linguistic Circle of Copenhagen, founded in 1934, concentrated from the outset on a theory which was intended to incorporate the content and expression of the sign within the sign system and to describe them in terms of precisely defined categories. Language was conceived of for the first time explicitly as an algebraic structure, the elements and relations of which could be formed into a mathematical theory. Louis Hjelmslev developed this concept into a rigorous system of definitions which he published in 1953 in his *Prolegomena to a Theory of Language* (the Danish version of which had appeared in 1943). The taxonomic theory outlined by Saussure was developed in the form of a series of logical dichotomies in a strictly formal way. Again the account given here will be restricted to the more central aspects.

5.1. CONTENT PLANE AND EXPRESSION PLANE

Hjelmslev first of all generalised beyond the well-known contrast between expression and content, and worked with the concepts 'expression plane' and 'content plane' of language in such a way that not only individual basic signs but items of any degree of complexity, such as phrases, sentences, and whole texts could be broken down into two planes. A particular segment of the expression plane stands in relation to a corresponding complex on the content plane on the

basis of the sign function. On both planes Hjelmslev distinguished between 'form' and 'substance'. Form is actual linguistic structure, and consists of the relations between pure values in Saussure's terms, while substance is the extralinguistic correlate in which form is manifested. Thus four strata are identified, which are grouped in pairs: content substance and content form, expression substance and expression form. Content form and expression form are linked by the sign function and together form the data of linguistic analysis.

The relation between expression form and expression substance was specified above as the correspondence between phonological features and their articulatory realisation. The corresponding relation on the content plane has long been the subject of speculation. Any real insight here would require that the relation between language and thought be precisely formulated. According to Hjelmslev's view of phonology the phonological and morphonological levels coincide. Their separation would in fact be impossible in taxonomic theory. The fact that one single level for the content plane is equally inadequate will become apparent in 7.2.

5.2. LANGUAGE AS SYSTEM OF RELATIONS

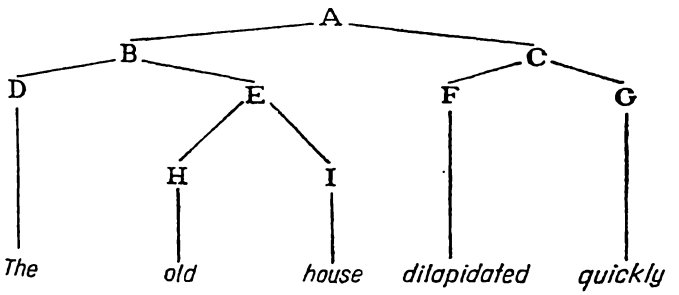
Hjelmslev called the formal structure of a word, a phrase, a sentence, or a sequence of sentences a c h a i n. A sign chain is defined as being composed of a chain of the content plane and a chain of the expression plane, these chains being formed from the elements of the underlying linguistic system. The relation between the system and the chain roughly corresponds to that between the grammar and the actual sentences of a language. Between the components into which the sentence can be analysed and the classes, sub-classes and elements which form the system, relations operate which

can be characterised in a very general way. The following example illustrates this point with regard to the relations within the chain, that is to the syntagmatic relations:

(5) A. *The old house dilapidated quickly*
B. *The old house* C *dilapidated quickly*
D. *The* E *old house* F *dilapidated* G *quickly*
H *old* I *house*

The whole sentence A consists of the parts B and C. B consists of D and E, E of H and I, and C consists of F and G. A is a member of the class of all sentences, B of the class of all subjects, C of the class of all predicates, D of the class of all articles, H of the class of all adjectives, and so on. This set of relations may be represented by a tree diagram:

(6)



Hjelmslev further assumed that any complex X must be analysed into two components Y and Z. Y and Z are called functives between which one of three relations obtains. Either Y and Z are both necessary to X, or one of them is optional, so that X can consist of Y or Z alone, or both are optional. The first condition is met by D and E *the* and *old house*. To form a class B element *the* and *old house* must be present. The second relation holds between H and I where H is optional since *house* alone, like *old house* can combine with *the* to form a subject. Hjelmslev also derived from

the same three relations the connection between the classes, sub-classes, and elements in the linguistic system, that is the paradigmatic relations. The first type of relation for example obtains between nouns and verbs: every linguistic system, any grammar, which contains verbs also contains nouns, and vice-versa. The second relation obtains between verbs and adjectives: in a grammar in which there are adjectives, there are always verbs, while there are languages with verbs but no adjectives. Likewise every language which has a singular also has a plural and vice-versa. But a language which has a plural need not necessarily have a dual, so that the 'non-singular' can consist of one or of two sub-categories.

All the categories necessary for a taxonomic linguistic theory can thus be derived from three elementary relations obtaining between any elements on both the syntagmatic and the paradigmatic axis. Thus each individual language is a combinatory system in which the unanalysable basic elements can be combined into any structure with the help of three relations, and the ways in which they are combined can be formulated as a purely algebraic theory. It is not the three relation types that are the significant part of this concept, since on the one hand they are too general and on the other too narrow to account for the complex structure of natural languages. We have already seen above with regard to the sound structure that the complicated facts which linguistic theory has to deal with cannot be accounted for satisfactorily if only the combination of elements on one level are taken into account at a time. However, the idea that a series of highly abstract formal features must be identified which underlie the sentences of all languages is of great importance to the further development of linguistic theory. Natural languages can then be taken together as representing a class of structures which can be described precisely and formally in terms of the categories set up. This leads to the empirically and theoretically important question as to what, precisely, are the formal characteristics

of the class of all natural languages. As a psychological hypothesis the answer to this question is that all and only the sign systems of this kind can be learnt. Properties which in this way account for all languages and grammars are formal universals, as distinct from the phonological features, which are substantive universals. Formal universals are properties which must be realised in all languages, while substantive universals are those properties from amongst which individual languages make their own selections. Both describe different aspects of the same linguistic faculty.

5.3. LANGUAGE AS SYSTEM OF FIGURAE

The analysis of sentence elements need not stop at the point to which the example in (5) took us. We have already mentioned in connection with the Prague School that word forms are made up of phonemes and that phonemes are made up of features. Hjelmslev extended this principle to the content plane. The following example illustrates his view. If we compare the word pairs *father/mother, son/daughter, man/woman, he/she,* then the words in each pair are distinguished by the relation 'male/female'. If this feature is extracted from *father* or *mother* then one meaning, 'parent', remains, which is common to both. This meaning can be subdivided still further. *Father/mother* (parents) and *brother/sister* (siblings) have in common the feature 'kinship', which is not shared by *man/woman.* Comparison with *aunt/uncle* shows that this in turn must be subdivided into first and second degree kinship. Subdivisions like these are made differently in different languages. The relations *father/mother* and *brother/sister* must be further specified with regard to the feature 'previous generation' or 'same generation'. Thus for *father* we would eventually arrive at the features 'animal', 'human', 'male', 'kinship', 'first degree', 'previous generation'. This

analysis, while imprecise and incomplete, does show that the content of signs consists of combinations of semantic features, just as their sound structure consists of combinations of phonological features. These semantic features do not usually have their own corresponding element in the sound structure: the component 'kinship' in the meaning of *father* is not the content of *a* or *f* but, together with all other components, of the whole word. For these components of meaning Hjelmslev introduced the term *content figurae* and correspondingly for minimal expression elements without their own meaning — phonemes and features — the term *expression figurae*.

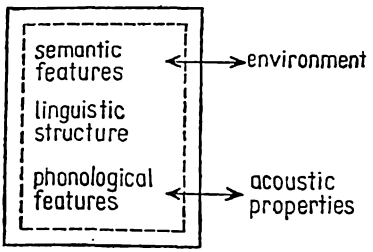
One implication of such an analysis is a modification of the Saussurian thesis that language is a system of signs. Now we see that it is a system of *figurae*, and that only certain combinations of *figurae* have the status of signs. This leads to an extensive reduction in the number of unanalysable basic elements, but at the cost of a more complicated combinatory structure. At this point natural languages differ essentially from other sign systems. The trivial sign system of traffic lights is not a system of *figurae:* the expression *red light* has the meaning 'stop', and cannot be further divided into *figurae*, since *green light* and *amber light* are also indivisible. Hjelmslev grouped together basic elements which cannot be further analysed linguistically, that is the phonological and semantic features, under the term g l o s s e m e, and accordingly called his theory g l o s s e m a t i c s.

5.4. THE STATUS OF BASIC COMPONENTS

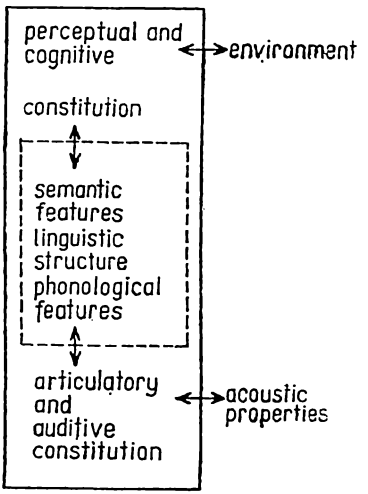
Hjelmslev was not alone in observing that the meanings of words can be broken down into smaller components: the first signs of this insight are also found in the work of the Prague School and in American linguistics. But glossematics developed the idea furthest. Now the question arises as to whether semantic features can be universally categorised

in the same way that Jakobson has attempted in phonology. Hjelmslev considered this question only occasionally, since he excluded the relation between form and substance from linguistics in the narrow sense. It is, however, an important problem not only for linguistic theory but also for the whole field of concept formation, the relation between thought and language. According to one widely held view semantic features are the linguistic image of the properties, relations and objects in the reality of our environment. For example, the feature 'animal' would correspond to the class of all living beings. According to this notion the features which together make up the meaning of a word used in a particular situation indicate characteristics of this situation: colours, objects, relations, and so on. This is what led Leonard Bloomfield to assert that we cannot study meaning scientifically until we have an exact knowledge of every aspect of the universe. However, this notion is beset with serious difficulties attributable to one fundamental fallacy. Semantic features do not directly represent properties of our environment any more than phonological features represent acoustic properties. The universal phonological inventory is a hypothesis about distinctions which human beings, in accordance with their physiological structure, the ear, the speech organs, and the nervous system controlling these, can exploit linguistically. By analogy a universal inventory of semantic features would be a hypothesis about distinctions which human beings are able to make within their environment on the basis of their senses and their nervous system, more generally: their whole perceptual ability. Put rather differently, the complete inventory of semantic features from which each individual language makes a specific selection would finally characterise one essential aspect of the perceptual and cognitive means by which man comes to grips with his environment. We may compare schematically both concepts of the status of basic linguistic components in the following diagram.

(7) A



B



Model B provides a simple and significant solution to the otherwise problematic discrepancy, which is readily observable at every point, between the structure of meaning and the reality of the speech situation. If the assumption outlined in B proves to be valid, then insights can be gained into problems of central interest in philosophy and psychology through linguistic analysis, while, conversely, linguistic insights are oriented to relevant results in psychology. Although we are still very far from this goal, this is not mere speculation: a promising start has been made in this field in some of its more simple aspects, for instance in the study of structure of temporal and spatial relations, and in kinship relations.

It could be argued that a final inventory of semantic features is impossible because the cognitive process itself is continually producing new concepts, so that a hypothesis about the radius of 'every conceivable thing' is unmotivated. But this objection would miss the point of the basic semantic inventory: new concepts are not new semantic features but new combinations of semantic features. And a limited number of basic elements can be combined to form an in-

finite number of combinations: theoretically, the infinite set of all natural numbers can be constructed from one single basic element. The combinatory structure of natural languages is the essence of Hjelmslev's concept of the system of *figurae*. The finite basic inventory of semantic elements does not delimit the possible concept formations but only the human aptitudes and dispositions they are based on. And these can, at least on a reasonable historical basis, be regarded as fixed. Obviously these relations are far more complicated than those of the sound system. Even a rough estimate of the scope that a basic semantic inventory must have is not yet possible. The combinatory types of semantic features are equally unknown. Simply to construct matrices is insufficient here. For the basic semantic inventory it is reasonable to assume a hierarchical structure: certain features occur in all languages, while others appear only under special conditions. It is also conceivable that several basic classes of features would be necessary.

The discussion of semantic universals takes us not only beyond the Copenhagen School, but also beyond the present state of linguistic theory.

6

AMERICAN LINGUISTICS

Linguistic research in the United States, the theoretical foundations of which were also formulated in the thirties, is less strongly influenced by Saussure than the European schools have been. Two main sources have given it its particular stamp: research on hitherto unexamined North American Indian cultures and languages, and behaviourist psychology. Both influences converged at one point: in the rejection of all speculation, of all mentalistic notions, and of *Sprachgefühl* as linguistic criteria. Scientific statements may only be made about objective facts, 'objective' here meaning actually observable facts. In the analysis of unknown languages this is a practical necessity. When the linguist himself does not speak the language under analysis he cannot analyse his own intuitions about it, and he can only rely on properties of the acoustic signal and study their patterns. For behaviourist psychology, however, the same attitude was a matter of methodological principle: all mentalistic assertions, that is to say all statements which could not be verified by observable behaviour, were regarded as fictitious and scientifically inadmissable. The claim to a high degree of exactitude entails a serious limitation of the field of research: all concepts not directly verifiable were excluded. The implication for linguistics was crucial: meaning was practically ignored. Linguistic research could only be based on model A in (7), and would even have to be restricted to the direct relation between acoustic phenomena and 'objective' situational

features, which is not only unpromising from the practical point of view, but, as we have seen, is even theoretically mistaken.

American linguistics was thus committed for a long time to the principle that language must be analysed without regard to meaning. But even in the sound structure restrictions must be made on this principle, since the morphonological level, the significance of which we have attempted to show, likewise eludes direct observation.

The classic formulation of antimentalist linguistics was Bloomfield's book, *Language* (1933). For more than two decades followers of Bloomfield have failed to realise or to recognise the significance of Sapir's mentalistic conception. Sapir's deep insights were closely linked to the concept of language as a reflection of the psychological patterns underlying the formation and understanding sentences.

The fact that the categories admissible were deliberately limited in order to correspond to the behaviourist ideal of exactness has proved in one respect useful to the development of structuralism: the unsteady foundations of many notions became apparent when they were more precisely formulated. Two closely related problems now became the centre of theoretical interest: categories and relations had to be exactly defined on an empirical basis, not in a quasi *a priori* way as in glossematics; and a definite pattern was laid down for checking and justifying the decisions made in the analysis of a language.

6.1. DISTRIBUTIONAL CLASSIFICATION

The classification of the sound segments into structurally relevant units was determined for Saussure and for the Prague School by their ability to distinguish meanings. In English *l* and *r* are separate phonemes because they distinguish the meanings of *leader* and *reader, load* and *road,* while

there are no such pairs in Japanese, where both sounds are thus variants of the same phoneme. If, however, the criterion of meaning is excluded, then some other, formal basis for classification has to be found. This is where American linguistics resorts to co-occurence, the possible distribution of sound segments in a language. In English, *s* cannot always occur where *l* occurs: besides such pairs as *song—long, kiss—kill,* there are many words beginning with *st,* for instance *stay, street, stone,* while in the same word position *lt* never occurs. Therefore *s* and *l* belong to different phonemes. The case is different, however, with 'clear *l*' as in *leaf* and 'dark *l*' as in *field:* where one occurs the other does not, at least in R P. This situation is called complementary distribution, and the two (or more) sounds in question are assigned as variants, or a l l o p h o n e s, of the same phoneme. These distributional criteria have been developed into an exact axiomatic system and have been responsible for giving American structuralism the name 'distributionalism'. The same criteria are not only applied in assigning sound segments to classes but also in classifying combinations of them. This leads to a meaning-independent definition of the smallest signs, called morphemes. Morphemes are not necessarily words, but often only parts of words. For example *unfinished* can be segmented into the morphemes *un finish ed,* which are characterised by their distribution. Just as a phoneme can have several allophones, a morpheme often represents a generalisation on a number of allomorphs, which we can illustrate by taking part of the English verb conjugation system:

(8) *I look* Ø *he look* *s* *he look* *ed* *looked*
I speak Ø *he speak* *s* *he spoke* Ø *spoken*

While the system of *look* always has the form |luk|, that of *speak* alternates between |spi:k| and |spouk|, which is conditioned by the relation to other morphemes. Likewise the morpheme

for the past tense is in one case *ed* and in the other phonetically zero, represented by Ø. Morphemes behave in a similar way in some noun categories, such as *house, wife, etc.* Depending on environment these morphemes may have the allomorphs *hous-* |haus| or *hous-* |hauz|, *wife* |waif| or *wive-* |waiv|. For the distributionalists each of the alternations *s—z, f—v* yields two distinct entities, since there are no morphonemes *S* and *F* and no systematic rules of the type (4) by which *s—z* and *f—v* could be derived from *S* and *F*. At this point a serious inadequacy of the antimentalist view becomes apparent: it leads in principle to the conclusion that each speaker stores an abundance of allomorphs — with all their redundancy — in the memory.

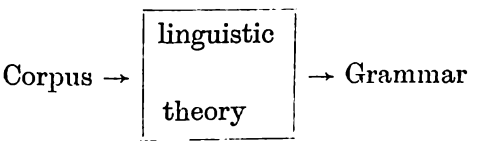
Even the structure of morpheme combinations, the syntactic classes and constructions, has been defined distributionally. We shall not go into these definitions here, since, although they differ from glossematic analyses, they nevertheless only lead to the kind of structure we have seen in (6). What is important is the fact that distributionalism is based on the two basic operations of segmentation and classification, and thus represents no more than a taxonomic theory motivated by behaviourism and therefore sharing its weaknesses. Moreover, the exclusion of mentalistic concepts, which was never a methodological principle of the European schools, involved a further limitation of the scope of taxonomic theory.

6.2. DISCOVERY PROCEDURES

In distributionalism the definitions of terms are always subject to the demand that they can be related to the physical data by a set of precisely stated procedures. This leads to the following basic pattern of approach. The linguist chooses a representative set of concrete, spoken utterances which receive as precise a phonetic transcription as possible.

This 'corpus' is the linguist's objective material in which he finds out the distribution of the structural elements in order to arrive at the linguistic system, the grammar underlying the corpus. The relation between corpus and grammar is analogous to the chain and the system, in Hjelmslev's terms, but with an important difference. The corpus is a set of empirical facts, while Hjelmslev's chain is a theoretical concept, which merely states the structure of actual sentences, not their concrete substance. Thus the set of chains is not finite, as the corpus is. The empirical and the theoretical standpoints are thus quite distinct. Now for each element, from the phoneme to the syntactic classes and constructions there must be a series of exact procedures which determine formally how the element may be found. Linguistic theory thus becomes a strict analytic programme, which, applied to any corpus, will yield an appropriate grammar. The role of a linguistic theory of this sort may be outlined thus:

(9)



Such a series of procedures was formulated explicitly by Zellig S. Harris in *Methods in Structural Linguistics* (1951). It may be added that the operations to be carried out are time-consuming and awkward in practice, so that intuitive short-cuts are admissible, if the results are at least guaranteed to be verifiable by procedures of the prescribed sort.

The question of the significance of linguistic analysis has given rise to controversy even among distributionalists. Some have held the view that the structures found are merely a useful convention for concisely summarising the data but do not describe any objective facts. This view corresponds exactly to the neopositivist theory of science, and echoes the views of the neogrammarians, but on a structuralist

basis. Others have taken a more 'realistic' view and have regarded the grammar resulting from analysis as a reflection of objective properties of the language analysed. This led to a new dilemma: how could their findings be objective, when, according to their own objections against mentalistic notions, the only rational explanation, *viz:* that grammar is the description of the linguistic competence of the speaker, is excluded? If this psychological interpretation were admitted then discovery procedures would begin to have a new and interesting meaning. A linguist who analyses a language in order to discover its grammar does the same thing in a way controlled by theory that a child does spontaneously and unconsciously when he learns a language: on the basis of certain observations the patterns underlying the observed phenomena and the experience of the child are reconstructed. Thus the discovery procedures ought at the same time to describe what the mechanisms are like which enable people to learn languages. But this is precisely the requirement that taxonomic theory in general, and the antimentalistic version in particular, cannot meet. To give just one reason for this: with all the aids provided by distributional theory a child, even after years of uninterrupted analytical and learning process, would not command a natural language.

7

GENERATIVE GRAMMAR

About 1955 Noam Chomsky (a pupil of Harris) drew some radical conclusions from the total positive and negative outcome of linguistic research in the thirties and forties. When Chomsky published his *Syntactic Structures* in 1957, structural linguistics entered a new phase. It was an extract of the results of extensive theoretical research into the foundations and the structure of linguistics. Although it originated in America and grew out of a critical discussion of the ideas of Harris, the theory it presents incorporates the most important ideas of Saussure, Sapir, Trubetzkoy, and Jakobson, combining them with recent insights in the fields of mathematical logic and psychology.

The theory centres on the following simple but essential observation. Whoever speaks a natural language does not simply carry around in his head a long list of words or sentences which he has stored, but is able to form new sentences and to understand utterances he has never heard before. The command of language is thus a productive capacity, not merely the knowledge of an extensive nomenclature. The first to point out explicitly the productive nature of the linguistic faculty was Wilhelm von Humboldt. The central question with which linguistic theory is concerned must in view of this productivity be: what is the basis of the ability to form and understand sentences? We may call the linguistic knowledge involved here, in keeping with the traditional sense of the word, a grammar, and may assume that every

speaker has somehow stored such a grammar in his brain. Of course the term also includes the whole vocabulary of the language. Given this assumption, the basic problem of linguistics is: what is the exact and complete structure of the grammar of a language? The satisfactory solution of this problem must at the same time enable us to answer further questions: how is the grammar applied? That is, how are actual sentences formed and used? How is linguistic competence, or grammar, acquired? How do languages and their underlying grammars change? A theory of grammar in the narrower sense must be seen in close conjunction with a theory of the acquisition, the use, and the change of language. What every conception of language we have mentioned so far lacked with regard to such requirements was an adequate understanding of the syntactic mechanism, while the problems of sound structure (through the idea of the morphonological level and the system of distinctive features) are already related to linguistic competence and acquisition more closely than the other theories we have mentioned. The theory which has been and is still constantly being developed by Chomsky, Halle, and some other linguists is, then, mainly concerned with accounting for how sentences are generated, and is appropriately called 'generative' grammar. In order to be able to outline the general aims and implications of this theory we must first examine more closely some terms which are generally current.

7.1. LANGUAGE AND GRAMMAR

'Language', a term which has a whole range of different meanings, we shall now use to mean a set of sentences. Every sentence consists of a finite number of basic elements and has a particular structure. The English language, then, is the set of all English sentences. By this we do not mean that a language consists of individual speech events, in the

neogrammarian sense. Each individual sentence is an element of *langue* in the Saussurian sense, that is: every sentence can be actually realised any number of times under concrete conditions, just as the same sonata can be played any number of times. The set of sentences of a natural language is, in a strictly theoretical sense, infinite, as the following consideration shows. Although every sentence consists of a finite number of elements, there is none which could in any meaningful way be regarded as the longest. A sentence containing 10,000 words could, by the addition of an adverb, be lengthened to 10,001 words. This procedure could be applied an infinite number of times in accordance with the very same rules by which sentences of three or twelve words are formed. Therefore a language contains an infinite number of sentences. Language is thus not an empirical fact which is given, but is only potentially real. It differs from the set of all actual utterances, that is from any concrete corpus, in two ways. On the one hand many utterances are used in communication which are not regular sentences of, for example, English. Concrete utterances can deviate from a normal structure in a number of ways: by a wrong choice of words, by wrong syntactic construction, by careless speech and so on. Such defects can arise unintentionally by lack of concentration, excitement, influence of alcohol *etc.*, or they can be intentional, for instance in parody, punning, or by poetic licence. Deviant utterances are only comprehensible in as far as they can be interpreted by analogy with regular structures. Their deviations from these give rise to comic or poetical effects, or are simply incorrect. On the other hand a language contains an infinite number of sentences which are never actually spoken because they are too long, or because their structure is too complicated — which is not the same thing, since a sentence can be very long but very simple in its structure — or because their meaning would render their actual use inappropriate: the sentence *In the tertiary age there was no press censorship on the moon* is cer-

tainly an English sentence, but it would never have been used but to illustrate this point. We may go even further and say that nearly all the sentences of English, which are infinite in number, are never used, and that only a finite though very large number occur as utterances. Nevertheless, every potential English sentence is an element of the English language, and if it is actually used, then it is accepted as being a well-formed sentence and will be understood. From this we can conclude, among other things, that grammatical correctness is not a statistical property which becomes apparent through the frequent use of a word sequence. Whether an utterance is a correct English or Chinese sentence depends solely on whether its structure corresponds to English or Chinese grammar.

The infinite set of potential sentences must be covered by a finite system of basic elements and combinatory rules, since a human being can only store a finite grammar in his brain. These basic elements include the phonological and semantic features we have discussed above. The problem to be tackled by the combinatory rules, namely the description of the infinite set of complex structures of the sentences of a language by a finite system, has been studied in detail for the last half century in research on the fundamentals of mathematics and on formal logic. The insights gained by this research may be regarded as part of the formal structure of grammar. A grammar, then, means a system of rules capable of precise formulation, which when applied repeatedly, generate, or, in mathematical terminology, enumerate, all the sentences of a language. If the sentences of a language are thought of as numbered in any arbitrary sequence — ordered, say alphabetically, or according to length — and are labelled S_1, S_2, S_3 etc., then the grammar is a mechanism which generates the set of these sentences:

(10) $\boxed{\text{grammar}} \dashrightarrow S_1, S_2, S_3, S_4, S_5, \ldots .$

Such a procedure is called recursive definition of a term, or definition by recursive enumeration. A grammar then characterises all the sentences derivable from it, in a way which is logically simultaneous, since the rules of such a system do not necessarily describe a process which takes place in time. They are merely a logical system which specifies which combinations of elements may be formed. In this sense English grammar is a recursive definition of the term 'sentence of the English language'. A grammar may also be thought of as an analogy to a computer program to determine abstract relations which can be realised in various ways, according to which computer carries out the program.

7.2. DEEP STRUCTURE AND SURFACE STRUCTURE

Both the set of elements and the kind of elements enumerated depend on the structure of the generative system. The general structure of grammars of natural languages must accordingly allow for all aspects of possible sentence structures.

The nature of language as a sign system implies that each sentence links a particular sound structure with a particular meaning. Thus we may regard sentences as structural pairs consisting of a phonological matrix and a combination of semantic features. For each sentence the grammar must thus generate a sound structure and a semantic structure at the same time. Given this, a grammar could then also be regarded as a mechanism for mapping an infinite set of sound structures onto an infinite set of semantic structures. It specifies for example that the sound sequence *drink* is linked to a meaning which may be paraphrased as follows: 'the speaker tells the hearer to consume liquid'.

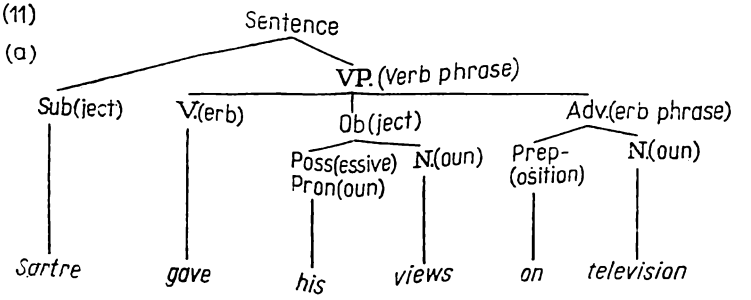
Even this, however, does not state specifically enough what the grammar must do. The matching of sound and semantic structures is ambiguous in natural languages: one sound sequence can have several different meanings, as in

the landing was dangerous, while one and the same meaning can be expressed by various sound sequences, such as *the bridge is too low* and *the bridge is not high enough*. The grammar must therefore be able to assign several semantic structures to one sound structure and the same meaning structure must recur in the case of synonymous sentences.

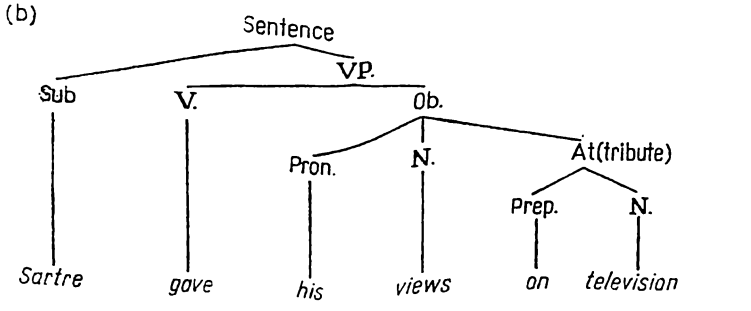
Whether a sentence has several meanings depends on a number of factors. In our example the ambiguity of the sentence arises from the ambiguity of the word *landing*. The sentence *Sartre gave his views on television* contains an ambiguity arising from the possibility of different groupings of the elements in it. We can illustrate this by use of the kind of tree diagram explained in (5) and (6):

(11)

(a)



(b)

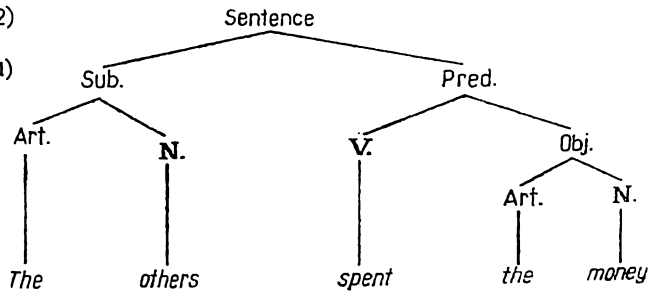


Thus (a): *Sartre's views were given by him on television.*
(b): *Sartre's views on television were given by him.*

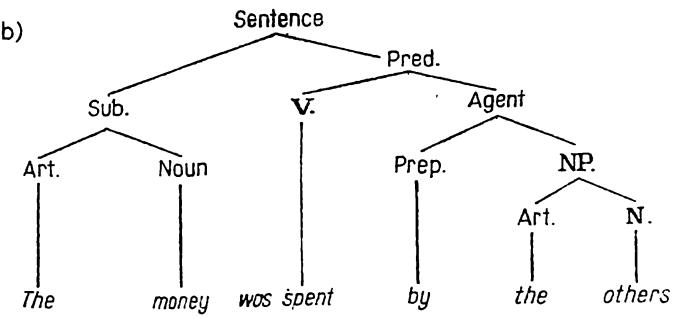
It follows that if the grammar is to state fully how a sentence is understood, then besides the sound structure and the combination of semantic features, it must also indicate the syntactic structure. Formally this can be done by means of the kind of tree diagram we are using, where the points of division show the syntactic categories, and the branches the relations of membership between the basic syntactic elements and 'higher' structures. This idea in itself was common to glossematics, distributionalism, and taxonomic theories in general. We now have to show why it is insufficient to describe natural languages. We can do this by means of the following simple sentences:

(12)

(a)



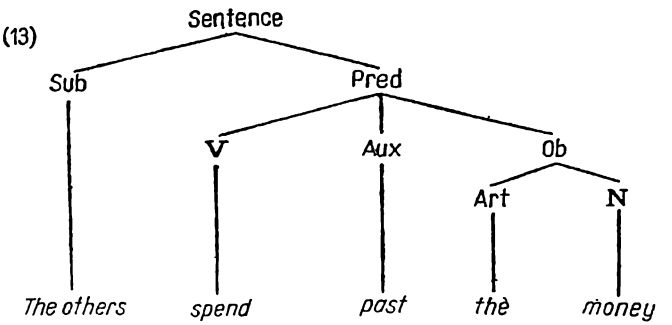
(b)



The syntactic structure of these two sentences is different if we only consider the taxonomic segmentation. But they have the same meaning, because on a more abstract level they show the same relations between the individual elements.

Their difference appears only on the 'surface' in a way which can be stated explicitly. To express this fact the grammar must, in addition to the structures (12) (a) and (b), construct a common abstract 'deep structure' for both sentences. The same deep structure would in fact cover many other instances, for example the interrogative *did the others spend the money?* In the sentence *we saw the others spending the money,* which likewise has quite a different surface structure, the same deep structure is present which underlies sentences (12) (a) and (b), since in order to understand the sentence correctly we have to know that the phrase *the others* has two simultaneous functions: that of object in *we saw the others* and the latent subject in *spending the money.* This becomes apparent when we compare for example: *we saw the others, who were spending the money,* where the pronoun *they* represents the subject *the others.* The deep structure too may be displayed by means of a tree diagram, which cannot, however be directly related to the concrete words, their form or their sequence. Ignoring details then, the sentences we have mentioned so far have the following common deep structure:

(13)



The structure in (13) can itself be embedded as part of a larger sentence, and appears in the surface structure for example as a subordinate clause, as we have seen.

Just as two representations were necessary for the sound structure — a more abstract one, and a more concrete one — we must now also assume two levels of syntax: deep structure

and surface structure. Both can be shown by tree diagrams, and must be related to each other by rules, which then guarantees that from a given deep structure all the acceptable surface structures can be derived. Thus in English the concrete sentence *the others money the spent* may not be derived from (13), while *did the others spend the money?* may.

The particular insight that a more abstract form underlies the concrete syntactic structure of natural languages, and corresponds more closely to its logic, goes back some centuries, and is explicitly formulated in the *Grammaire générale et raisonnée* of Port Royal. We encounter it again in Wilhelm von Humboldt's concept of 'inner form'. Only this abstract structure influences the meaning of sentences; the different forms of the surface structure have no semantic influence. They do, however, determine certain features of the sound structure, for example inflection, accent, and intonation.

7.3. THE SYSTEM OF LINGUISTIC LEVELS

If we summarise those aspects of sentence structure which a hearer or speaker must have at his disposal, and the minimal information a grammar must be able to give about a sentence, we arrive at a system of five levels: each sentence must be specified by a concrete and an abstract representation of the syntactic as well as the sound structure, and by its semantic structure:

(14)

Meaning		= complexes of semantic features
Syntax	deep structure	= abstract branching diagram
	surface structure	= concrete branching diagram

$$\text{sound structure} \begin{cases} \text{morphonological structure} = \text{classificatory matrix} \\ \text{phonetic structure} = \text{phonological matrix} \end{cases}$$

We shall call all five levels of representation of a sentence taken together its structural description. A grammar can then be more exactly specified as a mechanism which generates an infinite set of structural descriptions.

The sentences of natural languages have proved to be complex structures which are related to each other in a variety of ways. But their different structural features are subject to conditions which can be formulated exactly and are universal, because although we have illustrated some individual points mainly with English examples, the total framework is a hypothesis about the structural possibilities of all natural languages. The five levels with their special kinds of elements and interrelations are formal universals of the kind illustrated by glossematics, and the system of levels is at the same time a hypothesis about one aspect of the human linguistic faculty: the human central nervous system must be of such a nature that complex structures of the type (14) can be generated and represented within it. Understood in this way as a psycholinguistic assumption, the system can be verified and, if need be, corrected on the basis of both linguistic and psychological findings.

7.4. THE FORM OF THE GRAMMAR

The multilevelled structure of sentences results in the correspondingly complex structure of the grammar. Examination of this structure has proved very fruitful during the past few years. The insights gained so far have been formulated by Chomsky, Halle, Postal, Katz, and others. The rules of which a grammar consists are divided into the three components syntax, semantics, and phonology. The syntactic rules first

of all generate an infinite set of syntactic structures, to which a meaning is then assigned by semantic rules, and the sound structure by phonological rules.

The syntax contains two types of rules which have quite distinct functions. As a framework for all other properties of a sentence the p h r a s e-s t r u c t u r e r u l e s generate a hierarchy of syntactic categories and relations. The result is an abstract tree diagram, at the end-points of which the individual morphemes or words are added by l e x i c a l r u l e s, so that deep structure appears in the form shown in (13). To assign the surface structure of the individual sentences to these deep structures a second class of rules must be applied. The t r a n s f o r m a t i o n a l r u l e s reorder parts of the tree diagram, add the inflectional markings — for example number in nouns and personal endings in verbs — and they eliminate certain elements that are 'understood' because they are contained in the abstract structure, for example *you* in the sentence *drink*. The transformational rules are applied to tree diagrams in order to transform them into modified tree diagrams. These two classes of rules correspond to two distinct basic features of all natural languages: the phrase structure rules give the sentences their hierarchic structure and specify the relations and functions of morphemes and morpheme constructions, while the transformational rules specify the different surface forms which are possible or necessary for a given deep structure; they are applied according to its hierarchic structure, in a way which yields other hierarchic structures. They prevent (13) from being realised as *others money the spent*. According to this conception it is impossible to regard a sentence merely as a linear string of words or morphemes, for which the grammar simply has to state the probability of one word following another. This kind of linear and statistical interpretation of syntax played an important part in the first attempts to find a mathematical formulation for the syntax of natural languages. Its apparent plausibility is however

misleading, since it fails to take account of hierarchical structure of natural languages.

The lexical rules which together constitute the very extensive lexical component merit our special attention. They specify for each individual morpheme the conditions under which it can be inserted into a tree diagram. In the example *the others spent the money,* in place of the stem *spend* it would be syntactically correct to use *get, steal, pay, earn,* but not *snore* or *loiter: the others snored the money, others* could be replaced by *students* but not by *lakes: the lakes spent the money.* Thus the morphemes must be classified in various ways, not merely in such traditional terms as 'verb', 'noun', 'adjective', etc., but with more detailed categories such as 'verb with obligatory object', 'personal substantive', 'gradable adjective'. This can be done by classificatory syntactic features in such a way that each morpheme receives a combination of syntactic features. Then, only if this combination complies with the conditions present in the tree diagram can a morpheme be used in its normal way. The morpheme itself is characterized by its sound structure and is represented by a classificatory matrix. This matrix must distinguish each morpheme from all others, for example *of* from *at, by, with, etc.* and to do this it need not contain all the features of which the morphemes consist. Thus there is a large set of English words beginning with *s* followed by a stop: *spy, sky, string, spring.* According to the sound structure of English, however, the consonant preceeding a stop in morpheme-initial position can only be an *s.* Hence only the feature + consonant need be given in these cases, while all other features of *s* result from general redundancy rules. Instead of the complete morphonological representation the lexicon therefore contains only a minimal specification of the individual morphemes. The redundancy rules, which guarantee completion of the morphonological matrices later, at the same time account for the principles of the construction of possible morphemes and thus also for another important fact: in

English the two morphemes *blice* and *lbice* are non-existent for two different reasons: *lbice* is impossible as an English form, while *blice* is a form which happens not to be used but could be introduced into the lexicon at any time. The redundancy rules, which distinguish the possible from the impossible forms, have to be formulated separately for each language and must be able to account for example for the fact that *Tbilissi*, which is possible in Georgian, is impossible in English. Besides the syntactic and morphonological features the lexicon contains for each item the semantic features which describe its meaning. Here too redundacy has to be avoided. Of the noun *brother* for example we know that it shares certain features with *father, king, soldier, etc.*, such as those of 'human' and 'male'. But these are automatically implied by the more special feature 'kinship', and may therefore be dealt with by redundancy rules in a similar way to the sound features.

Every lexical item is thus composed of a morphonological matrix and a combination of syntactic and semantic features. It may be viewed as a rule which says that a morpheme, represented by its morphonological features, may be inserted, together with its semantic features, into a tree diagram if the syntactic features allow. The reduced representation of all these feature combinations, which is then expanded by the redundancy rules, removes many predictable statements from the part of the grammar which has to contain the most items. This corresponds to the psychological fact that a speaker, in learning a new word, already 'knows' a great deal about its sound and meaning, because the word is not simply added to an amorphic list, but is integrated into a highly structured framework, that is, the lexicon with all its ensuring redundancy rules. Thus the structure of the lexicon is related in a profound way to the fact that learning new words is not difficult when the principles of the structure of the lexicon are already known, whereas even a few words of an unknown language are difficult to memorise.

The phrase structure rules, together with the lexicon, form the basis of the syntax and of the whole grammar. These rules of the base stipulate for each sentence its basic structure, its morphemes and their syntactic function and meaning. But since the total individual meanings of the morphemes are not the same thing as the meaning of the whole sentence, the semantic rules must now be applied to the deep structure. The semantic rules amalgamate the meaning of the individual morphemes into the meaning of larger constructions and eventually of the whole sentence on the basis of syntactic relations. The transformational rules operate on the same deep structure, though without taking into account or influencing the meaning, to produce (among other things) the concrete morpheme sequence, which by applying the redundancy rules is then completed to form the morphonological representation. From this the phonological matrix is derived by applying the phonological rules in the way described above.

The five levels shown in (14) are thus constructed in stages during the generation of a sentence and are brought into relation with each other by the rules of the grammar. The types of interlocking rules we have roughly outlined are capable of general and precise formulation in mathematical terms so that the implications of various assumptions can be closely examined. Formal studies of this kind have produced the beginnings of an exact mathematical theory of linguistic competence not merely consisting of a superficial mathematisation of linguistics but arising out of its own development, in exactly the same way that the mathematical formulations of physical or astronomical problems are the result of the development of physics and astronomy.

7.5. PROBLEMS OF THE SEMANTIC COMPONENT

The structure of the meaning of a sentence and the function of the semantic rules must be considered in somewhat more

detail. If the meaning of the sentence is not only the sum of the meanings of its individual morphemes but also their syntactic relations within the sentence, then the same morphemes must lead to different sentence meanings due to different deep structures. We have seen examples of this in (11). On the other hand, the ambiguity of a sentence can result from the ambiguity of one word, as we saw in the example *the landing was dangerous*. Ambiguous words must therefore be provided with more than one combination of semantic features in the lexicon. The lexicon rules for *landing* must enter at least the feature complexes for the meanings 'disembarkation', 'coming to ground', 'the level part of a staircase between the flights of steps'. All three meanings are already available if a deep structure contains the word *landing*. But since the sentence *the landing was high* only has one meaning, the semantic rules for the combination of *landing* and *high* must exclude all the meanings except the third, while in *the landing was tricky* only the first two meanings may be kept. These two are distinguished in *the landing took place at the other quai* and *the landing took place on the other runway*. These complexes illustrate the first function of the semantic rules. Furthermore, every speaker of English knows that *it was not a safe landing* and *it was a dangerous landing* have the same meaning, whichever of the three meanings *landing* happens to have. This is where the second function of the semantic rules operates. The semantic features must be combined in such a way that the same semantic structures emerge from synonymous expressions, even if these contain different lexical items. Thus two quite different ways of combining the basic elements of meaning may be distinguished. Firstly, the semantic features in the lexicon are grouped into word meanings. The combinations must be learnt, since, as part of the competence of the speaker, they belong to the available components of a language. From these components new and larger combinations of infinite variability can be constructed in accordance with the syntactic rules.

This combination takes place within the system of the rules which have been internalised and which together constitute the linguistic competence of the speaker. In addition, every speaker or speech community is able to form new combinations of features and to incorporate them into the lexicon either by providing a morpheme with a new meaning, for example the word *cancer* with the features for 'malignant growth', or by coining completely new morphemes, such as in *sputnik* for 'artificial earth satellite'. In both cases new feature combinations emerge, not by applying an internalised grammatical system but by changing the system, namely by modifying the lexicon. It is obvious that this is one of the ways in which language change takes place and that this possibility is used in every living language. However, a sharp distinction must be made between the generation of new meanings by the application of existing rules on the one hand and by a change in the rules on the other. The expression 'generation' has a different meaning in each case: in the first it means the use of a given system of rules; in the second it involves an adjustment to the system.

7.6. LINGUISTIC UNIVERSALS

The types of grammatical rules and their joint function in the components of grammar are empirically motivated by properties common to all languages. Together with assumptions about the basic formal properties of all sentence structures they form the system of formal universals which characterises the class of all natural languages. In a complete formulation this system becomes the formal framework of the theory of human languages, of which the description of each individual language is a special case. In terms of logic the formal universals form a metatheory which is an abstraction from the properties of all grammars, each individual grammar being regarded as a theory of a particular language.

This framework of linguistic theory can be formulated as a mathematical theory and is a part of algebra and of the theory of abstract automata. Psychologically, the formal universals are a hypothesis about the disposition of the human organism which enables it to internalise natural languages. Since the command of language is one of the highest of the specifically human accomplishments, the mathematical study of linguistic universals allows us to draw significant conclusions about the capacity of human intelligence and its underlying neurophysiological processes. A formal characterisation of this capacity must meet two limitations given in advance: an upper limit is imposed by the fact that the domain of automata with a finite memory capacity must not be exceeded, and a lower limit by the demand that at least that degree of complexity must be guaranteed which is necessary to generate natural languages. The narrowing of this nevertheless very wide field is one of the most interesting problems facing mathematical linguistics.

We must extend also the system of substantive universals, that is, the individual elements of which grammars are constructed, which is also still far from being completed. This becomes clear from the following consideration. In order to arrive at the meaning of a sentence the syntactic deep structure and the meaning of the individual morphemes must already be known. Now the analysis of various language types has shown that the deep structures, despite differences between structural types, have essential properties in common. Even without any knowledge of Chinese or Mohawk one could understand the semantic structure of their sentences if one knew the meaning of their morphemes and their deep structure. This leads to the assumption that the basic syntactic categories and functions such as subject, predicate, object, verb, adverb, noun, etc., are substantive universals. Corresponding to the basic inventory of phonological and semantic features there is then a set of syntactic categories from which each language makes a characteristic selection.

This was the idea underlying the traditional 'universal grammar', the convincing development of which was only prevented by its inadequate theoretical foundations.

This consideration may be taken a step further. Not only the syntactic categories but also the essential phrase-structure rules which combine them to form tree diagrams of the deep structure are possibly universal and do not need to be relearnt for each new language. But this then means that, besides the elements with which the grammars of individual languages operate, some of their rules are provided by a general reservoir, and, as substantive universals, specify the human aptitude which we have termed *faculté de langage*. This does not apply to the level of syntax. It is very probable that the semantic rules are also largely independent of individual grammars: both the combination of the meanings of individual constituents and the solution of ambiguities take place in the same way in all languages. How far the infinite possibilities of variation in the structure of natural languages and their underlying grammars are limited by general rules, that is, to what extent all natural languages are characterised by invariant features based on the inherent aptitudes of the human organism, remains an open question and one which is of great significance for future research.

8

THEORY OF PERFORMANCE

Insight into the productive nature of the linguistic faculty sheds new light onto the relation between language and speaking, between knowledge of language and use of language. Our earlier analogy between a sonata and its performance is now no longer adequate. The competence of the native speaker seen in this light now resembles not so much the score as the rules for its composition. The speaker unites to a certain extent the role of composer and performer. The use of language thus represents rather the musical improvisation which follows the rules of a particular tone system. But the psychological and neurological processes operating in the speech act follow by no means directly from the grammatical rules and their systematic relation to each other. In order to approach this aspect the grammar must be supplemented by various strategies which determine its application in accordance with certain psychological conditions. Strategies are necessary for the role of the speaker and for the role of the hearer, which clearly interact in a complex way. Well-founded hypotheses about the structure of these strategies are not easy to formulate, and research in this field is only just beginning. The theory of language use does not belong to linguistic theory in the narrower sense; it constitutes rather a special branch of psychology, although its dependence on linguistic theory is obvious. What it examines specifically are those psychological mechanisms which govern the application of linguistic competence. Yet these strategies

cannot depend on the differences between individual languages they are part of the general constitution of human beings, and are, ultimately, what makes the use of any language possible.

8.1. STRATEGIES OF THE SPEAKER

What the speaker actually does in formulating and speaking a sentence may be described roughly as follows: a thought, a wish, an idea, in general an intended message, is adapted to the semantic structures which the grammar allows; the syntactic and phonological forms appropriate to this semantic structure are selected; finally the speech organs are innervated according to the phonological patterns of the sentence, and sound waves are produced. The speaker strategy may thus be regarded as a mechanism which has the intended thought as its input and an acoustic signal as its output:

(15) thought structure → [speaker strategy] → sound waves.

This entire process, which codifies a message into a sequence of acoustic signals, consists of several component strategies which are interrelated in various ways. A relatively autonomous component converts the syntactic surface structure, in accordance with the phonological rules, into the innervation pattern for the speech organs. For written language a special strategy must be introduced alongside this peripheral component, which organises, according to the syntactic surface structure, the impulses for the activity of writing. This component strategy has to rely on a modified component of the grammar, since the phonological and graphological structures of a language do not correspond one-to-one. Both components are controlled by the more central component strategies which convert the intended message into the required syntactic structure.

Thought structure is determined, according to the assumptions explained in 5.4, by general human dispositions which form the basis for the semantic features. If these assumptions are correct, then the thought intentions possess a discrete structure related, in a way as yet unknown, to linguistic structure. What is certain is that not every thought can be expressed in every language in a similar way: where a short sentence may be adequate in Chinese, a long and complicated sentence may be required in English, and vice-versa. The reason for this lies in the syntactic and lexical differences between the grammars of various languages. An essential part of the speaker strategy must adapt the thought structure to the semantic structure of a possible sentence or part of a sentence, which can be represented by a syntactic deep structure. The thought structure organises a syntactically structured 'plan', which releases the concrete details of the speech act. How this syntactic plan is produced is at present not clearly understood. Simple mapping between concepts and words or between propositions and sentence plans is excluded because linguistic structures themselves must first be generated, and are given only in the form of formation rules. Nor can it simply be postulated that a thought always has an autonomous existence before it is linguistically formulated, although research in psychology has shown that this cannot be excluded as one of various possibilities. A certain grading in the language-dependency of the thoughts to be coded therefore has to be envisaged.

Yet another component of the strategy complex converts the syntactic elements and relations underlying the semantic structure into the more concrete plan of the syntactic surface structure. This takes place on the basis of the syntactic transformation rules and is dependent on the capacity of the memory: complex structures which are beyond the capacity of the strategy are blocked, broken down, and restructured. Not until then can the peripheral strategies produce the actual spoken or written form.

This necessarily rough sketch shows that the grammar is one of the essential conditions of speaker strategy: it provides the structures necessary for coding and producing sentences, the component strategies relying on particular components of the grammar. On the other hand the generation of a sentence according to the rules of the grammar must not be confused with actual speech production. This important distinction has an analogy in arithmetic. The multiplication and addition laws determine formally how the product or the sum of any given numbers is formed. At least the unconscious knowledge of these laws is preconditional to every arithmetical operation and, like grammar, must be present in the brain. How the individual operations are carried out in mental arithmetic depends however on a psychological calculation strategy which is not part of arithmetic. It is conditioned, among other things, by the limitations of the memory. A multiplication which cannot be carried out mentally can easily be performed when the capacity of the memory is supplemented by pencil and paper, the same rules, which are stored in the brain, operating here too. Likewise, a concrete utterance is not produced by applying the individual rules in accordance with the logical structure of the grammar. The grammar only stipulates that the result of all the operations of the speaker strategy possesses a particular structure. Thus a complete deep structure is not necessarily generated first of all, this then being converted to the surface structure and finally completed phonologically. Part of the sentence can also be generated and spoken immediately with all its phonetic features and then its deep structure can be completed. The individual parts of the whole procedure must therefore be applied cyclically and must include complex feedback operations. The limitations imposed by memory can be overcome in generating sentences, just as in doing mental arithmetic. A sentence which exceeds the operation capacity of the memory and ends in anacoluthon can be easily rectified by pencil and paper according to the rules

of the grammar. Because of this not only the peripheral but also the central components of the strategy work differently in speaking and in writing. This will easily be verified by reflection on the process of writing.

8.2. STRATEGIES OF THE HEARER

Roughly speaking, the hearer for his part must reverse the speech process: from a sequence of sound waves — or marks on paper — the sentence structure with all its essential features has to be discovered. Accordingly the hearer strategy takes the form of an input-output mechanism which receives sound waves and produces the structural description of the sentence in such a way that it is represented in the brain:

(16) sound waves → hearer strategy → structural description

Like the speaker strategy, the hearer strategy is made up of several interlocking component strategies. Its structure can only be sketched briefly here. Firstly, however, it is necessary to preclude the following misunderstanding. It is easy to imagine that understanding a sentence is mainly a passive procedure by which the sounds heard, and their linguistic features, are registered as in a tape recording. Research in the last decades has shown that this is not even true of the purely acoustic aspects itself. The ear, in an extremely complex and actively — even though unconsciously — directed process, selects certain acoustic phenomena, and modifies the impressions according to certain patterns which are by no means contained in the acoustic signal. This may be observed directly when one listens to two speakers simultaneously: one can concentrate deliberately on the speech of one speaker and hardly notice the other, even if objectively he is speaking louder. On the other hand, one often registers sounds which are acoustically absent but are supplemented

by the ear. This selection process takes place on several levels, and the syntactic and semantic structures of the sentence — which the hearer must first construct himself — influence the operation on nearly all of these levels.

The basic processes of the hearer strategy are roughly as follows. The ear draws from the speech waves certain pieces of information, which are not only those determining the linguistic structure. The hearer recognises from the signal the age, sex, mood, and other characteristics of the speaker. This information is stored in the short-term memory and is subjected to a provisional phonological analysis. The result of this preliminary analysis is compared with a sound structure produced in a subcomponent of the speaker strategy. If they correspond, then the sound structure is identified, and the analysis can proceed to the next step. If they do not correspond, then a corrected sound structure must be produced and compared over again. This alternation of production and comparison continues until a sound structure corresponding to the grammar can be mapped onto the perceived sound. This structure then becomes a trigger for the syntactic and semantic component of the hearer strategy until all the levels of structure are identified and the meaning of the sentence is reconstructed. The hearer strategy also goes through component strategies in cycles, and decisions as to the semantic or syntactic structure can influence the analysis of the sound structure. Sometimes the hearer becomes conscious of the feedback correction of sentences, for instance in first identifying a signal as: *He ate a good deal* and then re-identifying it on the basis of other relations as: *He ate a good meal.* The dependence of hearing on the semantic structure is clearly shown by uncertainty in understanding proper names, which are not semantically determined, or in the acoustic identification of sentences of a foreign language.

8.3. THE INTERPLAY OF PERFORMANCE STRATEGIES

The processes taking place within the speaker and hearer correspond to each other as do the coding and decoding of the same message. On the other hand these processes do not take place according to separate or in some way reverse strategies. Rather, every speaker is at the same time a potential hearer, and vice-versa, the strategies for both roles being closely interwoven. In the case of the more essential components we may assume that the same mechanisms operate, but for different purposes. Both strategies rely on the same grammar, which generates the structures necessary for coding and decoding, so that the view held by many linguists that there is one grammar for the speaker and another for the hearer is without foundation. Not even the strategies for applying the grammar can really be separated.

It is probable that the processes we have summarised as the hearer-speaker strategy are also similar in other functions and levels of behaviour: in doing arithmetic a psychologically determined strategy is applied in a similar way to put formal rules or laws which have been learnt into action. The same applies to playing chess and to following -- or disobeying — the highway code, to playing the piano and thinking logically. And from the combination of the hearer and speaker strategies, on the basis of two different grammars, the basic pattern of interpreting between languages easily follows. In all these cases, a complex pattern of intentional behaviour -- a plan of activity or of thought formed according to memorised rules — is carried out, operated on, and realised in numerous interwoven strategic steps.

The most recent developments in psychology have shown in far more detail the concepts of the structure and function of the individual operations which we have only been able to outline here. We can, however, assume that thought and behaviour strategy in the use of language does not differ

essentially from that used in other equally complex activities. Knowledge gained about linguistic structure and the conditions on its use can serve as a guide in analysing other psychological structures.

9

GRAMMAR CONSTRUCTION AND LANGUAGE ACQUISITION

Part of the wider background against which the theory of the structure of human language must be seen is the capacity for language learning. Like language use, language-learning is a general psychological problem, the linguistic aspect of which is particularly important. Assuming a normal development, a child masters within a few years all the essential aspects of his native language, and thus commands a set of sentences which can be extended at will even to sentences which he has never previously heard or used. This learning takes place spontaneously and actively: a child can learn a language even without actively being taught by someone else. The only necessary condition is that he lives within a language community, so that others around him speak to him. Language learning is just as integral a part of the child's development as the phase in which he learns to use his hands or to stand or to walk. Anyone who has ever consciously observed this process knows that a child does not learn a list of words or sentences, but learn in stages first to understand and then to produce utterances, beginning with individual words and then going to structures of increasing complexity, and thus assimilates in stages the whole grammar of the language, or rather constructs it, since the active handling of individual experiences is necessary: a child hears sentences, but he must deduce their regularities for himself. To describe this process in somewhat more detail we must clarify certain terms we have been using.

9.1. THE STATUS OF LINGUISTIC CONCEPTS

Linguistic analysis can mean two different kinds of process. Firstly the term denotes the specification of the elements and their relations in concrete sentences on the basis of certain given rules. This form of analysis is carried out unconsciously by the hearer or reader during the process of communication, and is carried out consciously during sentence analysis in a grammar lesson. It ought to be capable of being carried out by a machine constructed for automatic translation and equipped with an appropriate analysis program. Secondly, linguistic analysis means the discovery of rules which underlie a given set of sentences and which are a prerequisite to an analysis in the first sense. This is the kind of analysis used consciously by the linguist who tries to discover the rules of a language, that is, its grammar, and unconsciously, in the language-learning process of the child who constructs the grammar on the basis of sentences heard, repeated and corrected. In both cases the analysis is a procedure applied to given sentences, but the result and the theoretical bases are different. In the first case each individual sentence receives a structural description, based on the assumption of a knowledge of the rules underlying the sentences. In the second case a grammar is assigned to a corpus. The grammar should then be capable of generating all the sentences of the language of which the corpus is a representative sample. This presupposes an appropriate analytic strategy and a conception of the form of the desired results, that is, of the form of the grammar.

The relation between these two different procedures has a counterpart on a higher level: on the basis of a particular theory of grammar, a language can be analysed; alternatively, several languages can be analysed in order to discover this theory — the linguistic universals — in the first place. This procedure presupposes general principles of methodology. The two meanings of the term 'analysis' are by no means

restricted to linguistics. A social system can be analysed according to a particular economic theory. That is, rules or laws in the first sense of the word can be applied to an individual case. Alternatively, an attempt can be made to deduce such laws by analysing different social systems. Similarly, a sonata may be analysed on the assumption of the sonata form, or several compositions can be analysed to find the underlying rules of composition. An analysis of the first kind is clearly impossible without the results of the analysis of the second kind. But at the same time the second kind of analysis, discovery of general laws or rules, can only be made by a series of provisional analyses, the results of which must be tested to decide on their suitability for a more general analysis. The provisional analysis of individual sentences which a linguist undertakes must accordingly constantly be tested against the grammar which results from it. And the tentative structuring of individual sentences is always tested by the child against constructed analogies.

From the relation between the two analytic processes is derived the methodological aporia of the 'hermeneutic' interpretation, the principles of which state that for any one object, one poem, one novel, one sonata, *etc.*, both analytic procedures should be applied simultaneously. No particular analytic system is presupposed, but the necessarily provisional analysis is not even tested against other provisional analyses with a view to general rules. The contamination of both procedures leads to the familiar dilemma that any result is as valid as any other and that all are equally unverifiable.

Our consideration of the research of the linguist and of the learning process of the child in connection with the process of discovering a grammar is not intended as a mere illustration. The same logical situation may be regarded both as a theoretical and psychological problem. We have used this double interpretation already for most of the terms we have been discussing: grammar, language, structural description, se-

mantic, syntactic, and phonological features were viewed both as theoretical concepts and as designations of psychological entities. The two interpretations correspond to each other in the same way as chemical formulae and the arrangement of atoms in a molecule or the circuit diagram of a radio set and the wires and components in the set itself. The formal rules of the grammar correspondingly represent in an abstract way certain psychological, or more exactly, neurophysiological relations without the concrete realisation of these relations being known or even suggested. This implies for language learning the fundamental hypothesis that the aids and the criteria a linguist uses to construct a grammar have some correspondence to the conditions necessary to a child's learning a language. But such a double interpretation of the actual discovery of a grammatical theory, that is of universals, would be pointless and invalid: this process has no psychological counterpart.

9.2. THE STRATEGY OF LANGUAGE ACQUISITION

In order to discover the grammar of a language the rules for all its sentences must be constructed on the basis of only a limited number of utterances. Here we have to take into account a certain asymmetry between language and grammar not considered so far. The set of sentences generated by a system of rules is uniquely determined. One grammar cannot generate two languages. On the other hand one set of sentences, one given language, can be generated by more than one set of rules, if we regard sentences as strings of words or phonemes underlying sequences of sound. Thus a grammar of English could contain the two phrase-structure rules 'a sentence consists of subject and predicate' and 'a predicate consists of a transitive verb and an object', and another grammar the one rule 'a sentence consists of subject, transitive verb, and object'. These extracts from the grammars may be formulated thus:

(17)

Grammar I	Grammar II
Sentence → Subject, Predicate Predicate → Verb, Object	Sentence → Subject, Verb, Object

Assuming that all the other rules of Grammar I and Grammar II are identical, both grammars will generate the same languages, although the sentences are analysed as having different structures: in Grammar I, Verb and Object are combined in the deep structure into one constituent predicate while in Grammar II they are not. Although both grammars generate the same set of sentences they do so by providing different structural descriptions. The result of the analytic process thus does not need to be uniquely determined by the sentences of the given corpus. However, if there are several possible grammars for one language, how does the child construct the grammar, and how does a linguist choose between different analyses?

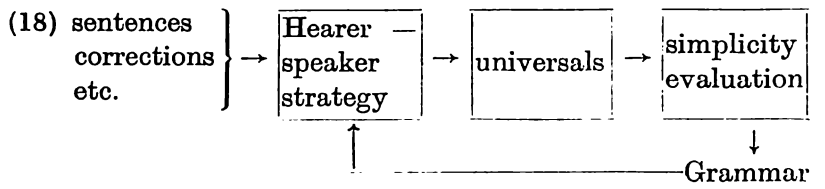
To begin with, it is crucial that the result of the learning process has, at many points, a predetermined form. The basic elements available for the construction of the phonological and semantic form are already given with the universal inventory of semantic and phonological features, and the possible syntactic relations by the inventory of universal categories and rules. The totality of universal features we have outlined so far form something like an inbuilt scanning device which all our linguistic experiences pass through. This means that a person does not simply perceive indiscriminately concepts, categories, and relations from his experiences, but only those which can be constructed from preformed patterns of elements and their combinations. However, the concepts and structures are by no means formed independently of experience: only those dispositions which are stimulated or activated by our experience and our reaction to our environment become part of our linguistic competence and the corresponding thought structure. But

concrete experiences in the learning process are not registered on a *tabula rasa,* but lead to a characteristic shaping of existing dispositions. This limits the possible results of the analytic strategy, the grammars accessible to the child: conditions imposed by the formal and substantive universals rule out most of the logically possible grammars from the infinite set of grammars compatible with a given language.

Nevertheless, more than one grammar — perhaps even an infinite number — probably always remains which is capable of generating a given language under the limited conditions. Of these a system of rules is chosen which is simplest, that is to say the grammar which contains the fewest and shortest rules and therefore demands the smallest memory capacity. Apart from the inventory of potential universals, the analytic strategy must, accordingly, also have at its disposal a procedure for choosing the most simple grammar. This assumption, while plausible, is by no means trivial.

It follows from our discussion of the double aspect of the analytic procedure that language-learning presupposes the development of the hearer—speaker strategy. Before learning a native language the child certainly does not yet possess a cultivated strategy enabling him to analyse sentences according to a grammar not yet learned. This faculty is only created by linguistic experience during the time of learning. It is, however, like the universal features of the grammar, one of the inborn aptitudes capable of normal development. The transition from the prelinguistic state to a command of language thus includes the development of the hearer—speaker strategy as well as the acquisition of a particular grammar. Once this mechanism is developed it can be used for analysing and producing sentences of other languages if their grammar has been acquired. Learning a second or third language is therefore a different process from learning the first or from learning to speak at all: this process can exploit the already developed and complex ability to analyse linguistic experience.

The total contribution to language-learning of the three necessary components: universals, simplicity evaluation, and language use, may now be described as follows. A child has a large but finite number of linguistic experiences: he hears sentences, and tries to imitate them and to construct new ones, he is understood, or misunderstood and corrected, relating linguistic utterances with other phenomena at the same time. Experiences of this kind form the input of the analytic strategy. These are subjected to a provisional structural description, the scope of which depends upon how far the hearer strategy and the already stored linguistic knowledge have developed. This is why the child begins by identifying and imitating elementary one-word sentences, global units which can hardly be analysed. The construction and extension of linguistic knowledge can now be understood as intuitive research: on the basis of inborn universals the child constructs rules — 'hypotheses' — which account for his experiences so far. These hypotheses are arranged according to their simplicity: the most simple and most general ones are tested first. This explains cases of false generalization such as *I taked* for *I took, he speaked* for *he spoke,* the weak verb inflection being simpler to generate than the strong one. The hypotheses are incorporated into the store of linguistic knowledge until disproved by new experiences. Then additional rules are constructed, old rules modified, and the grammar improved. If new differences occur between knowledge and experience then the grammar is again reorganised. The rules developed are tested both actively and spontaneously. This is how it comes about that a child makes meaningless word combinations, plays with words, and talks to himself, and by doing so improves and tests his knowledge and develops the hearer—speaker strategy. The grammar developed at each stage of the learning process thus immediately becomes available for language use. The following cycle represents the whole analytic strategy:



Although we have emphasised that all these operations are carried out largely unconsciously, diagram (18) at the same time represents the strategy and method of conscious linguistic analysis, where the first component is substituted by heuristic considerations and testing of postulated rules, and the second and third form the linguistic theory. Thus (18) represents a detailed and modified version of the discovery procedure schematised in (9).

9.3. SHORTCOMINGS OF THE BEHAVIOURIST THEORY OF LANGUAGE-LEARNING

If we regard spontaneous language-learning as intuitive linguistic research which makes use of all the means reflected in linguistic theory, then the faculty of language-learning is characterised by a complex set of special conditions based on biological dispositions. In order to justify this suggestive hypothesis more precisely we may compare it with the behaviourist theory of learning, the only alternative concept of language-learning which has been explicitly formulated.

According to this theory an organism learns its behaviour patterns by two mutually conditioning processes: firstly, characteristic sense impressions are generalised inductively, and secondly, triggering signals, or stimuli, are associated with a reaction, a meaning. B. F. Skinner, one of the protagonists of this theory of learning, was able to show by experiment that in this way, a rat can learn to obtain food by pressing an iron bar. The rat learned the 'meaning', the purpose, of the bar. Similarly, animals are able to distinguish colours, musical notes, and geometric shapes, and to associate

them with experimentally determined meanings. Pavlov's experiments with dogs were the first physiological proof of this ability. The motor for the abstraction and the association of meaning and the signal for the creation of a reflex arc is the confirmation by the repeated success of the response, which was at first coincidental. According to this conception a child discriminates in the same way during language-learning between sound signals and environmental phenomena, and associates them with each other to form a linguistic sign. Which characteristics of the sign are suitable for constructing a linguistic form is no more predetermined than the structure of the environmental conditions which the meanings are based on, assuming that only these two lie within the scope of perception. Thus the language-learning mechanism can have a far less complex structure than the one we have postulated (diagram (18)). It only needs to provide for the ability to perform two basic operations: to generalise inductively, that is to construct perception classes, and to associate these classes with meanings in order to construct signs or sign complexes. These are precisely the two principles of taxonomic theory initiated by Saussure and logically related to behaviourist psychology by the concepts of distributionalism. Having presented this much simplified outline of the theory of learning based on the concept of reflex activity, we may now go on to show that such a theory is incapable of explaining the language-learning process. We may note in passing that it cannot even account for the natural spontaneous acquisition of animal behaviour not capable of experimental manipulation, such as the building of nests. As regards language-learning specifically, we may mention two of the many reasons:

Firstly, we have shown that a speaker, in understanding or constructing a sentence, has to rely for example on its deep structure and thus on elements which in certain cases, do not occur in the surface structure. English imperative sentences are a simple example. *Come on!* contains a latent

subject *you*, which does not appear in the surface structure, but is nevertheless part of the deep structure. This is proved by the fact that it is impossible to use other reflexive pronouns than *yourself* with imperatives: Since there is a general rule that reflexive pronouns must be congruent with the subject, even when the subject is latent, such sentences as *behave myself!* or *behave himself!* are impossible. Latent elements can never, however, occur as a signal in the learning process. In order to learn rules which underlie sentences containing latent elements the organism must already be provided with aids to enable it to complete systematically the surface structure, or, more precisely, the signal structure. Similar though less direct arguments apply to the description of the complex meanings of individual elements. Here also, sensual perception does not provide an adequate basis for the learning process. The ability to predict and combine the elementary components, that is the semantic features, must be provided by the learner.

Secondly, the sentences which a child after a few years can use correctly and can distinguish from incorrect or meaningless ones far outnumber those it could have learnt during the same time by the simple adaptation of associations: a child also commands sentences he has never heard before and which he could not have learnt by way of association but which he only commands by virtue of the inborn faculty to construct and to extrapolate. At the same time a child acquires the complete and correct grammar on the basis of his experience of rather defective material containing a large number of corrupt sentences. The fact that it is not these corruptions which are learnt, but the rules themselves, from which the sentences deviate, is likewise not accounted for by the association theory. Finally, the surprising degree of convergence of the results of learning by different children with different individual experiences can only be explained if these experiences are filtered through a special system of identical dispositions.

These considerations do not show that behaviourist theory cannot explain in its own terms how associations and behaviour patterns come into being. Many experiments have demonstrated the working of these processes quite convincingly. Our considerations do show, however, that the results of these experiments are insufficient for us to draw conclusions about complex phenomena for which associations and induction provide no explanation. Such complex knowledge as the command of language must rely on hereditary dispositions of the learner, which, stimulated by contact with the objective environment, become actual abilities. The concrete experience itself determines which of these dispositions are activated and developed. The linguistic community, the linguistic environment of a child, determines which language the child learns, but not whether he learns one. There is clear evidence to support the view that language-learning is determined by biological dispositions which are not restricted to external organs but extend to deeply rooted neurophysiological structures. Above all, the faculty for learning languages is a property of the human species. No other living being is capable of learning even part of a natural language. The linguistic faculty is thus related specifically to the human hereditary disposition.

Further evidence for the fact that language-learning is biologically determined is provided by the radical change which this faculty undergoes during the development of the whole organism. It begins to operate spontaneously at a certain age before which all attempts to teach a baby even single words are unsuccessful. It quickly reaches a climax, and then slackens considerably after the tenth or twelfth year. An adult is only able to extend his grammar by the acquisition of additional rules and in particular to adopt new combinations into his lexicon. But he is hardly capable any longer of assimilating grammars globally, as a child does. This is clearly shown by the different ways in which a child and an adult learn a foreign language: the adult

relies largely on translation, that is, analogies to a language he knows already, as an aid to learning, and merely adds to this knowledge. A child acquires a second or third language autonomously and with much less intellectual effort, in other words, just as spontaneously as his native language. Which physiological processes are at work in this change is not yet known. The parallel to the decline in other physiologically determined abilities is obvious. An adult learns to ski, to swim, and to cycle in quite a different way than a child does.

According to considerations such as these, the theory of language-learning shows interesting connections with the results of more recent European research into, human behavior achieved above all by Lorenz and Tinbergen. Language-learning now appears, contrary to the behaviourist conception, as a complex set of interwoven dispositions and stimulating experiences in the social environment.

9.4. THE PROBLEM OF LINGUISTIC RELATIVITY

A necessary component of the theory of language learning is the system of linguistic universals from which is also derived the universal predisposition of thought structure. If this assumption — and along with it the whole hypothesis concerning universals — were to be disproved, then the theory of learning in this form would be untenable. It is therefore necessary to mention here a thesis of Benjamin Lee Whorf, a student of Sapir, which implicitly involves a denial of the hypothesis of universals. During the thirties, Whorf developed the idea that thought structure, and thus our whole understanding of the universe, is determined by the specific structure of individual languages. Every speech community would thus be clearly committed to particular attitudes towards the surrounding universe, attitudes which would distinguish it from other speech communities. Whorf illustrated this hypothesis partly by analysing the expressions

of time and space in certain Amerindian languages, and concluded that these languages express a view of time and space inconceivable to a European: the space and time conception of the Indian tribes does not, according to Whorf, correspond to Euclidian geometry and Aristotelian logic, to which the European languages are specifically related. The idea of linguistic relativity has also been developed, though somewhat differently, by Leo Weisgerber, and has, under the name 'linguistic world image', *(sprachliches Weltbild)* become a mainstay of 'content-oriented' grammar *(inhaltsbezogene Grammatik)*, a school of thought which has had a decisive influence on German linguistics since World War II. Despite the numerous illustrations of Whorfian Hypothesis all attempts have failed to state it in such a way as to be able to derive from it empirically verifiable statements which invalidate the assumption of semantic universals. Experiments have been performed with regard to the widely differing subdivision of the colour spectrum according to the names of colours in various languages. If the hypothesis were strictly valid, then we should be able to conclude that the perception of colour differs between speech communities. Yet the experiments have merely shown that the difficulty of being able to give names to colours depends on the linguistic structure. It is not the perception but the difficulty of naming it that varies. The simpler the expression available in a language for a particular difference, the easier the labelling becomes. But this by no means disproves the universality of the basic semantic components. The Eskimo language distinguishes by special words between about a dozen different kinds of frozen water, while in English the equivalent expressions would be more complex, and hence less readily available constructions. But the semantic structure of such expressions could be brought as close as desired to that of the individual Eskimo words.

Now if neither the Whorfian Hypothesis nor that of universals can be proved or disproved directly, then indirect

considerations and theoretical implications have to decide. And this is where the Whorfian Hypothesis leads to an impasse. Since behaviourist theory has proved to be inadequate, and since therefore a complex inborn disposition of the learning mechanism has to be assumed, it would follow from the thesis of linguistic relativity in the strict sense that each child is disposed to learning one particular speech and thought system. But this would contradict all experience. A child learns without any difficulty the language of the community in which he grows up, completely independently of the race or national culture of his parents. The thesis of linguistic relativity must therefore be regarded as disproved at every point where it runs counter to the hypothesis of universals. Otherwise it would remain a complete mystery that a child learns any language, depending only on its own environment.

10

LANGUAGE CHANGE

Structural linguistics has led to a precise understanding of the relation between language and grammar, its formal structure, its basic components, and the psychological mechanism underlying the learning and the use of language. This gives new meaning to the insights of the historical linguistics of the 19th century. All the properties of a language determined by linguistic universals must be regarded as historically constant. But within this universal framework, everything is changeable, has become historical, and is capable of further change. A theory of linguistic change must, on the basis of observed developments and according to the requirements of general linguistic theory, show the conditions and the mechanisms which allow or force such changes.

10.1. CHANGE OF GRAMMATICAL RULES

The laws of the neogrammarians, set up to explain the phonetic change of a language, now turn out to be phonological rules which the grammar of a language has acquired at a particular point in time. In the 6th century for example, the German stops *p*, *t*, *k* were replaced in certain environments by the corresponding fricatives *f*, *s*, *x*. Thus *dorp* became *dorf*, *dat das* and *maken maxen*. The rule corresponding to this so-called High German Sound Shift can be expressed in the following somewhat simplified form:

(19) Stop becomes fricative in word-final and word-medial position.

Rule (19) changes one single phonological feature, and the historical process consists of the fact that the members of the pre-Old High German speech community adopted the rule into their grammars. Rules of this kind do not necessarily always apply consistently throughout a whole speech community. If only particular groups adopt particular rules, then geographical or social differences emerge. Rule (19) for example applies in the Upper German but not in the Lower German region. In Middle German regions differing partial rules operate, leading to the splitting of the German dialects. A more recent change, which can be described by the rule

(20) *au* and *ai* become *o:* and *e:*

has not been adopted into the grammar of High German: only in some dialectal and colloquial varieties do we find *o:x ke:nə* for *aux kainə*. Rules such as (19) or (20) may be included in the grammar of a language for a long time without the abstract morphonological form of its words changing. Then the change only applies to the phonetic surface properties, and, because the morphonological structure has remained unchanged, the speakers of different dialects find it easy to understand each other despite the phonetic difference: their grammars only differ with respect to a relatively small number of rules. In the course of time, however, so many new rules may be adopted that the resulting system is no longer the best grammar for the language which has emerged. A child learning a language in this situation, under the influence of the simplicity evaluation directing the learning process, will construct a grammar which has changed and in which the rules are reduced, but at the same time the abstract sound structures are also changed. This kind of

grammatical mutation can only occur when the language is passed on from one generation to the next, since adults, as we have seen, can only change their linguistic knowledge by addition. This mutation does not appear on the surface, since the new grammar still generates the same language.

If we consider sound change in this way as modification and mutation of the grammar, that is, as a change in linguistic competence, then numerous difficulties and speculations which were previously necessary to explain the causes of sound change are now eliminated. The neogrammarians explained changes such as described by rule (19) by a slow shift of articulation, by a gradual increase in aspiration and a reduction of energy during the articulation of the stop. Apart from the fact that here too an unknown physiological cause had to be assumed, there are many sound changes it could not explain. One striking example is the metathesis according to which a vowel changes position with a following *r*, so that, for example, the New High German *Brunn* corresponds to the older Low German *Born*. A gradual change in articulation is impossible in this case, while a simple rule of inversion would account for the process satisfactorily.

Thus sound change is not caused by physiological processes but rather by a variability in linguistic competence as a social norm, which is just as subject to change as are norms for example of dress or of manners. Social need, the need for differentiation or innovation can find expression in sound change, or can even cause it. Social prestige has been as influential in the spreading of innovation in language as in other spheres of human social life, and the patterns which emerge, as far as general statements of these are possible, must be accounted for by sociolinguistics.

Historical changes in syntactic structure need to be accounted for just as much as sound change: the grammar is first extended by transformation rules, by which a deep structure is mapped onto a changed surface structure. The deep structure is then also changed by mutations as far as

the conditions governing universals allow. Detailed research into this is only just beginning.

10.2. MODIFICATIONS OF THE LEXICON

Changes in meaning hardly take place through changes in the semantic rules which assign the total meaning to an utterance according to its syntactic structure and its individual morphemes: these rules must largely be regarded as universal. Change in meaning takes place solely on the basis of the reconstruction of the semantic complexes in the lexicon. There are two possible processes which operate here, of which the first, the disappearance of certain meanings, does not cause any theoretical problems. Certain feature complexes are no longer applied, and finally no longer learnt. If the carriers of these complexes have no other meaning which is still used, then they too, disappear from the lexicon. The appearance of new meanings is more interesting. Here a foreign loan-word or an abbreviation is sometimes adopted into the lexicon as a new carrier of meaning. But more often, already existing morphemes are provided with new features, for example the word *group* has obtained one special meaning in sociology and another in mathematics. More often still, new meanings are assigned not to single morphemes but to morpheme combinations, such as *underdeveloped countries* or *United Nations Organisation*, shortened furthermore to *UNO*. Such combinations of items are lexicalised, and obtain a meaning with more features or with a different structure than they receive on the basis of the ordinary rules.

The formation of new meanings is subject to certain conditions. Firstly, each new feature complex is not merely annexed to the lexicon but integrated into the whole structure. When a previously non-existent concept enters the lexicon, for example through the word *helicopter*, there is a ready-made network of feature combinations which deter-

mines its systematic relations: there are antonyms, collective names (such as *aircraft)*, and overlapping concepts, so that the new meaning has parts in common with complexes already existing. This explains how a new meaning can be introduced without an explicit definition. They are understood, on the basis of usage and of the given lexical structure, and then incorporated. At the same time however, the introduction of each new meaning has the effect of modifying the structure of at least certain component systems of the whole lexicon.

What these examples loosely indicate is still in need of a theoretically exact explanation in which the processes can be formulated with the aid of semantic features. But most of the prerequisites for such a theory of semantic change have not yet been met. The empirical observations of previous linguistic research were *ad hoc,* and included a great deal of speculation. Research into basic semantic elements is still in its infancy, so that even the synchronic structure of the lexicon is still not fully known, let alone the processes by which this changes. However, we are at present able to state two important things. Firstly, while the phonological structure of the lexical items only changes relatively seldom, namely by mutations of the sound structure, but then uniformly for all morphemes, the semantic structure is subject to the continual change of component systems, subject in each case to new thought content, communicative intention, and environmental change. This above all is the process by which socially acquired knowledge is accumulated linguistically. The phonological and semantic structures of the lexicon thus change independently and in quite different ways. Secondly, the changeability of meaning is influenced by motivation rules which must be part of the lexicon itself. At any time metaphors and transferred or derived meanings can be constructed and understood which do not affect the semantic structure permanently, but, after their application, disappear from the inventory. The rules according to which this happens also operate when new meanings come into

being. These 'metaphor rules' are obviously to a great extent universal.

The details of semantic change are difficult to understand, because two processes interact which we have already explicitly separated: the generation of new sentences and the generation of new rules, in this case of new lexical items, or, to put it differently, generation by applying and by changing the grammar. Many normative attempts at etymological explanation are made on the erroneous assumption that the two processes are identical: a previous context of motivation is assumed to be still active as the impulse for generating the sentences under discussion, although this motivation has long disappeared with the emergence of the new meaning.

11

FURTHER EXTENSIONS: POETICS AND LOGIC

Insights gained by structural linguistics shed new light on problems which do not come directly within the scope of linguistics itself. Here we shall briefly touch on two problems: literary language and the relation between language and logic.

11.1. LINGUISTICS AND POETRY

Many features which, in various combinations, are characteristic of poetic language, can be explained by two main principles: secondary structures superimposed on language, and deviations from normal structures.

Examples of the first of these principles are rhyme and metre. Here, features of the sound structure — syllable sequence, stress, and similar combinations of phonological features — form, as it were, a hybrid set of patterns which determine the shape of the primary linguistic structure. Secondary structures of this sort imposed on the organisation of the linguistic structure are not restricted to phonology. Syntax and semantics are just as likely to be used in this way. Many passages in Shakespeare are based essentially on both syntactically and semantically parallel structures. This is one of his favourite and most well-known devices:

> Now are our brows bound with victorious wreaths;
> Our bruised arms hung up for monuments:
> Our stern alarums changed to merry meetings,
> Our dreadful marches to delightful measures.
>
> (Shakespeare, *Richard III*)

The last two lines especially show a marked degree of parallelism syntactically (where *changed* is latent in the last line). Each of the last three lines contains a semantic antagonism between its first and its final noun phrase. Another kind of parallelism obtains between the following two lines:

> The evil that men do lives after them;
> The good is oft interred with their bones.
>
> (Shakespeare, *Julius Caesar*)

Here the semantic antagonism obtains between lines, and is at the same time somewhat looser. The syntactically parallel *evil* and *good* are antonyms. *Lives* and *interred* which are syntactically parallel, are not antonymous in the strict sense. This principle of parallelism extends in numerous variations from naive folk poetry to high artistic sophistication. Such regularities even suggest that the construction and understanding of poetic structures is subject to rules similar to those of primary linguistic structures. A 'grammar of poetry' would thus describe poetic competence just as the grammar of a language describes linguistic competence. At the same time, the general structure of such a grammar would have to take account of many extralinguistic phenomena. Analogous principles of patterning — parallelism, repetition, similarity, contrast, *etc.* — determine with much the same effect music, children's games, and advertising techniques. The grammar of poetry can thus be seen as a special case of a general theory of aesthetic competence, and here, too, we must distinguish between universals and conventional relations.

The second principle is, in a sense, opposed to the first: it does not consist in imposing additional rules but in the deviation from those given. The following examples display various types and degrees of anomaly:

> if you can't smoke you got to
> Sing and we aint got
> nothing to sing; come on kid
> lets go to sleep

if you can't sing you got to
die and we aint got
nothing to die; come on kid
lets go to sleep

(E.E. Cummings)

windows go orange in the slowly
town, night
featherly swifts
the
Dark on us
all;

(E. E. Cummings)

In the first of these, which is otherwise regular for a particular variety of English, the syntax is anomolous as to the transitivity of the verb *die,* which makes it parallel with *sing.* In the second the anomalies are found in grammatical classification.

The following examples demonstrate anomalies based on semantic and derivational deviations:

The wordy shapes of women
the star-gestured children
Especially when the October wind
(some let me make you of autumnal spells,
the spider-tongued, and the loud hills of Wales)
With fists of turnips punishes the land,

(Dylan Thomas)

Children, if you dare to think
Of the greatness, rareness, muchness,
Fewness of this precious only
Endless world

(Robert Graves)

It must be added that poetic rules themselves can be violated. Thus parallelism might be introduced and later in some way

interrupted. Rhyme and metre might similarly be intentionally varied. In 'Lycidas', obviously written in pentameters and with a basic rhyme scheme *aa, bb, . . .*, Milton introduces the occasional trimeter and freely interrupts the basic rhyme scheme:

> Hence with denial vain and coy excuse:
> So may some gentle Muse
> With lucky words favour my destined urn,
> And as he passes turn,
> And bid fair peace to be my sable shroud!
> For we were nursed upon the self-same hill
> Fed the same flock, by fountain, shade, and rill;

Aesthetic effects — surprise, stress, *etc.* — cannot, however be brought about by arbitrary, involuntary deviations. Poetic deviations are rather themselves subject to certain regularities. A theory of aesthetic effects would have to specify the conditions governing such irregularities besides the regularities of parallelism, metre, and rhyme.

Considerations of this kind allow certain impressions, for example that poetic language is 'more economical' than everyday language, to be formulated more specifically. The secondary structures and the deliberate deviations introduce into poetry relations and constructions on all levels which the regular grammar does not account for. That these may also serve a decorative purpose is not the main point. The enriched, economised structures of poetic language, unfamiliar in themselves, enter the general reservoir of novel and original models of thought and of concept formation, as input to the constantly creative cognitive process. They are often the cause of changes in language itself. The conditions governing such structures could be explained a good deal further against a background of linguistic insights. They would represent problems of a structural poetics which accounts for the specific properties of literary texts in a general and empirically verifiable way. Seen in this way, such a theory would thus not

have to resort to statistical values, which would have to leave precisely the interesting individual case largely out of account. A poetics of this kind does not represent a theory of literature, but it is certainly a necessary part of one.

11.2. LINGUISTICS AND LOGIC

Linguists and logicians, in agreement on the view that natural languages are not logically constructed, worked for a long time independently of each other's insights: linguists refused to consider questions felt to be dictated by logic, while logicians constructed their calculi without reference to natural language, in order to overcome its inadequacies. This isolation has long since been abandoned, by logicians such as Carnap and Quine on the one hand, and by structural linguistics themselves on the other. Despite this, one remarkable fact has still been largely ignored until now. Anyone who commands a given logical calculus can without difficulty decide whether and how a given sentence of his language can be expressed by this calculus. With the help of 'predicate calculus' the sentence *people who take exercise don't grow fat* can be expressed by (24) via the steps (22) and (23):

(21) People who take exercise don't grow fat.

(22) For all people it is the case that, if they take exercise, they don't grow fat.

(23) For all objects x, if x is a person, it is the case that, if x takes exercise, it is not the case that x grows fat.

(24) $\forall x(Ax \supset (Bx \supset \sim Cx))$

where the predicate A stands for *being a person*, B for *taking exercise* and C for *growing fat*; $\sim$ stands for negation, $\supset$ for implication, and $\forall$ for *all*.

Any logician can perform such translations, and Carnap has shown that, within the framework of a given calculus, the ambiguity, incorrectness, and meaninglessness of sentences in a natural language can be revealed by these translations. If natural languages were really 'illogical', or logical calculi independent of language, then this fact could not be accounted for, since the formulae of a calculus are constructed according to strict rules, while no rules are given which relate the formulae to everyday language. The relation between the two must thus be based on the immanent structure of natural languages. This fact remains obscure as long as one only takes into account surface structure, which, from the logical point of view, seems largely irregular and fortuitous. The systematic discovery of the deep structure has, however, made the logical structure of sentences accessible and has shown that natural sentences stand in a specific relation to corresponding logical expressions. This leads to the following possible conception of the relation between natural languages and logical calculi. The deep structure of a sentence, by which its meaning — or meanings — is fully specified, receives a concrete phonetic shape by the application of transformational and phonological rules. On the other hand, the same deep structure could, by another set of 'secondary transformations', have assigned to it an expression in a particular calculus, if there is a formula in the calculus which corresponds to it. For example, formula (24) in predicate calculus corresponds to the deep structure of sentence (21). The deep structure of natural languages now appears as a general logical calculus from which any artificial language can be derived, depending on its particular purpose. Naturally this does not prevent formal calculi from being developed and enriched in regard to their own immanent rules, so that they then contain elements which do not correspond to features of natural languages. But even the boldest innovations are only possible and comprehensible in calculi which are based on the deep structures of natural languages

to begin with. Thus if calculi are not thought of as arbitrary games, then it is possible to understand that, if the rules are known, their translatability into natural language is automatic. Linguistic analyses have provided a great deal of evidence to support this assumption. The syntactic deep structure and linguistic semantics thus represent, in a strict sense, the logic of everyday language.

These considerations have another important implication. The crisis undergone by the foundations of mathematics and the necessity of providing the formal sciences with a theoretically sound basis, were what gave rise to the rapid development of formal logic. It turned out that certain concepts, above all that of synonymy, were in need of exact clarification. For this purpose Carnap introduced what he called meaning postulates, which simply determine which elements of a calculus have the same meaning. Now such postulates can be set up at will, as long as they do not lead to contradictions. Quite apart from the fact that this arbitrariness is not in accordance with the real situation in the sciences, these postulates still fail to explain the concept of synonymy. One could no doubt stipulate that certain terms, for instance *bigger, longer,* and *higher* be synonymous in a given calculus, but one would not, in this way, arrive at an explanation of the understanding of synonymy, which is always given, underlying also the logical situation, and is rooted in the general linguistic faculty. And in fact Jarrold Katz has shown that the concepts of synonymy and antonymy, (analytic, contradictory, and synthetic propositions), can be exactly defined according to a theory of natural languages.

Thus linguistics forms part of the foundation of logic, just as logic has become one of the foundations of mathematics. The implications arising from this fact have so far only begun to be studied by logicians and linguists. But in the course of time they will bring to light the complicated relations by which our knowledge and our theories are based on the foundation of natural language.

12

GENERAL CONCLUSIONS

The possibilities discussed in the previous section show how the methods, concepts, and categories of structural linguistics may be usefully employed in the study of other disciplines concerned with human activity: sociology, anthropology, aesthetics, and folklore. These possibilities must be based on the point of view of the concrete problems of the various disciplines themselves, and we cannot go into them here. We end our survey of the development of and the present situation in linguistics with some general concluding remarks.

12.1. SOME METHODOLOGICAL PRINCIPLES

A series of methodological principles which have proved their worth in the exact sciences have also become indispensible in linguistics. Above all, the naive concepts which often dominate the study of the "humanities" and which are usually based directly on intuition have proved to be inadequate and even misleading. Concepts such as deep structure, transformation rule, semantic feature, are just as abstract and just as theoretically stringent as those of electron and gravitational field in physics, or gene and mutation in biology. This situation demands two main changes in traditional thought. Firstly, since linguistic concepts only have meaning in relation to the abstract theory as a whole, which aims to account for a certain body of data, they can no longer be

formulated and defined in everyday terms. Technical terms like morpheme, syntactic rule, meaning, word, or sentence can only be defined within the framework of grammatical theory. Since some of them have a meaning in everyday usage, the study of this usage is part of semantics. But their everyday meanings are of no use to linguistic theory. This is exemplified rather strikingly by the endless list of pre-theoretical sentence definitions. Thus linguistic research cannot begin by improving ~~an~~ old concepts but only by constructing an adequate general theory. This, incidentally, does not contradict what we have said about the relation of logic to everyday language. It merely implies that scientific statements can only be made within a theory, while the theory itself may be described formally or in everyday language.

Secondly, theoretical categories can no longer simply be applied directly to concrete observations. Rather, they often refer to abstract relations and theoretical entities which are inaccessible by direct observation. They are admissible only by virtue of their help in constructing a theory which accounts for complex phenomena and relations in reality. This alters the whole role of the concrete observable facts, and the positivist concept, which only admitted those categories which could be related directly or indirectly to perceptible data, collapses. Recent developments in the philosophy of science also apply fully to linguistics: scientific statements are not the result of pure generalisation on observations but are constructed as hypotheses — often with recourse to unobservable entities — and tested against reality. The facts only come to play the most important part in research when they invalidate an assumption which the scientist has been working on. Observations which cannot be incorporated into the framework of the hypothesis are the stimulus of scientific advance. The fact that the syntactic surface structure cannot account for the formation and understanding of sentences is one such complex fact,

and it led to the hypothesis of deep structure, which cannot be observed directly. Constructs of this kind are not only found in the natural sciences: value and surplus value are familiar examples from economics.

Another principle which has been responsible for changing linguistic methods is the necessity for meaningful idealisation. The relations in natural languages are so complicated that the diverse related facts cannot possibly all be accounted for at once. Certain phenomena must first of all be excluded, and certain aspects isolated, so that in accounting for them further insights into more complex relations may be gained. Thus in analysing a language we have to limit ourselves to normal unabbreviated sentences, on the basis of which we can then go on to account for deviations, ellipses and metaphors, which constantly occur for many different reasons in normal conversation or in poetry. It follows that we need not and indeed cannot regard just any sentence as a subject for analysis.

Accordingly, the scientific process is determined by the interplay of observation and experiment on the one hand, and the construction of hypotheses on the other, the interplay being dictated by the theory and checked against the facts. Basically this is a well-known truth. Even our day-to-day behaviour is based on it. We have discussed and explained it to some extent in the case of language acquisition and language use. Yet in the formulation of methodological principles it has often been violated and suppressed by an artificially naive conception of the data.

12.2. LINGUISTICS, HUMANITIES, AND SCIENCES

One essential consequence of structuralist thought has been the abolition of the traditional distinction between the natural and the social sciences. This has not come about by superficially and arbitrarily transferring the categories and methods

of the natural sciences into the field of the "humanities" or the social sciences — although short circuits like this do occur, for example in certain attempts to examine linguistic or aesthetic phenomena statistically — but by analysing more deeply the phenomena in the field of the social sciences themselves.

As part of the general process we have mentioned new concepts have developed in the field of the exact sciences themselves within the framework of cybernetics: certain basic processes of the mutual influence of elements in a system are reflected in a general body of theory, independently of whether technical systems, organisms or even groups of organisms are being dealt with. Cybernetics and structuralism have developed completely independently of each other, structuralism being the earlier of the two. There has been a legitimate but sometimes fashionably exaggerated tendency to describe every aspect of art, literature, language and psychology, using cybernetic terminology, which often gives the impression that structuralist thought is a by-product of the development of computers and cybernetic techniques. But we have seen that it has its own immanent basis, and structural linguistics in particular did not evolve out of work on machine translation, which for a long time aroused so much interest dominated by fallacious ideas.

The relative independence of their origins shows that structuralism and cybernetics are two important factors in the development towards the unity of sciences which allows even historical facts to be conceived of, not as individual events which are merely recorded, but as a process to be accounted for within the framework of a general theory and, conversely, to be used to test the theory. And linguistics in fact does not only aim to provide a theory of the structure of individual speech events, but also the historical change in this structure. Incidentally, the first significant step towards the unification of the empirical sciences was made at the latest in the 19th century: Marx's theory of the relations

of production in early and developed capitalism does not only show theoretical understanding, in the strict sense, of social, historical processes. It is at the same time a model for a concrete, empirically verifiable theory, which formulates general laws and explains complex phenomena on the basis of underlying structures.

12.3. THE INTEGRATION OF LINGUISTICS

Structural linguistics makes its own contribution to the unity of the sciences, not only by its methodology, but by its substantive insights. We have shown at various places the interweaving of linguistic problems with psychology, cognition theory, logic, mathematics, and acoustics. Linguistics is, on the one hand, dependent on the solution of psychological, mathematical, and acoustic problems. On the other hand, it suggests answers to questions of psychology, learning, cognition theory, logic, and linguistic philosophy, and even poses questions which have only become capable of formulation through the special insights of linguistics. In the relation between linguistics and other disciplines we find a remarkable complication common to all knowledge: linguistics shows on the one hand that essential conditions of concept formation and logic are based on inborn dispositions of the human organism, and thus on the biological structure and physical laws of the universe. On the other hand, to formulate theoretical assumptions of linguistics we need the laws of logic and mathematics, the bases of which are partly linguistic. This apparent paradox is an expression of the uniqueness of human knowledge, which is not built on existing foundations, but, as a whole, must always provide its own. The relation between linguistics and philosophy is another illustration of this: on the one hand linguistics can solve some — though not all — problems of philosophy with all the means of an empirical science. And, as a whole, it provides

an empirically motivated theory of the medium of all knowledge. On the other hand, it is one of the objects of philosophical explanation.

The unity of sciences, which structuralism, seen in this light, is working towards, thus differs fundamentally from the concept of the Vienna Circle in the thirties, that the unity of sciences must be achieved by the analysis of the languages of individual sciences and their integration into a whole, with the language of physics as a model. According to this idea philosophy would inevitably eventually be absorbed by linguistic analysis. Modern linguistics has demonstrated the impossibility of this by beginning to examine the regularities of natural language, the linguistic universals, and to reveal their foundations in reality. If it thus plays a special part in philosophy, then this is because it represents the theory of the intelligible sphere of the real, social individual, in which, more than in any other sphere, the self liberation of man envisaged by Hegel and Marx takes place.

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